Evaluation of Regional Logistics Competitiveness of Wuhan’s "1+8" Urban Circle Based on SPSS

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Abstract. In this paper, 8 cities in the "1+8" urban circle of Wuhan were taken as research objects to construct the evaluation system of regional logistics competitiveness. Based on relevant data in 2017, the competitiveness of regional logistics in 8 cities was compared by factor analysis. Based on cluster analysis, the development level of regional logistics in the 8 cities was revealed. Finally, we put forward several suggestions to improve regional logistics competitiveness for the 8 different cities.

Keywords: Wuhan, Urban Circle, Regional Logistics Competitiveness, SPSS, Principal Component Analysis, Clustering Analysis

1 Introduction

The Wuhan urban circle, also known as the "1+8" urban circle of Wuhan, is a pilot area for the comprehensive reform of building a resource-conserving and environment-friendly society in China, approved by the national development and reform commission on December 14, 2007. It means to take Wuhan as the center of the circle and covering 8 medium-sized cities, including Huangshi, Ezhou, Huanggang, Xiaogan, Xianning, Xiantao, Qianjiang and Tianmen. The area of Wuhan urban circle is less than one third of that of Hubei Province, but it has concentrated more than half of the population of the province and more than 60% of the total GDP.

Regional logistics competitiveness means the logistics of a region can provide more competitive than other regions in terms of development ability of service economy, improvement of comprehensive economic strength and sustainable development ability in market competition.[1-3] With the further development of economic integration of urban circle, the demand of logistics integration has been generated. The development of regional logistics has important practical significance for optimizing regional economic structure, improving urban environment. The main purpose of this paper is that the government can understand the competitiveness level of urban logistics, and make the development plan of urban logistics according to the comparison results, so as to lay the foundation for the stability of urban logistics.

In China, there are few documents related to the logistics competitiveness of Wuhan urban circle, and there is not a mature evaluation index system of regional logistics competitiveness. Foreign scholars mainly focus on the micro level evaluation from the perspective of logistics supply chain. The
evaluation of regional logistics competitiveness is a complex process. Commonly used evaluation methods include factor analysis, DEA, clustering analysis, grey system method, etc. On the basis of relevant theories, this paper selected factor analysis and cluster analysis.

2 Construct of Evaluation System of Regional Logistics Competitiveness

2.1 Analysis and Selection of Index System
The authoritative views on the connotation of competitiveness mainly include Porter's diamond theory and international competitiveness theory. International competitiveness theory points out that the international competitiveness of a country (or region) includes not only the existing comprehensive strength, but also the internal growth ability of long-term sustainable development, that is, the potential for future growth. This paper uses the theory of international competitiveness to construct the evaluation index system shown as table 1.

| Table 1. Evaluation index system of regional logistics competitiveness |
|-----------------------------|-----------------------------|
| Primary indices             | Secondary indices           |
| Competitive strength of urban logistics | X11 Highway mileage (Kilometer), X12 Total number of civilian vehicles, X13 Number of employees in transportation, warehousing, postal services, X14 Total fixed assets investment in transportation, warehousing and postal services (Ten thousand Yuan) |
| Industrial scale            | X5 Ton-kilometers (0.1 Billion ton-kilometers), X2 GDP of transportation, warehousing and postal services (0.1 Billion Yuan) |
| Economic development level  | X1 Per capita GDP (Yuan), X3 Total imports and exports (0.1 Billion Yuan) |
| Information-based level     | X8 Internet users of computer broadband (10 thousand), X7 Mobile-telephone users (10 thousand), X6 Postal services (0.1 Billion Yuan) |
| Logistics support factors   | X10 Total urban population (10 thousand), X4 Retail sales (0.1 Billion ton-kilometers), X9 Annual number of invention patents per ten thousand people in a city |

2.2 Data Sources
The data used in this paper are all from the 2018 Statistical Yearbooks of each state and city of Hubei Province.[4-6] The data is the actual data of the city in 2017, and the specific data is shown in Table 2. Because there are big differences in quantity and dimension of each index data, in order to get more accurate analysis results, we do non dimensional treatment for the original data of each index by SPSS19.0 first of all.
Table 2. Logistics evaluation data of each city in Wuhan Urban circle in 2017

