Analysis on Wuhan E-commerce Industry Cluster Competitiveness Based on GEM Model

Chen Degang
School of Economics and Management
Hubei University of Science and Technology
Xianning, Hubei, 437100 China

Abstract—According to GEM model, it constructs the evaluation index system of e-commerce industry cluster competitiveness, using AHP analysis method to determine relevant index weight, to make quantitative evaluation of Wuhan e-commerce industry cluster competitiveness. The empirical study finds that Wuhan e-commerce industry cluster competitiveness is over the national average level, in the middle and upper level. The basic factor score is the highest and market factor score is the second, and enterprise factor score is relatively lower, illustrating that industry cluster competitiveness level is to be improved. For the empirical analysis results, it proposes the countermeasures of improving Wuhan e-commerce industry cluster competitiveness.

Keywords—e-commerce industry cluster; competitiveness; analytic hierarchy process; GEM model;

I. Introduction

The data of Chinese e-commerce research center shows that, by the end of 2012, Chinese e-commerce market size is of 78500 billion, increasing 30.83%. According to the data calculation in 2012, e-commerce occupies the GDP proportion of up to 15%. E-commerce and its industry development are very important for social development. Wuhan City, as the demonstration city of e-commerce, the development of e-commerce industry is becoming more and more prominent. This paper, according to six influence factors of GEM model, combined with AHP to determine the weight of each factor, makes empirical analysis of Wuhan e-commerce industry cluster competitiveness, obtaining the scores of each influence factor and total competitiveness, in order to provide relevant decision and reference for the development of Wuhan e-commerce industry cluster.

II. E-commerce Industry Cluster Competitiveness Model and Evaluation Process Based on GEM

2.1 E-commerce Industry Cluster Competitiveness GEM Model

Padmore and Gibson (1998) studied and summarized the experience of industry cluster development. Based on Potter's “diamond model”, it makes innovation, proposing a model of analyzing industry cluster competitiveness --- GEM model. GEM model has three elements, with altogether six influence factors. G represents basic element, including “resource” and “equipment” element; E represents enterprise element, containing “supplier and relevant aided industries” and “enterprise structure, strategy and competitiveness” element. M represents market element, including “local market” and “external market” element.

2.2 GEM Model Evaluation Process

2.2.1 GEM Model Index System Construction

Compared with traditional industry cluster, e-commerce industry cluster competitiveness is mainly reflected in the application of Internet platform, highlighting the features of e-commerce information flow, fund flow and logistics. In selecting six elements of GEM model, it should take the elements of Internet and e-commerce as the center. Through the discussion of relevant experts, it makes second index division for six elements of GEM, finally obtaining 27 second-indexes.

Table 1  E-commerce industry cluster competitiveness index system

<table>
<thead>
<tr>
<th>Basis</th>
<th>D11</th>
<th>D12</th>
<th>D13</th>
<th>D14</th>
<th>D15</th>
<th>D16</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Enterprise</td>
<td>Facility</td>
<td>Supplier</td>
<td>Local market</td>
<td>External</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D11</td>
<td>D12</td>
<td>D13</td>
<td>D14</td>
<td>D15</td>
<td>D16</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Supplier and relevant aided industry D1</th>
<th>D11</th>
<th>D12</th>
<th>D13</th>
<th>D14</th>
<th>D15</th>
<th>D16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enterprise D2</td>
<td>D11</td>
<td>D12</td>
<td>D13</td>
<td>D14</td>
<td>D15</td>
<td>D16</td>
</tr>
<tr>
<td>Local market D3</td>
<td>D11</td>
<td>D12</td>
<td>D13</td>
<td>D14</td>
<td>D15</td>
<td>D16</td>
</tr>
<tr>
<td>External market D4</td>
<td>D11</td>
<td>D12</td>
<td>D13</td>
<td>D14</td>
<td>D15</td>
<td>D16</td>
</tr>
</tbody>
</table>

2.2.2 E-commerce industry cluster factor weight determination

For different importance of industry cluster index factor, it can adopt AHP method to respectively determine 27
second-index weight. It is scored by experts and reconstruct to judge matrix, then it calculates to obtain various index weight.

