Research on World City Evaluation System Based on the Concept of Regional Space "Flow"

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Abstract: In 2012, the United Nations published the white paper "Big Data for Development: Challenges and Opportunities", pointing out that the "big data era" has arrived. The concept of "data stream" will continue to profoundly affect all aspects of the global economy, society and life. The "vertical" relationship between cities in the traditional urban hierarchy is gradually replaced by the "horizontal" relationship in the urban network system. As the concept of "big data" gradually moves from theory to practice, the world city evaluation system is based on the evidence of air passenger flow, port logistics, Internet information flow data, enterprise top 100 multinational corporations' enterprise layout and scale data, and high-end productive service industry. Data research, further reorienting the path of urban competitive advantage from the perspective of world urban network, proposes the strategy of urban competitiveness improvement under the background of the world urban network system, which undoubtedly promotes the refinement of China's big data urban and rural planning to the planning process. Scientific advancement provides guarantee and technical support for scientific and rational planning results.

1. Introduction

In the 1960s, most western countries experienced a sharp increase in urban population, and there was an imbalance between regions. To solve the problem of unbalanced development, western scholars proposed the "urban system" theory (the core of China's urban planning). Divide a number of cities in a region into different levels, and divide the criteria according to functions, scale, division of labor, etc.; and think that each city is more part of the internal economic, political, and cultural development system of the country and is not transnational.

Peter Hall, published in 1966, "The Big City of the World" for the first time opened up the modern exploration of the systemic principles of global cities, but lacks the objective development of the world's development background, and is rejected by the national urban system school and urban geography. After the 1980s, the development of the world economy towards grouping, regionalization, internationalization (economic globalization), the restructuring of the spatial structure of the globalized urban economy and the reconstruction of the world market have become the fundamental driving force for the development of metropolises and regions, affecting the urban system.

The world city, also known as the global city, the international city, was first proposed by the humanities planning and regional planning scholar Patrick Geddes in 1915, "The City of Evolution", describing "world city" as a city with an important position in world business.
Since then, Peter Hall has more comprehensively described the world city as the world's major and internationally influential city.

2. Early Chinese world city evaluation of regional spatial structure research
GaWC, as the main research organization or researcher of world urban network, initially focused on the central position and functions of "core node" world cities in the world urban network system, and mostly studied the functions and relations of core node cities. Then Peter hall, led by a large number of scholars will flow space, global city, metropolis group of related theory and concept integration, and use the network analysis method, puts forward the concept of a polycentric mega-city-region, and system and empirical research has been carried out in the northwest area (Loughborough team's study of Western European megacities), and study the world city theory extends to the giant urban areas (large cities or urban agglomeration) study: in the pearl river delta, the core power in the hands of Hong Kong, and the related function of service industry in Guangzhou, same time, the service functions of manufacturing, and other distributed in other cities in this area. Nevertheless, overall, the concentration of the region is very high on a global scale. A similar situation exists in the Yangtze river delta. Shanghai is a high-end service center, while Suzhou is a high-tech research and development center and high-end manufacturing center.

This series of studies confirm that with the development of economy and industry, China's major cities present different scale structures of world cities. First, they are world cities with real world economic strength or capital cities with political power, as well as big cities with economic significance (Hong Kong, Shanghai and Beijing). Second, secondary or regional international cities (Guangzhou, Shenzhen); Third, the rapid growth of population, resulting in a huge regional gathering of domestic metropolis; Fourth, the regional central cities in China (Chengdu, Tianjin, Hangzhou, etc.) (figure 1).

![Figure 1](image)

Figure 1. The trend of architecture change of Chinese regional space in GAWC world city list.

3. Informatization transformation of regional spatial structure research
3.1 Network of producer services in world cities
The development of globalization and informatization has led to two transformations of urban network research, from focusing on the relationship between network nodes and the basic research of network structure to expanding the "flow space" of world urban areas. The globalization of high-level service branches and highly developed global communication network have formed a global urban network system. In a word, many studies at home and
abroad show that under the background of globalization and informatization, the theory of "flow space" has become the foundation of the world's urban network research.