| Cities | X1 | X2 | X3 | X4 | X5 | X6 | X7 | X8 | X9 | X10 | X11 | X12 | X13 | X14 |
|--------|----|----|----|----|----|----|----|----|----|-----|-----|-----|-----|-----|
| Ezhou  | 844| 42 | 37 | 336| 71.9| 3.  | 102.| 28 | 2  | 107. | 3726| 6086| 546 | 1858|
| Huang  | 303| 35 | 54 | 1083| 371.| 9  | 445.| 94 | 2  | 634. | 3050| 1062| 988 | 1863|
| Gang   | 56 | 59 | 6  | .16| 22 | 97  | 1  | 4  | 36 | 1   | 0   | 834 | 3   | 080 |
| Huang  | 599| 72 | 22 | 723.| 4984| 9  | 212.| 57 | 5  | 247. | 7047| 2003| 895 | 1482|
| Shi    | 43 | 84 | 8.1| 28 | .32 | 1   | 66 | 6  | 7  | 0.5 | 804 | 53  | 2   | 042 |
| Qian   | 697| 20 | 20 | 232.| 64.4| 1  | 77.9| 16 | 8  | 96.5 | 3190| 8747| 401 | 3946|
| Jiang  | 31 | 73 | 9  | 31 | 4  | 4   | 6  | 38 | 56 | 78  | 8   | 8   | 48  |
| Xian   | 627| 20 | 53 | 332.| 75.1| 1  | 141.| 24 | 1  | 154. | 4498| 8904| 251 | 6166|
| Tao    | 92 | 7  | 1  | 55 | 3   | 86  | 1  | 63 | 5  | 3  | 7   | 0   | 8   | 2   |
| Xian   | 487| 38 | 34 | 497.| 116.| 5  | 260.| 69 | 5  | 253. | 1606| 3089| 111 | 1419|
| Ning   | 98 | 7  | 2  | 24 | 75 | 81  | 05 | 86 | 47 | 51  | 4.58| 0.5 | 47  | 200 |
| Xiao   | 354| 48 | 74 | 973.| 851.| 6  | 397.| 116| 4  | 94.1 | 1689| 2632| 194 | 1735|
| Gan    | 86 | 31 | 3  | 29 | 54 | 69  | 331| 64 | 47 | 5   | 0   | 21  | 76  | 043 |
| Tian   | 411| 12 | 8.4| 322.| 54.1| 1  | 73.3| 15 | 1  | 1.28 | 4331| 7975| 128 | 1101|
| Men    | 07 | 87 | 8  | 07 | 8  | 79  | 4  | 83 | 77 | 35  | 45  | 7   | 1   | 16  |

3 Comprehensive Evaluation of Logistics Competitiveness of Wuhan Urban Circle

3.1 Principal Component Analysis

It can be seen from table 3 that the cumulative contribution rate of the extracted three factors reaches 88.825%. It shows that the extracted three factors can reflect 88.825% of the information of the original indexes. The 14 indicators above can be integrated into three factors as F1, F2 and F3. The calculation method is shown in Formula (1):

\[
F = \frac{59.496 \times f1 + 22.003 \times f2 + 7.326 \times f3}{59.496 + 22.003 + 7.326} \tag{1}
\]

Table 3. Characteristic value and cumulative contribution rate of some main factors

| Factors | Initial variances | Extract the sum of square and load |
|---------|-------------------|-----------------------------------|
| Total | Varnaces (%) | Accumulation(%) | Total | Varnaces (%) | Accumulation(%) |
| 1 | 8.329 | 59.496 | 59.496 | 8.329 | 59.496 | 59.496 |
| 2 | 3.080 | 22.003 | 81.499 | 3.080 | 22.003 | 81.499 |
| 3 | 1.026 | 7.326 | 88.825 | 1.026 | 7.326 | 88.825 |

The component matrix obtained after rotation is shown in Table 4. The first main factor has a higher load on X8, X4, X7, X6, X10, X11, X12, X13, X14 and X1. These can be regarded as factors reflecting the economic foundation and logistics industrial environment of a regional city. The second main factor has a higher load on X5, X3, X2. These can be regarded as the development level factors of logistics industry. The third principal component has a high load on X9. It can be regarded as the supporting factor of scientific and technological innovation.[7-9]
### Table 4. The component matrix after rotation

| Factors                                      | Components |
|----------------------------------------------|------------|
|                                              | 1         | 2         | 3         |
| Total number of internet users of computer broadband | .975  | -.072 | .071 |
| Retail sales                                 | .972  | -.038 | -.081 |
| Mobile-telephone users                       | .967  | -.212 | .020 |
| Total amount of postal services               | .945  | .251  | -.120 |
| Total urban population                        | .940  | -.285 | -.025 |
| Highway mileage                               | .897  | -.413 | .048 |
| Total number of civilian vehicles             | .809  | -.406 | -.121 |
| Total investment in fixed assets of transportation, storage and postal services | .768  | .230  | .256 |
| Per capita GDP                                | -.654 | .476  | .168 |
| Ton-kilometers                                | .335  | .859  | -.306 |
| Total imports and exports                     | .410  | .837  | -.316 |
| GDP of transportation, warehousing and postal services | .591  | .782  | .017 |
| Annual number of invention patents per ten thousand people in a city | -.023 | .452  | .717 |

The scores of main factors, comprehensive scores and rankings of logistics competitiveness of each region are shown in Table 5.