(1) Expert scoring. It adopts questionnaire form to score second-index by experts, with score from 1 to ten, showing the importance of this index. Because experts can make subjective feeling evaluation according to experience, thus, it needs further scientific quantification.

(2) Constructing judgment matrix. Judging matrix is to mean the relevant importance comparison of all the factors for the above level of a certain factor. It sets up second-index and determine scaling value, indicating the importance between the two, and it constructs judgment matrix.

Table 2 Judgment matrix

<table>
<thead>
<tr>
<th>A</th>
<th>D_1</th>
<th>D_2</th>
<th>...</th>
<th>D_n</th>
</tr>
</thead>
<tbody>
<tr>
<td>D_1</td>
<td>X_{11}</td>
<td>X_{12}</td>
<td>...</td>
<td>X_{1n}</td>
</tr>
<tr>
<td>D_2</td>
<td>X_{21}</td>
<td>X_{22}</td>
<td>...</td>
<td>X_{2n}</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>D_n</td>
<td>X_{n1}</td>
<td>X_{n2}</td>
<td>...</td>
<td>X_{nn}</td>
</tr>
</tbody>
</table>

(3) Calculating second-index weight. Generally speaking, it can use calculation to judge matrix feature value to express the same level elements’ relative importance, using the square approximation to obtain the weight W_a, namely,

\[ W_a = \sqrt{X_{11} \times X_{22} \times \ldots \times X_{nn}} \]

Then, it uses normalization method to calculate the relative importance of indicators \[ W_a = \frac{W_a}{W_1 + W_2 + \ldots + W_i} \]

(4) Checking the consistency of judgment matrix

First, it calculates judgment matrix’s feature value \[ \lambda_i = \frac{\sum (X_{ij} \times W_a)}{W_a} \]

Then, it calculates judgment matrix’s maximum feature root approximate value \[ \lambda_{max} = \frac{\lambda_{max} + \sqrt{\lambda_{max}^2 - 4 \lambda_{max} \lambda_i}}{2} \]

Then, it calculates matrix consistency.

Calculating index CI, \[ CI = \frac{\lambda_{max} - n}{n - 1} \], index RI to obtain through checking table. According to judgment matrix consistency testing, namely, CR = CI/RI < 0.1, determining the rationality of judgment matrix and weight coefficient.

(5) It can use the above method, respectively calculating six factor second-index’s relatively importance degree and weight.

2.2.3 Quantitative Evaluation of GEM Model

In order to make a more comprehensive and intuitive analysis of industry cluster competitiveness, it can make quantitative evaluation of influencing cluster competitiveness factor in GEM model. The quantitative process is as follows.

(1) Second-level influence factor assignment. According to the world’s industry cluster competitiveness standard to score various second-factor, each factor value is from 10 points (very outstanding) to 1 point (very poor), representing different situations of various factors.

(2) It makes factor calculation and transfer, calculating “factor score value”. Factor value = \( \left( \frac{D_{2i-1} + D_{2i}}{2} \right) \) where \( i = 1, 2, 3, D_{2i-1}, D_{2i} \), showing the scores of various factors. \( D_{2i-1}, D_{2i} \), representing factor is 2 replaceable factors.

(3) Calculating “cluster linear value” and final results. Cluster linear value = \( \prod_{i=1}^{2,3} (\text{factor and score is } i) \). Finally it makes 2 conversions. The first conversion is to make cluster linear score into various “factor score” times. The second transformation is only a proportion transfer. The goal is to make the final score is 1000. Finally, the quantitative expression of GEM model cluster competitiveness is:

\[ \text{GEM} = 2.5 \times \left( \prod_{i=1,2,3} (D_{2i-1} + D_{2i}) \right)^{2/3} \]

Through the calculation of GEM competitiveness quantitative expression, if six influence factors’ score of an industry cluster are about 5 scores, namely, GEM score is 250, showing the industry cluster competitiveness achieves the domestic average level. If six influence factors’ score is about 7, namely, GEM score is about 490, showing that the industry cluster has strong competitiveness in China.

