The Location Modeling and the Simulation of the Integrated Logistics Distribution Center of Beijing-Tianjin-Hebei on the Internet+

Xiao-hui YAN
Beijing Polytechnic, Beijing, China

Keywords: Distribution center, Beijing-Tianjin-Hebei integration, Internet+, Distribution center location model.

Abstract. With the development of the integration of Beijing-Tianjin-Hebei on the Internet+, logistics integration has become the foundation and premise to realize the integration of Beijing-Tianjin-Hebei. The layout optimization of distribution center and the improvement of infrastructure are the effective approaches to solving two bottlenecks of e-commerce that are called “last kilometer” and “last 100 meters”. In this paper, an optimized location model for the distribution center of the logistics integration of “Internet + Beijing-Tianjin-Hebei” is created; the Tabu search algorithm and the simulation-based case study are used to solve and analyze the model. It is shown that the optimized transportation route can minimize the total transportation cost when the requirements of both supply and demand are met. Research results in the paper are valuable and research methods worth being made more widespread.

Introduction

The core planning contents of Beijing-Tianjin-Hebei integration refer to the mutual cooperation and complementary advantages between different government functional management departments, different industries and different enterprises in Beijing, Tianjin, some prefecture-level cities in Hebei Province (mainly Shijiazhuang, Baoding, Langfang, Tangshan, which revolve around Beijing and Tianjin, Qinhuangdao City, Cangzhou City, etc.), in order to obtain the added value of social benefits. Among them, Beijing, Tianjin, Baoding and Langfang are the core functional areas. The integration of Beijing-Tianjin-Hebei will inevitably promote the economic development and production of Beijing-Tianjin-Hebei region.

The readjustment of the industrial structure has prompted the emergence of enterprise organizations in new forms. The old enterprises need to survive in the new market. Its production organization and resource allocation will change qualitatively, and more external resources will need to be utilized, which will promote logistics demand. With the continuous expansion of logistics demand, the logistics layout also needs to be changed, and the integration and standardization of product distribution in the region have emerged as the times require. It is imperative to construct a reasonable logistics distribution system, which shows that logistics integration is the foundation and prerequisite for the integration of Beijing, Tianjin and Hebei.

Extending the core content of logistics integration to the whole supply chain, and effectively integrating the business in the whole supply chain into the development of industry in the Beijing-Tianjin-Hebei region, It will strictly require the establishment of a deep strategic partnership among member enterprises in the supply chain in the region. Through the rational operation of the distribution center, we can recombine and optimize the related resources in the whole supply chain, break the original business model, form the management thought of mutual benefit and win-win, and finally improve the economic benefit of the whole society. Remove key factors that hinder the effective operation of regional supply chains. Through the coordination of member enterprises and the unified information sharing platform of “Internet + Distribution Center”, the logistics operation in the supply chain can be closely cooperated, the most suitable logistics distribution center can be constructed, and the efficiency of logistics operation can be improved together. Logistics cost is reduced effectively and fast and convenient to serve the customers in Beijing, Tianjin and Hebei regions, which makes the whole supply chain competitive power continuously enhanced. Finally, the integration of Beijing, Tianjin and Hebei is realized.
through logistics integration. With the continuous promotion of the “Internet circulation” action plan, the rational distribution of distribution centers and the continuous improvement of infrastructure will become an effective way to solve the “last kilometer” and “last 100 meters” bottleneck of e-commerce.

In the implementation of the integration of Beijing, Tianjin and Hebei on the Internet+, it is necessary to plan various types of distribution centers and give full play to the regulatory role of logistics distribution centers in order to improve the investment environment in the Beijing-Tianjin-Hebei region, make the supply in Beijing-Tianjin-Hebei area adapt to the change of demand in different time and season in this area, strengthen the competitive ability of Beijing-Tianjin-Hebei region. By establishing regional and urban distribution centers, the circulation socialization level of Beijing-Tianjin-Hebei region can be realized and the scale economic benefit can be realized. Through the establishment of specialized storage, packaging, processing, distribution, information and other system services logistics distribution center, to achieve the integration of logistics in Beijing-Tianjin-Hebei region; The distribution function of distribution center connects various departments and economic functions to promote the rapid economic growth of Beijing-Tianjin-Hebei region. At the same time, we should make full use of the great role of distribution centers in chain operation, accelerate the turnover of commodities in Beijing, Tianjin, Hebei and even the whole country, and promote the expansion and development of businesses, accelerate the overall development of China's modern logistics industry, and improve the quality of the whole society's economic operation.