### Table 5. The scores of main factors, comprehensive scores and rankings of logistics competitiveness of each region

| Cities  | F1       | Rankings | F2       | Rankings | F3       | Rankings | F       | Rankings |
|---------|----------|----------|----------|----------|----------|----------|--------|----------|
| Ezhou   | -0.606   | 5        | 0.374    | 2        | 0.253    | 4        | -0.292 | 5        |
| Huanggang | 1.612    | 1        | -1.161   | 8        | -0.572   | 5        | 0.744  | 2        |
| Huangshi | 0.551    | 3        | 2.162    | 1        | -0.853   | 6        | 0.842  | 1        |
| Qianjiang | -1.031   | 8        | 0.075    | 3        | 1.404    | 1        | -0.560 | 6        |
| Xiantao  | -0.847   | 6        | -0.397   | 6        | -1.037   | 7        | -0.750 | 7        |
| Xianning | 0.283    | 4        | -0.221   | 5        | 1.008    | 2        | 0.215  | 4        |
| Xiaogana | 0.986    | 2        | -0.042   | 4        | 0.846    | 3        | 0.718  | 3        |
| Tianmen  | -0.949   | 7        | -0.790   | 7        | -1.049   | 8        | -0.917 | 8        |

#### 3.2 Clustering Analysis
In order to reflect the logistics competitiveness level of Wuhan urban circle more clearly, SPSS19.0 is used for clustering analysis in this paper.

It can be found that Huangshi is the city in the first category. We can see from its main component score that the city's economic foundation, logistics industry environment and development of logistics industry are all relatively high, but the scores on supporting factors of scientific and technological innovation is relatively low and so that there is still room for its improvement. Xiaogan and Huanggang are the cities in the second category. From the results, Huanggang and Xiaogan's scores on the first principal component are the first and the second respectively, indicating that their economic foundation and logistics industry environment are relatively high, but the scores on the second principal component are relatively low. It shows that their logistics industry development level still has a lot of room for improvement. The five other cities are in the third category and their scores on the three principal components are relatively low. Belonging to areas with weak logistics competitiveness, the main reason is that the cities' economic foundation is relatively lag behind, so it is worth studying to explore their own advantages and improve the competitiveness of regional logistics.[10]

4 Policy Recommendations

4.1 Improve the Unbalanced Development

In this paper, 14 indexes were selected to comprehensively evaluate and rank the regional logistics competitiveness of Wuhan "1 + 8" urban circle by using principal component analysis and clustering analysis. The final sorting result was that Huangshi, Huanggang, Xiaogan, Xianning, Ezhou, Qianjiang, Xiantao, Tianmen. Based on the above analysis, this paper puts forward the following suggestions.

To overcome the gap, the government should take system optimization as the core and take the balance of them into account in order to promote the agglomeration effect of logistics resources in the urban circle in the process of improving logistics competitiveness.

4.2 Create Beneficial Economic Environment for Logistics Development

From the evaluation results, the areas with high level of logistics competitiveness are all cities with developed regional economy. This reflects the dependency of logistics industry. Therefore, we must speed up the economic development, strengthening the construction of infrastructure facilities, so that we can create the conditions for higher level logistics and so as to provide better services for future regional development.

4.3 Develop Their Own Advantages

The logistics competitiveness of Huangshi ranks in the front row, which is inseparable from its resource endowments. For Huangshi, we should give full play to its own advantages and linkage role so as to promote the development of Huanggang and Ezhou nearby. Other relatively undeveloped areas can make full use of the strategic opportunity of the country's strong promotion of "One belt one road" and the construction of the Yangtze economic zone. Huanggang can develop its manufacturing industry to drive its logistics industry, Xiaogan can attach importance to its commercial and logistics industry. For Qianjiang, Xiantao and Tianmen, they can use their own advantages of agricultural products to promote the synergetic development of electronic commerce and express logistics because they are geographically similar. Xianning can strengthen the railway-river combined transportation and build it into a regional logistics center.

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