

# Characteristics and Influencing Factors of Urban Agglomeration Competitiveness in Pearl River Delta

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## ABSTRACT

Through the construction of evaluation system, based on Entropy TOPSIS and obstacle degree model to measure competitiveness characteristics and influencing factors of Pearl River Delta. The results showed that: (1) The advantages in the competitiveness dimension were economic competitiveness, social competitiveness and ecological competitiveness, while resource competitiveness and institutional competitiveness were relatively weak; and the competitiveness of nine cities in the Pearl River Delta were divided into three levels. (2) There were certain differences in the obstacle degree about competitiveness, but resource competition and institutional competition had relatively high.

**Keywords:** urban competitiveness, Entropy weight TOPSIS, obstacle degree, Pearl River Delta urban agglomeration

## 1. INTRODUCTION

The "one belt, one road" initiative had given important opportunities to the development of the Pearl River Delta. However, facing the complex economic situation and the transformation of domestic industrial structure, the Pearl River Delta urban agglomeration also had great challenges, such as insufficient sharing of innovation resources, insufficient industrial integration and serious environmental pollution. These have seriously hindered the in-depth linkage and coordinated development of the Pearl River Delta [1]. Therefore, it is an urgent requirement to strengthen internal horizontal ties, break the division within the cluster, realize resource allocation and share infrastructure for the development of urban agglomeration in the Pearl River Delta.

The research on foreign urban competitiveness began in the early 1980s and attracted the attention of foreign scholars in economics, geography and urban planning. It mainly focuses on the concept of urban competition, influencing factors, case analysis, promotion strategy [2]. Classical competitive models are proposed, such as Porter's "Diamond Model", WEF-IMD model, Kresl Peter model, etc; Scholars explored national competitiveness, industrial

competitiveness, regional competitiveness and urban competitiveness from multi-scale [3]; They had constructed the explicit index system of competitiveness and the explanatory index system of urban competitiveness, which have laid a solid foundation for later research [4-5]. In the late 1990s, domestic scholars began to pay attention to the research of urban competitiveness, mainly focusing on the evaluation of urban competitiveness. The competitiveness evaluation index system focused on the collection of multiple elements, such as economic development, scientific and technological strength, infrastructure, etc; and research methods gradually pay attention to the refinement and scientific of evaluation process [6-7]. In conclusion, there were many research results on competitiveness, but mostly pay more attention to economic and social development indicators, ignored urban soft power, ecological environment and other indicators. therefore, this paper constructs an evaluation index system to analysis the characteristics and influencing factors of the competitiveness through entropy weight TOPSIS Model and obstacle degree, in order to promote the coordinated development of Pearl River Delta urban agglomeration.

## 2. METHODS

### 2.1 Index system

According to the relevant theories of economic geography and urban economy, this paper draws lessons from the relevant models and evaluation system of regional competitiveness and urban competitiveness, and combined with the specific situation of Pearl River Delta urban agglomeration, constructs the competitiveness evaluation index system from economic competitiveness, ecological competitiveness, social competitiveness, resource competitiveness and institutional competitiveness [8], as shown in figure 1.

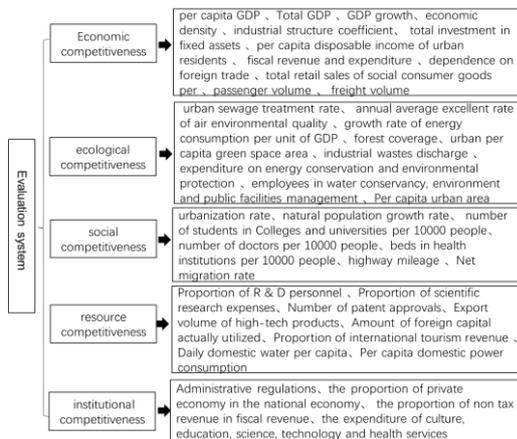


Figure 1 Competitiveness evaluation index system of Pearl River Delta Urban Agglomeration

### 2.2 Entropy weight method and TOPSIS

The entropy method determines the index weight through the information provided by the observed values of each index, which is conducive to increasing the objectivity of the results and reducing the influence of subjective factors. According to the distance between the evaluation unit and the best and worst scheme, TOPSIS method is sorted to understand the gap between each scheme and the objective and real actual situation. The specific formula is not listed. See literature [9] for details.

### 2.3 Obstacle model

The barrier degree model is introduced to diagnose the main factors hindering the development of urban agglomeration in the Pearl River Delta, which is conducive to the optimal regulation of the competitiveness of urban agglomeration. In this paper, the top five obstacle factors are obtained by ranking the obstacle degrees. The calculation formula is:

$$H_j = \frac{w_j X'_{ij}}{\sum_{i=1}^n w_j X'_{ij}} * 100\% \quad (1)$$

In the formula,  $w_j$  represents the index weight and  $X_{ij}$  is the value after standardization.