In this paper, the qualitative and quantitative methods are used in the location of distribution center. First of all, through market research, various factors affecting location of distribution center in Beijing-Tianjin-Hebei region are obtained, such as customer type and distribution, distribution of suppliers, transportation conditions, economy of land use, natural factors, human resources and so on. Then the optimization method is used to establish the distribution center location model to maximize the economic benefits under the condition that the basic requirements of both supply and demand are satisfied. On the basis of qualitative analysis, the location and quantity of distribution center should be allocated in Beijing-Tianjin-Hebei area.

The Purpose and Significance of the Integration Distribution Center Location of Beijing, Tianjin and Hebei on the Internet+

Distribution center is a logistics activity node with important influence in logistics integration. It is an integral part of supply chain logistics network, and is in the hub position, effectively linking up the flow of goods between the upstream and downstream members of the supply chain. Logistics distribution center not only covers the seven core functional elements of logistics activities, but also includes distribution operation functions such as stocking and stowage. In the whole supply chain, especially in the integration of logistics, the logistics distribution center plays a key role in connecting the past with the following. The selection of key elements such as number, type, scale and location of logistics distribution center will have an important impact on the logistics of the whole supply chain. It is related to the investment income, business performance and development strategy in the enterprise, and logistics cost in the upstream and downstream of the supply chain outside the enterprise.

The planning process of selecting one or more addresses to set up a logistics distribution center in Beijing, Tianjin and Hebei is the location of a logistics distribution center. The location of logistics distribution center belongs to the strategic level of logistics management. Reasonable distribution center layout can save the logistics expenses in the region, coordinate the resource flow caused by the adjustment of industrial structure in Beijing-Tianjin-Hebei region, and ensure the integrated development of logistics. It is an important link in the overall layout of the integrated logistics system between Beijing, Tianjin and Hebei. The reform strategy of metropolitan area is from centralization to decentralization, and the mode of reform is from merging to co-governance. Finally, the network governance is realized [1], The Beijing-Tianjin-Hebei integration takes the traffic integration as the basic idea [2][3], takes the human flow as the main research object. Through
the construction of road and rail transit to alleviate the population expansion and traffic congestion in Beijing, that is, the optimization and adjustment of the passenger transport system. The adjustment of industrial structure may lead to the change of the flow of goods and the change of distribution center layout. Logistics plays a very important role in the integration of Beijing, Tianjin and Hebei. Logistics integration can promote the coordinated development of Beijing-Tianjin-Hebei, and the realization of logistics integration of Beijing-Tianjin-Hebei needs policy support established the Beijing, Tianjin and Hebei logistics function agglomeration area based on the industrial structure, and constructed the Beijing-Tianjin-Hebei area logistics information system. Regional integration is the core of regional economic development, but the gap between Beijing -Tianjin and Hebei has always been existing and widening, and the effect of intraregional polarization is stronger than that of diffusion. The Beijing-Tianjin-Hebei regional integration can adopt the frame analysis structure of “process-response-mechanism”, and analyze the evolution process and relationship of inter-governmental competition and cooperation in Beijing-Tianjin-Hebei region by combining qualitative analysis with quantitative analysis. However, the research on the influence of regional logistics network layout is not enough, which makes the research on the optimization and adjustment of logistics network layout especially important and urgent under the need of integration of Beijing, Tianjin and Hebei.

**Distribution Center Location Model and Its Solution**

**Problem Description**

According to the traditional transportation route optimization problem analysis, the components of the transportation route optimization in the Beijing Tianjin Hebei integrated logistics system include: transportation networks and distribution centers and customers, goods, vehicles, constraints, objective functions, etc. Transportation network is the core element of vehicle routing problem, including the trade flow and direction, distance, cost and so on between supplier and distribution center, between distribution center and customer, and between customer and customer. The distribution center mainly completes the distribution of FMCG (Fast Moving Consumer Goods) in Beijing-Tianjin-Hebei area. Customers include distribution outlets, stores, families, restaurants and so on in the Beijing-Tianjin-Hebei region. A vehicle is a vehicle for loading FMCG, including vehicle ownership, loading capacity, vehicle type, vehicle management, etc. The constraint conditions mainly refer to the supply capacity, transportation cost, customer demand and so on of the distribution center, while the objective function refers to the total transportation cost under the premise of satisfying all the demands of both supply and demand parties.

