Research on Warehouse Location Selection of Community Group Purchasing Platform

Meng Yanyi¹,a, Cao Liting¹,b,* , Wang Haoran¹,c, Dai Yufei¹,d, Li Zhen¹,e, Feng Bingqing¹,f

¹Beijing Union University College of Urban Rail Transit and Logistics Beijing 100101
a1713848575@qq.com, bcaoliting0618@163.com, c1821817649@qq.com,
d2022815247@qq.com, e1213260075@qq.com, ffbq1085273880@qq.com

Abstract—The warehouse location selection problem for the community group purchasing platform named "Hippo Tribe" is researched in this paper. By investigating the existing warehouse location of the "Hippo Tribe" and analyzing the existing problems, two alternatives are determined according to the actual situation in Beijing, and then the analytic hierarchy process and fuzzy comprehensive evaluation are used. Method, fuzzy evaluation of the location plan of the new warehouse, and thus the optimal choice plan is determined. Suggestions are given to help enterprises reduce operating costs and improve economic benefits.

1. INTRODUCTION
The planning and construction of the logistics system and the location of warehousing are important components of the logistics system. In the entire logistics system, warehouses have many manifestations of value, such as warehousing, turnover, item sorting, etc., while freeing up storage space to solve the problem of factory goods backlog; when carrying out goods distribution, the optimal choice of the distribution path is fast. Realize the solution of the shortest path problem, properly connect the time and cost issues, and improve the utilization rate of the entire logistics system.

Hippo Tribe was founded in April 2016, and it is an Internet company focusing on creating one-stop solutions for community life. After investigation, it is found that the company currently has many problems. For example, the delivery link can only be delivered the next day or the day after tomorrow, resulting in an increase in cargo damage rate and a decline in product quality. Based on Beijing’s economic development in recent years and combined with the current logistics development planning and design situation, this paper analyzes the existing problems of the "Hippo Tribe" through actual investigations, and uses the analytic hierarchy process and fuzzy comprehensive evaluation method to analyze the "Hippo Tribe" warehouse Site selection optimization. Finally, the optimal planning and design plan of the "Hippo Tribe" warehouse was determined to improve the customer satisfaction of the "Hippo Tribe" and reduce logistics costs [1-2].

2.OVERVIEW OF THE RESEARCH METHODS FOR THE LOCATION OF THE WAREHOUSES OF THE HIPPO TRIBE
In this paper, when researching and optimizing the location of the warehouse of the "Hippo Tribe", the analytic hierarchy process and the fuzzy comprehensive analysis method are used. The indicators in each plan are evaluated and scored. Finally, choose the best warehouse construction site.
3. ESTABLISH AN ANALYTIC HIERARCHY PROCESS EVALUATION INDEX SYSTEM

Whether the construction of the warehouse evaluation index system [3-5] is reasonable directly affects the construction and maintenance costs of the warehouse, saving expenses and creating income. According to the actual situation of the survey, a three-level index system for the evaluation of the location of the "Hippo Tribe" warehouse shown in Fig. 1 was constructed.

![Three-level index system for the evaluation of the location.](image)

In Fig. 1:
P1: Situation of colleagues;
P2: Facilities, equipment and transport;
P3: Factors of alternative scheme;
P4: Policy of government;
P5: Situation of market;
O1: Number of colleagues;
O2: Service price level of colleagues;
O3: Scale situation of colleagues;
O4: Number of roads;
O5: Daily traffic flow;
O6: Parking area;
O7: Maintenance shop of nearby;
O8: Provision of accommodation;
O9: Nearby bus routes;
O10: Density of residential area;
O11: Security situation;
O12: Building rental;
O13: Building area;
O14: Geographic location;
O15: Advertising visibility;
O16: Vehicle Restriction;
O17: Government planning in five years;
O18: Government's preferential policies;
O19: Surrounding industrial areas;
O20: Large market;
O21: Situation of the commercial building nearby.

4. DETERMINE THE CORRESPONDING INDEX WEIGHT OF THE ANALYTIC HIERARCHY PROCESS

Considering the actual situation of Beijing's Hippo tribe logistics warehouse, this article selects two options as warehouse location options, and uses analytic hierarchy process and fuzzy evaluation method to determine the options. Option one is Xinfadi, Haidian, Beiyuan South Road, Tongzhou District near the intersection with Fuxingli West Road; Option 2 is Xinfadi, Haidian, and Changping. An evaluation model is established.

Set the index weights of the criterion layer to 0.3, 0.2, 0.2, 0.1, 0.3, and establish the judgment matrix P1, P2, P3, P4, P5, and establish the warehouse logistics evaluation index system and detailed scale value in the paper. The indicators in the warehouse evaluation system provided by professionals in the logistics field. After calculation, Table 1-5 can be obtained.

After obtaining the five judgment matrices, combine the analytic hierarchy process to calculate the independent ranking weight values of the five judgment matrices at different levels, and then sort the criterion-level data according to the degree of importance according to the weight values: P1 (Situation of colleagues) = P5 (Situation of market) > P2 (Facilities, equipment and transport) > P3 (Factors of
alternative scheme) = P4 (Policy of government). The total ranking of discharge levels is shown in Table 6.

