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

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***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

Basis	Resource D1	D11	E-commerce talent resource
		D12	Region resource
		D13	E-commerce information resource
		D14	Product resource
	Facility D2	D21	Government support
		D22	Logistics equipment
		D23	Basic facilities
		D24	Financial market
		D25	Commercial market
Enterprise	Supplier and relevant aided industry D3	D31	E-commerce enterprise's comprehensive strength
		D32	E-commerce enterprise's financial strength
		D33	E-commerce enterprise's innovation ability
		D34	Good competitiveness degree of cluster enterprises
		D35	Strategic development planning of e-commerce enterprise
	Enterprise structure, strategy and competitiveness D4	D41	E-commerce industry chain integrity
		D42	Supplier's quantity and strength
		D43	Supplier's professional degree
		D44	Exchange and cooperation between e-commerce enterprises
		D45	Relevant industry maturity
Market	Local market D5	D51	E-commerce local market occupying rate
		D52	Consumers' trust for local brand
		D53	E-commerce local online consumption maturity degree
		D54	Local online market development prospect
	External market D6	D61	Share of external market
		D62	Demand of external online market
		D63	Obstacle of entering external online market
		D64	Development prospect of external online market

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

A	D_1	D_2 ...	D_n
D_1	X_{11}	X_{12} …	X_{1n}
D_2	X_{21}	X_{22} …	X_{2n}
...			
D_n	X_{n1}	X_{n2} …	X_{nn}

(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 Wa, namely,

$$Wa=\sqrt[i]{Xn1 \times Xn2 \times \ldots \times Xni}$$

Then, it uses normalization method to calculate the relative importance of indicators $W_a^1=\frac{Wa}{W1+W2+\cdots+Wi}$

(4)Checking the consistency of judgment matrix

First, it calculates judgment matrix's feature value $\lambda i=\frac{\sum(Xij \times Wa)}{Wa}$

Then, it calculates judgment matrix's maximum feature root approximate value

$$\lambda max=\frac{\lambda 1+\lambda 2+\ldots+\lambda i}{i}$$

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= (D_{2i-1} + D_{2i}) / 2, 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= $\prod_{i=1,2,3}$(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 t 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:

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

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 λmax 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 λmax and CR calculation value

Index	Resource	Equipment	Supplier and relevant aided industries	Enterprise structure, strategy and competitiveness	Local market	External market
λmax	4.2148	5.3571	5.1592	5.0458	4.1169	4.1391
CR	0.0805	0.0797	0.0355	0.0102	0.0438	0.0521

Table 4 GEM model second-index average value, weight and six factors' score

		Evaluation index	Index average value	Index weight	Scoring
Basis	Resource D1	D11	8.2532	0.4473	7.8111
		D12	8.0625	0.0714	
		D13	7.5429	0.1650	
		D14	7.2689	0.3163	
	Equipment D2	D21	8.1530	0.2697	7.5537
		D22	7.5395	0.3504	
		D23	7.2459	0.2448	
		D24	7.0535	0.0676	
		D25	7.1694	0.0645	
Enterprise	Supplier and relevant aided industries D3	D31	5.8346	0.1936	5.7330
		D32	5.9680	0.3475	
		D33	5.3659	0.3475	
		D34	6.6598	0.0568	
		D35	5.2583	0.0545	
	Enterprise structure, strategy and competition D4	D41	5.3598	0.4690	5.3751
		D42	4.9853	0.2694	
		D43	5.3588	0.0756	
		D44	5.5982	0.0434	
		D45	6.0984	0.1427	
Market	Local market D5	D51	5.0358	0.0550	6.6505
		D52	5.8465	0.2634	
		D53	7.0358	0.5638	
		D54	7.3584	0.1178	
	External market D6	D61	6.2589	0.1207	6.9942
		D62	7.2580	0.5777	
		D63	5.0532	0.0641	
		D64	7.25	0.2375	

(3)According to GEM model, it conducts "factor" calculation and conversion. The various factor score is:

Basis: PAIRSCORE(resource D1 , facility D2)= （D1+D2）/2=（7.8111+7.5537）/2=7.6824

Enterprise：PAIRSCORE（Supplier and aided industry D3，enterprise strategy, structure and competition D4）= （D3+D4）/2=

（5.7330+5.3751）/2=5.5541

Market：PAIRSCORE（Local market D5，external market D6）=（D5+D6）/2=（6.6505+6.9942）/2=6.8224

(4)Calculating "cluster linear score" and final result:

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

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

$$=2.5\times(15.3648\times11.1081\times13.6447)^{2/3}=2.5\times175.6927$$

$$=439.2318\approx439;$$

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)>local market(6.6505) >supplier and relevant aided industry（5.7330）>enterprise structure, strategy and competitiveness（5.3751）. 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 improve enterprise competitiveness.

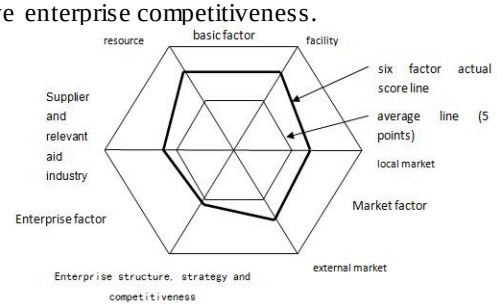

Figure 1 Wuhan e-commerce industry cluster GEM model quantitative analysis

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.

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References

[1] Michael Potter. National competitiveness advantage[M]. Li Mingxuan, translated by Qiu Rumei. Beijing: Huaxia Press, 2008.

[2] Yang Jianmei. Yang Jing. Evaluating enterprise cluster competitiveness's GEM model and application[J]. Science and Science Technology Management, 2003,(9).

[3] Li Jianlei, Xu Xiaoming. Hebei Province industry cluster competitiveness GEM model evaluation[J]. Journal of Hebei University of Technology, 2011. (10).

[4] Yu Haihui. Enterprise soft power index construction and measure based on fuzzy level evaluation[J]. Statistics and Decision-making, 2014(1).