**The Location Model of the Distribution Center**

This paper mainly studies the distribution of FMCG in Beijing-Tianjin-Hebei area. \( g \) represents the total cost of fast goods passing through the distribution center. The total cost consists of four parts: ① total transportation cost—the sum of transportation costs from suppliers to distribution centers. ② total distribution cost—the sum of the costs required for FMCG to reach each user from the distribution center. ③ fixed cost of constructing and operating Distribution Center. ④ variable cost of operating Distribution Center (mainly including the cost of circulation and processing of FMCG).

Constraints and parameter assumptions: ① \( n \) FMCG distribution center are set up in Beijing, Tianjin and Hebei region. The number of customers is \( d \), transport by vehicle. ②A distribution center can receive multiple suppliers and complete delivery requirements to multiple customers, using \( s \) to represent the number of suppliers, The number of shipments from the \( k \) th supplier to the \( i \) th distribution center is \( x_{ki} \). The distribution volume from the \( i \) th distribution center to the \( j \) th customer is \( y_{ij} \). ③ Unit transportation cost from supplier to distribution center and from distribution center to customer are known constant. \( t_{ki} \) represents the unit transportation cost of the \( k \) th supplier of a standard cargo to the \( i \) th distribution center. \( c_{ij} \) is used to express the unit delivery cost from the \( i \) th distribution center of a standard cargo to the \( j \) th customer, and the distribution center does
not supply each other. ④ The quantity demanded for each customer is known as constant D, and the demand for the j th customer is $D_j$. ⑤ Fixed investment costs for the establishment and operation of distribution centres are $f_i$, $f_i$ represents the fixed cost of the I distribution center for a standard cargo. ⑥ The unit variable cost of a standard cargo in a distribution center is $v_i$, $v_i$ represents the variable cost coefficient for the i th distribution center. ⑦ Capacity and number of distribution centers are limited. The total supply capacity of the k th supplier to the distribution center is $A_k$, the maximum capacity of the i th distribution center is $M_i$.

Based on the above objective functions and constraints, the mathematical model of distribution center location is established as follows:

$$\min g = \sum_{i=1}^{n} \sum_{k=1}^{s} t_{ki}x_{ki} + \sum_{i=1}^{n} \sum_{j=1}^{d} c_{ij}y_{ij} + \sum_{i=1}^{n} (v_iM_i + f_i)z_i \quad (3.1)$$

subject to:

$$\sum_{i=1}^{n} x_{ki} \leq A_k, \quad k = 1, 2, \cdots, s \quad (3.2)$$

$$\sum_{i=1}^{n} y_{ij} \geq D_j, \quad j = 1, 2, \cdots, d \quad (3.3)$$

$$\sum_{k=1}^{s} x_{ki} = \sum_{j=1}^{d} y_{ij}, \quad i = 1, 2, \cdots, n \quad (3.4)$$

$$\sum_{k=1}^{s} x_{ki} \leq M_i z_i, \quad i = 1, 2, \cdots, n \quad (3.5)$$

$$\sum_{i=1}^{n} z_i \leq n \quad (3.6)$$

$$x_{ki}, y_{ij}, z_i \geq 0,$$

$$z_i = 0 \quad or \quad 1, \quad i = 1, 2, \cdots, n$$

$$Z_i = \begin{cases} 1, & \text{if the } i \text{th distribution center is selected} \\ 0, & \text{other} \end{cases}$$

This is a mixed 0-1 integer programming problem with constraints. It is a special case in integer programming, where the value of variable $z_i (i = 1 \sim n)$ is only 0 or 1, while the other variable $x_{ki}, y_{ij} (k = 1 \sim s, j = 1 \sim d, i = 1 \sim n)$ can take any non-negative number.

Optimization target (3.1) represents the minimization of the cost of goods from the supplier to the customer point through the distribution center; The expression (3.2) indicates that the quantity of goods supplied from the supplier k to the distribution center i cannot exceed its own capacity; (3.3) means that the needs of all customer points can be met; (3.4) ensures that the distribution center uses supplier delivery exclusively for customer point distribution and does not save; (3.5) represents the capacity limit of a distribution center; (3.6) represents the number limit of the distribution center.