Table 1. Judgment Matrix P1

|   | W1  | W2  | W3  |
|---|-----|-----|-----|
| W1 | 1   | 5   | 3   |
| W2 | 0.2 | 1   | 0.25|
| W3 | 0.33| 4   | 1   |

Table 2. Judgment Matrix P2

|   | W4         | W5         | W6         | W7         | W8         | W9         | W10        |
|---|------------|------------|------------|------------|------------|------------|------------|
| W4 | 1          | 3          | 0.33       | 0.2        | 0.25       | 0.11       | 0.25       |
| W5 | 0.33       | 1          | 0.25       | 0.14       | 0.25       | 0.2        | 0.33       |
| W6 | 3          | 4          | 1          | 0.2        | 0.2        | 0.14       | 0.33       |
| W7 | 5          | 7          | 5          | 1          | 3          | 0.33       | 4          |
| W8 | 4          | 4          | 5          | 1          | 1          | 0.33       | 0.2        |
| W9 | 9          | 5          | 7          | 3          | 3          | 1          | 0.33       |
| W10| 4          | 3          | 3          | 5          | 5          | 3          | 1          |

Table 3. Judgment Matrix P3

|   | W11 | W12 | W13 | W14 | W15 |
|---|-----|-----|-----|-----|-----|
| W11| 1   | 1   | 1   | 1   | 1   |
| W12| 1   | 1   | 1   | 1   | 1   |
| W13| 1   | 1   | 1   | 1   | 1   |
| W14| 1   | 1   | 1   | 1   | 1   |
| W15| 1   | 1   | 1   | 1   | 1   |

Table 4. Judgment Matrix P4

|   | W16 | W17 | W18 |
|---|-----|-----|-----|
| W16| 1   | 3   | 0.17|
| W17| 0.33| 1   | 0.2 |
| W18| 6   | 5   | 1   |

Table 5. Judgment Matrix P5

|   | W19 | W20 | W21 |
|---|-----|-----|-----|
| W19| 1   | 1   | 0.25|
| W20| 1   | 1   | 0.25|
| W21| 4   | 4   | 1   |

5. Fuzzy Comprehensive Analysis and Evaluation of Site Selection Results

Invite 5 people in the industry to evaluate the two programs. According to the fuzzy evaluation method [6], the five levels in the set U (here represented as levels 1, 2, 3, 4 and 5) are used to evaluate the indicators of the scheme. The evaluation results are shown in Table 7 and Table 8.
Table 6. The total ranking of discharge levels

| Weights | P1  | P2  | P3  | P4  | P5  | Ranking |
|---------|-----|-----|-----|-----|-----|---------|
| W1      | 0.64|     |     |     |     | 3       |
| W2      | 0.10|     |     |     |     | 11      |
| W3      | 0.26|     |     |     |     | 5       |
| W4      | 0.05|     |     |     |     | 14      |
| W5      | 0.04|     |     |     |     | 15      |
| W6      | 0.07|     |     |     |     | 13      |
| W7      | 0.31|     |     |     |     | 4       |
| W8      | 0.13|     |     |     |     | 10      |
| W9      | 0.23|     |     |     |     | 6       |
| W10     | 0.18|     |     |     |     | 8       |
| W11     | 0.20|     |     |     |     | 7       |
| W12     | 0.20|     |     |     |     | 7       |
| W13     | 0.20|     |     |     |     | 7       |
| W14     | 0.20|     |     |     |     | 7       |
| W15     | 0.20|     |     |     |     | 7       |
| W16     | 0.18|     |     |     |     | 8       |
| W17     | 0.09|     |     |     |     | 12      |
| W18     | 0.72|     |     |     |     | 1       |
| W19     | 0.17|     |     |     |     | 9       |
| W20     | 0.17|     |     |     |     | 9       |
| W21     | 0.67|     |     |     |     | 2       |

Table 7. The evaluation results of program 1

| Indicators | W1 | W2 | W3 | W4 | W5 | W6 | W7 | W8 | W9 | W10 | W11 |
|------------|----|----|----|----|----|----|----|----|----|-----|-----|
| Expert 1   | 2  | 3  | 3  | 1  | 4  | 2  | 4  | 1  | 3  | 2   | 1   |
| Expert 2   | 3  | 2  | 4  | 1  | 4  | 1  | 4  | 2  | 2  | 3   | 2   |
| Expert 3   | 2  | 3  | 3  | 2  | 3  | 2  | 3  | 2  | 1  | 3   | 1   |
| Expert 4   | 1  | 4  | 3  | 3  | 2  | 1  | 5  | 1  | 2  | 1   | 3   |
| Expert 5   | 3  | 2  | 2  | 2  | 3  | 3  | 4  | 1  | 1  | 2   | 1   |
| Indicators | W12 | W13 | W14 | W15 | W16 | W17 | W18 | W19 | W20 | W21 |
| Expert 1   | 3  | 2  | 1  | 1  | 2  | 3  | 3  | 2  | 5  | 5   |
| Expert 2   | 3  | 3  | 1  | 1  | 1  | 2  | 4  | 3  | 4  | 2   |
| Expert 3   | 4  | 3  | 2  | 2  | 1  | 2  | 3  | 3  | 3  | 1   |
| Expert 4   | 4  | 1  | 2  | 1  | 2  | 1  | 3  | 2  | 4  | 1   |
| Expert 5   | 3  | 2  | 3  | 3  | 1  | 3  | 4  | 3  | 3  | 2   |
Table 8. The evaluation results of program 2