## 3. RESULT ANALYSIS

### 3.1 competitiveness dimension

According to Figure2, the nine cities can be divided into three levels according to the ranking results of economic competitiveness. The first level is Guangzhou and Shenzhen, whose relative proximity is greater than 0.4. They have strong advantages in economic benefits and undertake the important task of leading the rapid economic development of other cities in the Pearl River Delta. The second level is Foshan, Zhuhai and Dongguan, the comprehensive economic benefits of these cities have strong competitive advantages and are the backbone of the development of urban agglomeration in the Pearl River Delta. The other four cities are at the third level with weak economic competitiveness. From the numerical reflection, they belong to the upper middle level of economic strength. At the same time, the relative proximity of the two cities with the highest score and the lowest score is quite different, which is 0.22, indicating that the development of internal economic strength is uneven and prone to polarization.

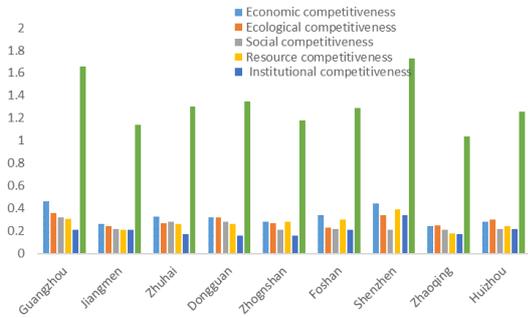
In terms of ecological competitiveness, the top four cities are Guangzhou, Shenzhen, Dongguan and Huizhou, and their relative proximity is greater than 0.30. Dongguan and Huizhou are relatively underdeveloped cities, but their ecological benefits are prominent, such as the annual average excellent rate of air environmental quality and forest coverage; Guangzhou and Shenzhen pay attention not only to the improvement of economy, but also to the coordination of ecological environment. The relative proximity values of the last five cities are less than 0.3. The reason is that these cities do not pay enough attention to environmental infrastructure, such as the high emission of industrial wastes.

Guangzhou ranked the first in social competitiveness, with a relative proximity of 0.3. At the same time, the difference of relative proximity between the cities with the highest and lowest scores is small, which is 0.12, which is the smallest difference among the five competitiveness dimensions, indicating that the social development level of each city is relatively balanced and there is no serious polarization.

The top in resource competitiveness are Shenzhen and Guangzhou. As the core cities of the Pearl River Delta urban agglomeration, they have great advantages in the proportion of R & D personnel in scientific and technological activities, the number of patent approvals, the export volume of high-tech products and other indicators. These indicators make these cities have high scientific research level, intensive knowledge and talents, rich human resources and strong resource benefits. The relative proximity values of the lower

seven cities are less than 0.3.

Shenzhen ranked the first in institutional competitiveness, and its relative proximity value is greater than 0.3. The last eight cities are Huizhou, Guangzhou, Jiangmen, Foshan, Zhuhai, Zhaoqing and Zhongshan, and their relative proximity values are less than 0.3.



**Figure 2** Ranking of competitiveness of cities in Pearl River Delta Urban Agglomeration

Finally, the nine cities in the Pearl River Delta can be divided into three metropolitan areas, namely Guang-Fo-Zhao metropolitan area, Shen-Guan-Hui metropolitan area and Zhu-Zhong-Jiang metropolitan area [10]. In the first place is the Shenzhen-Dongguan-Huizhou metropolitan area, with a comprehensive benefit of 4.35. Compared with the other two metropolitan areas, the economic, ecological, resource and institutional benefits of the Shenzhen-Dongguan-Huizhou metropolitan area are at a higher level, but the social benefits of the Shenzhen Dongguan Huizhou metropolitan area are the lowest among the three metropolitan areas. It shows that in the development process of Shenzhen-Dongguan- Huizhou metropolitan area, several indicators included in social benefits: the number of college students per 10000 people, the number of doctors per 10000 people, the number of beds in health institutions per 10000 people, local financial and educational expenses and other social and people's well-being are less concerned than economic benefits. From the numerical point of view, the gap between the comprehensive benefits of the latter two metropolitan areas is not too large. The main gap is obviously in the economic benefits. The economic benefits of Guang-Fo-Zhao metropolitan area are equal to those of Shenzhen Dongguan Huizhou metropolitan area. Due to the existence of two strong cities of Guangzhou and Foshan, Zhaoqing, a city with weak development, has a relatively strong heritage and follow-up development conditions. Although the Pearl River Delta metropolitan area is temporarily at the bottom of the Pearl River Delta urban agglomeration, it has strong development potential and comprehensive ability.