The Method for Solving the Model

Synthesizing the relevant literature, we find that the common methods to solve the transportation route optimization problem mainly include[16]: exact algorithm and heuristic algorithm. By synthesizing the research results of many scholars, it is shown that: In solving the vehicle routing optimization problem, compared with the limitation of the exact algorithm, the heuristic algorithm shows good application. There are four main criteria to follow: accuracy, rapidity, simplicity and adaptability. Based on this, this paper mainly analyzes the Tabu search algorithm. As a sub-heuristic random search algorithm, Tabu search algorithm is based on specific Tabu rules, starts with the initial feasible solution, and tries to determine the movement of the value of the objective
function according to the specific search direction. Compared with the traditional local search algorithm, the Tabu search algorithm is no longer limited to the local search, according to the specific constraint rules, the search area is constantly expanded in order to obtain the optimal solution. The Tabu search algorithm flows as follows:[16] (Figure 1)

![Figure 1. The Tabu search algorithm flows.](image)

In addition, the optimization model (3.1) ~ (3.6) solutions are as follows: Branch definition, implicit enumeration, Hungarian and Monte Carlo methods.

**Simulation-Based Case Study of the Location Model**

**Given Data**

The suppliers are Hohhot, Taiyuan, Zhengzhou, Jinan and Shenyang. Alternative distribution centers are: Beijing, Langfang, Tianjin, Baoding and Tangshan. Number of customers: Beijing 5, Tianjin 4, Langfang 3, Tangshan 2, Baoding 1. The remaining known data are as follows:

**Table 1. Transportation cost.**

<table>
<thead>
<tr>
<th>Supplier</th>
<th>distribution center(1)</th>
<th>distribution center(2)</th>
<th>distribution center(3)</th>
<th>distribution center(4)</th>
<th>distribution center(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplier(Hohhot)</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Supplier(Taiyuan)</td>
<td>6</td>
<td>7</td>
<td>6</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Supplier(Zhengzhou)</td>
<td>8</td>
<td>8</td>
<td>7</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>Supplier(Jinan)</td>
<td>8</td>
<td>7</td>
<td>5</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Supplier(Shenyang)</td>
<td>8</td>
<td>9</td>
<td>8</td>
<td>10</td>
<td>7</td>
</tr>
</tbody>
</table>

378
Table 2: Distribution cost.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribution center1 (Beijing)</td>
<td>1.5</td>
<td>1.2</td>
<td>1.2</td>
<td>1.8</td>
<td>1.5</td>
<td>2.4</td>
<td>2.1</td>
<td>1.8</td>
<td>2.7</td>
<td>1.5</td>
<td>1.8</td>
<td>2</td>
<td>2.1</td>
<td>2.4</td>
<td>2.4</td>
</tr>
<tr>
<td>Distribution center2 (Langfang)</td>
<td>2.4</td>
<td>1.8</td>
<td>2</td>
<td>2.7</td>
<td>2.1</td>
<td>1.8</td>
<td>1.5</td>
<td>2.4</td>
<td>3</td>
<td>0.8</td>
<td>0.8</td>
<td>2.7</td>
<td>3</td>
<td>2.7</td>
<td></td>
</tr>
<tr>
<td>Distribution center3 (Tianjin)</td>
<td>2.4</td>
<td>2.1</td>
<td>2.1</td>
<td>3.2</td>
<td>2.4</td>
<td>1.2</td>
<td>1</td>
<td>0.8</td>
<td>1.5</td>
<td>1.8</td>
<td>2.1</td>
<td>1.5</td>
<td>2.1</td>
<td>2.1</td>
<td>2.4</td>
</tr>
<tr>
<td>Distribution center4 (Baoding)</td>
<td>2.7</td>
<td>2.4</td>
<td>2.1</td>
<td>3.2</td>
<td>3</td>
<td>3.2</td>
<td>2.7</td>
<td>2.4</td>
<td>3.2</td>
<td>1.8</td>
<td>2.1</td>
<td>2.4</td>
<td>3.2</td>
<td>3.6</td>
<td>0.8</td>
</tr>
<tr>
<td>Distribution center5 (Tangshan)</td>
<td>3.2</td>
<td>2.4</td>
<td>2.7</td>
<td>3.2</td>
<td>2.7</td>
<td>2.4</td>
<td>2.1</td>
<td>1.8</td>
<td>2.1</td>
<td>2.4</td>
<td>2.3</td>
<td>2.7</td>
<td>0.8</td>
<td>0.6</td>
<td>3.6</td>
</tr>
</tbody>
</table>