| Indicators | W1  | W2  | W3  | W4  | W5  | W6  | W7  | W8  | W9  | W10 | W11 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Expert 1   | 4   | 3   | 3   | 2   | 1   | 2   | 1   | 2   | 4   | 3   | 2   |
| Expert 2   | 5   | 4   | 2   | 1   | 2   | 3   | 2   | 4   | 5   | 3   | 2   |
| Expert 3   | 5   | 3   | 3   | 2   | 3   | 1   | 3   | 3   | 4   | 4   | 3   |
| Expert 4   | 3   | 2   | 2   | 3   | 1   | 1   | 2   | 4   | 3   | 5   | 1   |
| Expert 5   | 4   | 4   | 1   | 3   | 2   | 3   | 3   | 5   | 4   | 2   |     |

| Indicators | W12 | W13 | W14 | W15 | W16 | W17 | W18 | W19 | W20 | W21 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Expert 1   | 2   | 1   | 3   | 3   | 1   | 3   | 1   | 1   | 4   | 4   |
| Expert 2   | 3   | 2   | 2   | 2   | 1   | 4   | 2   | 1   | 3   | 5   |
| Expert 3   | 2   | 2   | 3   | 2   | 2   | 4   | 1   | 2   | 3   | 4   |
| Expert 4   | 1   | 3   | 1   | 3   | 3   | 2   | 3   | 4   | 4   |     |
| Expert 5   | 3   | 1   | 2   | 1   | 1   | 5   | 5   | 2   | 5   | 3   |

The fuzzy comprehensive evaluation method is based on fuzzy mathematics, and the specific steps for converting qualitative evaluation and quantitative evaluation are as follows:

A. **Determine the domain of the factors of the sample**
B. **Finish the domain of the review rating**
C. **Establish the fuzzy relationship matrix to obtain the fuzzy relationship**

\[
R = \begin{bmatrix}
(R_{X_1}) & \cdots & (R_{X_m}) \\
R_{X_1} & r_{12} & \cdots & r_{1m} \\
R_{X_2} & r_{22} & \cdots & r_{2m} \\
\vdots & \vdots & \ddots & \vdots \\
R_{X_m} & r_{m2} & \cdots & r_{nn}
\end{bmatrix}
\]  \hspace{1cm} (1)

D. **Determine the weight vector of the evaluation factor**
E. **Synthesize the fuzzy comprehensive evaluation result vector**
F. **Analyze the fuzzy comprehensive evaluation result vector**

Take option one as an example: from the judgment matrix in Table 5, five single-factor fuzzy comprehensive evaluation matrices such as R11, R12, R13, R14 and R15 in option one can be obtained:

\[
R_{v1} = \begin{bmatrix}
1/5 & 2/5 & 2/5 & 0 & 0 \\
0 & 2/5 & 2/5 & 1/5 & 0 \\
0 & 1/5 & 3/5 & 1/5 & 0
\end{bmatrix}
\]  \hspace{1cm} (2)

\[
R_{v2} = \begin{bmatrix}
2/5 & 2/5 & 1/5 & 0 & 0 \\
0 & 1/5 & 2/5 & 2/5 & 0 \\
2/5 & 2/5 & 1/5 & 0 & 0 \\
0 & 0 & 1/5 & 3/5 & 1/5 \\
3/5 & 2/5 & 0 & 0 & 0 \\
2/5 & 2/5 & 1/5 & 0 & 0 \\
1/5 & 2/5 & 2/5 & 0 & 0
\end{bmatrix}
\]  \hspace{1cm} (3)
By analogy, from the evaluation results in Table 6, five single-factor fuzzy comprehensive evaluation matrices such as \( R_{21} \), \( R_{22} \), \( R_{23} \), \( R_{24} \) and \( R_{25} \) can be obtained in the second plan. Then according to the formula, calculate the total score \( E_1 = 56.99 \) for the first plan, and the total score \( E_2 = 46.35 \) for the second plan in the same way.

6. CONCLUSION

Based on the above analysis, the first plan is the Optimal location for the "Hippo Tribe" warehouse, that is, warehouse 1 is in Haidian, warehouse 2 is in Xinfadi, and warehouse 3 is at the intersection of Beiyyuan South Road and Fuxingli West Road in Tongzhou District nearby. These three locations are close to the main traffic arteries of Beijing, which is convenient for vehicle transportation and distribution; the surrounding area covers a wide area, which is closer to users, and the delivery time is high. Therefore, it is feasible.

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