### 3.2 influencing factors

As shown in Table 1, the system level obstacle degree of the competitiveness of Pearl River Delta urban agglomeration is economic competitiveness - ecological competitiveness - resource competitiveness - social competitiveness - institutional competitiveness. However, due to the different number of competitiveness indicators, there is a certain deviation in the total obstacle degree. Therefore, the average obstacle degree of each competitiveness is taken in combination with the amount of competitiveness. Among the 40 competitiveness indicators selected in this paper, the top 7 and more than 3% of the obstacle factors are per capita daily domestic water consumption, total urban GDP, passenger traffic, expenditure on culture, education, science, technology and health, energy conservation and environmental protection expenditure, number of college students per 10000 people and export volume of high-tech products. Among them, the indicator with the highest obstacle degree is per capita daily domestic water consumption, which belongs to resource competitiveness indicators.

**Table 1** Obstacle degree of index competitiveness of Pearl River Delta Urban Agglomeration

Competitiveness Style	Obstacle degree (%)	indicators Number	Average obstacle degree (%)
Institutional competitiveness	10.93	4	2.73
Resource competitiveness	20.89	8	2.61
Economic competitiveness	29.54	12	2.46
Ecological competitiveness	22.04	9	2.45
Social competitiveness	16.59	7	2.37

### 4. CONCLUSIONS

Based on entropy weight TOPSIS and obstacle degree model, the competitiveness characteristics and influencing factors of nine cities in the Pearl River Delta are analysed. The results showed that: The nine cities can be divided into three levels. The most competitive cities are Guangzhou, Shenzhen and Dongguan; Zhuhai, Foshan, Huizhou are highly competitive; The less competitive cities are Zhongshan, Jiangmen, and Zhaoqing. There is still broad space to improve the resource efficiency of the Pearl River Delta urban agglomeration. The development needs to focus on the system and resources, and promote the vigorous development of the Pearl River Delta urban agglomeration through the improvement of the efficiency of resources and systems.

Due to the availability of data, there is no dynamic evolution and prediction analysis; in the evaluation index system, there is still a lack of comprehensive understanding of the connotation of competitiveness, and cannot fully cover the development advantages and existing problems of urban agglomeration in the Pearl River Delta. Therefore, further evolve the index data of cities in the Pearl River Delta in time and space, improve the comprehensiveness and refinement of research methods, and strengthen the empirical research on the coordination and optimization of Urban Agglomeration Competitiveness, so as to achieve the high-quality development goal of urban agglomeration in the future.

### **AUTHORS' CONTRIBUTIONS**

Jieyu LIANG, Bo TANG, Tingting HUANG, Pingping JIANG, Xiaolin YOU contributed the framework and writing of the manuscript.

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### **REFERENCES**

- [1] Yi Laisheng, Feng Bangyan. Study on urban regional spatial evolution in the Pearl River Delta [J]. *Economic geography*,2012,32(1):64-69.
- [2] Yu Taofang. A review of research on urban competitiveness abroad [J]. *Urban Planning Overseas*,2004(1):28-34.
- [3] W Andrew. *Changing Cities: Rethinking Urban Competitiveness, Cohesion and Governance*. Edited by Nick Buck, Ian Gordon, Alan Harding and Ivan Turok[J]. *Economic Geography*,2015,83(3):329-330.
- [4] S Shaleen, B Jim, M Stanley. A Framework for Assessing Regeneration, Business Strategies and Urban Competitiveness[J]. *Local Economy: The Journal of the Local Economy Policy Unit*,2009,24(2): 111-124
- [5] Anoshkina E. Urban competitiveness and agglomeration development: A case study of Perm and Yekaterinburg[J]. *Regional ence Policy & Practice*, 2012, 4(2):125-137.
- [6] Ning Yuemin, Tang Lizhi. Concept and index system of urban competitiveness [J]. *modern city research*,2001(3):19-22.
- [7] Cao Qingfeng, Ni Pengfei, Ma Hongfu. International Comparative Study on the sustainable competitiveness of China's urban system [J]. *Henan Social Sciences*,2021,29(4):49-56.
- [8] Wang Fazeng, LV Jinrong. Evaluation and temporal and spatial evolution of urban competitiveness of Central Plains urban agglomeration [J]. *Geographical research*, 2011,30 (1): 49-60
- [9] WU Peng, DONG Huizhong, QIU Shilei,et al. A Study on the Evaluation of the Cities'Comprehensive Competitiveness in the Shandong Peninsula Urban Agglomerations—Based on the Improved Grey TOPSIS Method [J]. *East China Economic Management*, 2017,31(2):27-34.
- [10] ZHOU Chunshan,LUO Lijia,SHI Chenyi,et al.Spatio-temporal Evolutionary Characteristics of the Economic Development in the Guangdong-Hong Kong-Macao Greater Bay Area and Its Influencing Factors[J].*Tropical Geograph*, 2017, 37 (6) : 802-813.