Table 3: Customer demand.

|-----------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|----------------------|-----------------------|----------------------|----------------------|----------------------|
| Demand: D(Sta
| 360 | 420 | 450 | 220 | 160 | 580 | 480 | 520 | 330 | 620 | 240 | 380 | 540 | 340 | 640 |
| Fixed investment cost: f(Standard unit) | distribution center1 (Beijing) | distribution center2 (Langfang) | distribution center3 (Tianjin) | distribution center4 (Baoding) | distribution center5 (Tangshan) |
| Fixed investment cost | 1860 | 1520 | 1640 | 1340 | 1410 |
Table 5. Variable expenses.

<table>
<thead>
<tr>
<th>variable expenses(vi)</th>
<th>distribution center1(Beijing)</th>
<th>distribution center2(Langfang)</th>
<th>distribution center3(Tianjin)</th>
<th>distribution center4(Baoding)</th>
<th>distribution center5(Tangshan)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.65</td>
<td>0.46</td>
<td>0.52</td>
<td>0.37</td>
<td>0.42</td>
</tr>
</tbody>
</table>

Table 6. Supplier's supply capacity.

<table>
<thead>
<tr>
<th>Supplier's supply capacity</th>
<th>Supplier1(Hohhot)</th>
<th>Supplier2Taiyuan</th>
<th>Supplier3(Zhengzhou)</th>
<th>Supplier4(Jinan)</th>
<th>Supplier5(Shenyang)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply capacity: Ak (standard unit)</td>
<td>1200</td>
<td>1400</td>
<td>2200</td>
<td>2000</td>
<td>1800</td>
</tr>
</tbody>
</table>

Table 7. Maximum capacity.

<table>
<thead>
<tr>
<th>Maximum capacity: Mi(standard unit)</th>
<th>distribution center1(Beijing)</th>
<th>distribution center2(Langfang)</th>
<th>distribution center3(Tianjin)</th>
<th>distribution center4(Baoding)</th>
<th>distribution center5(Tangshan)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3250</td>
<td>4860</td>
<td>4160</td>
<td>3750</td>
<td>3440</td>
</tr>
</tbody>
</table>

The Solution to the Model and Analysis

Convert the optimization problem (3.1)–(3.6) to the following standard form:

\[
\begin{align*}
\min \quad & g = \tilde{h} \cdot \tilde{X} \\
\text{s.t.} \quad & A_{eq} \cdot \tilde{X} = beq \quad (4.1) \\
& \tilde{X} \geq 0
\end{align*}
\]

Here: \(\tilde{X} = (x_{i1}, x_{i2}, \cdots, x_{in}, \cdots, x_{s1}, x_{s2}, \cdots, x_{sn}, y_{11}, y_{12}, \cdots, y_{1d}, \cdots, y_{nd}, z_1, z_2, \cdots, z_n)\),

Subscripts correspond to the serial numbers of suppliers, distribution centers and customers in the basic data sheet.

The known data are written as vectors or matrices:

\[
T = (t_{kj})_{s \times n} = \begin{pmatrix}
6 & 7 & 8 & 8 & 8 \\
6 & 7 & 6 & 4 & 8 \\
8 & 8 & 7 & 6 & 9 \\
8 & 7 & 5 & 6 & 8 \\
8 & 9 & 8 & 10 & 7
\end{pmatrix}
\]