III. Empirical Analysis of Wuhan E-commerce Industry Cluster Competitiveness

3.1 Calculation of Wuhan E-commerce Industry Cluster Competitiveness

(1) Using AHP method to determine index weight. It surrounds GEM model of 3 factors for 6 factors to establish Wuhan E-commerce industry cluster competitiveness evaluation index system, including 27 second-index factor. It is designed into questionnaire, to make survey of various second-index importance and current actual situation. The questionnaire objects are Wuhan e-commerce industry experts and scholars and Wuhan e-commerce industry’s senior management staff, using 1-10 scoring, with 20 questionnaires and recovering 15 pieces. The second-index weight adopts AHP method. It obtains second index’s judgment matrix according to experts’ scoring.

(2) Calculating second index scores. Through experts’ current situation judgment and important degree of scoring for second index, it uses AHP method to determine weight, comprehensively obtaining Wuhan e-commerce industry cluster competitiveness and second index weight and index value. It respectively judges the maximum feature root of judgment matrix approximate value \( \lambda_{max} \) and judgment matrix consistency testing index CR. Through calculation, it obtains six factors’ CR less than 0.1, showing that judgment matrix and weight coefficient are rational.

Table 3 \( \lambda_{max} \) and CR calculation value

<table>
<thead>
<tr>
<th>Index</th>
<th>Resource</th>
<th>Equipment</th>
<th>Supplier and related aided industries</th>
<th>Enterprise structure and strategy</th>
<th>Local market</th>
<th>External market</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>4.2148</td>
<td>5.3371</td>
<td>3.1927</td>
<td>7.0458</td>
<td>4.8169</td>
<td>4.1391</td>
</tr>
<tr>
<td>CR</td>
<td>0.0805</td>
<td>0.0797</td>
<td>0.0535</td>
<td>0.0102</td>
<td>0.0430</td>
<td>0.0521</td>
</tr>
</tbody>
</table>
(3) According to GEM model, it conducts “factor” calculation and conversion. The various factor score is:

**Basis:** PAIRSCORE(res = D1, fac = D2) = \((\frac{D1+D2}{2})\) = \((\frac{7.8111+7.5537}{2})\) = 7.6824

**Enterprise:** PAIRSCORE (sup = D3, enter = D4) = \((\frac{D3+D4}{2})\) = \((\frac{5.7330+5.3751}{2})\) = 5.5541

**Market:** PAIRSCORE (loc = D5, ext = D6) = \((\frac{D5+D6}{2})\) = \((\frac{6.6505+6.9942}{2})\) = 6.8224

(4) Calculating “cluster linear score” and final result:

\[
GEM = 2.5 \times \left( \prod_{i=1,2,3} (D_{2i-1} + D_{2i}) \right)^{2/3}
\]

\[
= 2.5 \times (7.8111+7.5537) \times (5.7330+5.3751) \times (6.6505+6.9942)^{2/3}
\]

\[
= 2.5 \times (15.3648 \times 11.1081 \times 13.6447)^{2/3}
\]

\[
= 439.2318 \approx 439
\]

3.2 Evaluation Result

From total score, 439 score shows that Wuhan e-commerce industry cluster competitiveness is in national middle and upper level, more than the average level of national 250 scores, and overall competitiveness is not strong. According to calculation score, it obtains Wuhan e-commerce industry cluster GEM model quantitative analysis figure (see Figure 1), and the various factor sequence result is: resource (7.8111) > facility (7.5537) > external market (6.9942) > supplier and relevant aided industry (6.6505) > enterprise structure, strategy and competitiveness (5.7330). From GEM quantitative result, Wuhan e-commerce industry cluster falls behind Beijing, Shanghai, Guangzhou and Hangzhou e-commerce advanced cities, belonging to e-commerce second group front cities, which has some difference with e-commerce advanced cities. From the analysis of six factors’ score, the basic factor is good, but enterprise factor score is low, and it should improve from enterprise’s own development factor, enhancing e-commerce supplier and relevant industries’ development, optimizing e-commerce enterprise organization structure, improve enterprise strategy and

IV. Conclusion

This paper refers to the previous research method, adopting GEM model, combined with AHP to make quantitative analysis of Wuhan e-commerce industry cluster competitiveness, which can, to some degree, illustrate six factors’ competitiveness situation of GEM model, in order to have direction for Wuhan e-commerce industry cluster competitiveness.

Acknowledgments

Fund project: Hubei Province education department humanity and social science research project (13g394)

References