\[
C = (c_{ij})_{s \times d} = \begin{pmatrix}
1.5 & 1.2 & 1.2 & 1.8 & 1.5 & 2.4 & 2.1 & 1.8 & 2.7 & 1.5 & 1.8 & 2 & 2.1 & 2.4 & 2.4 \\
2.4 & 1.8 & 2 & 2.7 & 2.1 & 1.8 & 1.5 & 2.4 & 3 & 0.8 & 0.6 & 0.8 & 2.7 & 3 & 2.7 \\
2.4 & 2.1 & 2.1 & 3.2 & 2.4 & 1.2 & 1 & 0.8 & 1.5 & 1.8 & 2.1 & 1.5 & 2.1 & 2.1 & 2.4 \\
2.7 & 2.4 & 2.1 & 3.2 & 3 & 3.2 & 2.7 & 2.4 & 3.2 & 1.8 & 2.1 & 2.4 & 3.2 & 3.6 & 0.8 \\
3.2 & 2.4 & 2.7 & 3.2 & 2.7 & 2.4 & 2.1 & 1.8 & 2.1 & 2.4 & 2.3 & 2.7 & 0.8 & 0.6 & 3.6
\end{pmatrix}
\]

\[
\]

\[
(f_{i})_{5} = (1860, 1520, 1640, 1340, 1410), \quad (v_{i})_{5} = (0.65, 0.46, 0.52, 0.37, 0.42)
\]

\[
(A_{k})_{5} = (1200, 1400, 2200, 2000, 1800), \quad (M_{i})_{5} = (3250, 4860, 4160, 3750, 3440)
\]

From the matrix and vector above, \(\tilde{h}, \tilde{X}, \tilde{X}, A_{eq}, beq\) in the optimization standard form (4.1) can be obtained.

The solution to the optimization problem
According to the tabu search algorithm flow, the optimization problem (4.1) is solved, and vector $\bar{x}$ is obtained, and then use the following program to find out: $x_{ki}, y_{ij}, z_{i}$.

```
for k=1:s
    for i=1:n
        x(k,i)=X(n*(k-1)+i);
    end
end
for i=1:n
    for j=1:d
        y(i,j)=X(s*n+d*(i-1)+j);
    end
end
for i=1:n
    z(i)=X(s*n+d*n+i);
end
```

Computing result

$$(x_{ki})_{5x5} = \begin{bmatrix}
0 & 0 & 680 & 0 & 0 \\
0 & 0 & 0 & 1400 & 0 \\
0 & 0 & 110 & 2090 & 0 \\
0 & 0 & 2000 & 0 & 0 \\
0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

$$(y_{ij})_{5x5} = \begin{bmatrix}
0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

$$(z_{i})_{5} = (0, 0, 1, 1, 0)$$

(1) According to the order of arrangement and vector $(z_{i})_{5}$ in the basic data table, the address of the selected distribution center is: Tianjin, Baoding.

(2) The volume of traffic from the supplier to the two distribution centers is represented by matrix $(z_{i})_{5}$, namely: Hohhot $\rightarrow$ Tianjin 680 Taiyuan $\rightarrow$ Baoding1400, Zhengzhou $\rightarrow$ Tianjin 110, Zhengzhou $\rightarrow$ Baoding2090, Jinan $\rightarrow$ Tianjin2000.

(3) The amount of distribution from the distribution center to each customer is represented by matrix $(y_{ij})_{5x15}$, namely: Baoding $\rightarrow$ Beijing (5 customers), Tianjin $\rightarrow$ Tianjin (4 customers), Baoding $\rightarrow$ Langfang (3 customers), Tianjin $\rightarrow$ Tangshan (2 customers), Baoding $\rightarrow$ Baoding (1 customers). “$\rightarrow$” represents shipping.

**Conclusion**

Based on the relevant data and information of the existing distribution centers in Beijing-Tianjin-Hebei area, an optimized model of integrated logistics distribution centers of “Internet+ Beijing-Tianjin-Hebei” was created in this paper. Five actual distribution centers were selected and used in simulation cases, and the Tabu search algorithm was used to solve the problem. The analysis results show that the optimized operation route can not only fully satisfy the load and volume of the vehicle, but also can deliver goods needed by a customer from the distribution center to the customer according to the customer's demands, so as to realize the optimization goal with the minimum total cost of both the supplier and the customer.
Acknowledgement

Item No.: SM201610858003
Project name: Research on the Integrated Logistics Distribution system of Beijing, Tianjin and Hebei on the Internet+

References

[4] Chen Yao, Chen Zi, Hou Xiaofei, Remodeling Industrial Structure under the Background of Beijing-Tianjin-Hebei Integration [J], Journal of Tianjin Normal University (Social Science), No. 6, 2014.
[15] Shi Zhao, Location-Rounding Problem of Logistics Distribution [D], Doctoral Dissertations from Central South University, 2014.5.