Basic productive sectors and industries (consumer and living services: catering, tourism, etc.) have been allocated in the construction and development process. The allocation of public productive sectors and industries (e-government, health care, education, etc.) is mostly dominated by the government, and their location selection is closely related to service scope and social equity. The important commonality of high-end service industry (production-oriented service industry), including operation and management, scientific research and development, creative design, human resources, information and communication, is led by information "flow" which is separated from the place meaning. Their function to the regional spatial structure belongs to the post-industrial age and is "reconstructive", so it is also "revolutionary" to the traditional geography.

3.2 Combination types of urban spatial elements in the world

Traditional space network structure analysis, the traditional theory reveals the evolution of regional spatial structure regularity and mechanism of common said: development poles theory, gradient theory and point axis development theory highlights the consciousness of "nuclear" space centricity, consider regional development cannot leave the one with the center of the focus and innovation ability, through the center of the agglomeration and radiation effect to promote regional social and economic development.

As the three basic elements of regional spatial structure, point (node) and node system, line and network system, and plane domain can be combined into 7 different modes and have specific economic functions. With the development of globalization, central place theory, rent-seeking theory, market area and market network theory (liao assorted landscape) in explaining the networked world cities such as new spatial pattern of the show, all kinds of infrastructure in city system, the role of information and communication is becoming more and more attention, thus promote the research on all kinds of "flow" of the empirical data, the relationship between the city and in the various elements of "flows" become more complicated, the traditional world city (district developed international metropolis) didn't weaken the centricity, instead make more center (developing regional core city), the trend of specialization also more hasten is clear. The fundamental reason is that despite the continuous development of transportation and communication technologies, spatial aggregation is still crucial for economic activities. The nature of professional service industry determines that their products cannot be provided remotely in a standardized way, and they must maintain close interaction with customers, peers and other enterprises to obtain implicit information.

Table 1. Combination of traditional spatial elements and world urban elements (source: author statistics).

| Elements and combinations | Space subsystem | Traditional space combination type | World city element combination type |
|---------------------------|----------------|------------------------------------|-----------------------------------|
| Point - point             | Node system    | Village system, market town system, urban system | Urban functional division, regional gateway |
| point - line              | Economic hub system | Transportation hub, industrial hub | Aviation, port, track hub |
| point - surface           | Urban-regional system | Urban agglomeration area, urban economic zone | Metropolitan area |
| line-line                 | Network facility system | Communication network, power network, water supply and drainage network | Logistics network, business chain network, multinational enterprise network |
With the migration of time, people flow, logistics, information flow and capital flow gather and disperse at different speeds and have different influences. The layout of many functions shows the regional trend of gathering and dispersing, such as science and technology innovation zone, technology industrial park, logistics management and new headquarters complex. This new urban area structure is a network consisting of multiple nodes and linear links (Table 1).

3.3 Global and regional information "flow space" cases

Early producer services in New York showed a trend of centralized layout, main layout in Manhattan's central business district (CBD), characterized by a single large cluster mode: with financial business service industry as the leading industry cluster development model, effectively improve the rapid development of service product supply ability, stimulating for the world market demand, so as to induce the formation of Manhattan in the financial services industry cluster (cluster is centered on Wall Street financial trade big Banks, finance, insurance, trade companies gather place). Thereafter under the globalization, information technology as an important content of business communication needs, the New York metropolitan CBD area as a place for with credit value to some extent, and rows of Banks, trading companies, exchange, law firms, accounting firms, advertising companies, design center, real estate, transportation, communications services company high-end producer services such as the dominant industry chain structure, is the heart of New York City in the world for many years the first.

The characteristics and advantages of world cities such as Hong Kong are inclined to the high-end productive service economic system in the urban circle, and it is also the region with the most emphasis on the service industry in the global economic system. Early dominant industry of Hong Kong's economy is manufacturing, producer services in the service of manufacturing development, producer services following the ecological transition stage, the producer services in Hong Kong began to form independent industrial clusters, including high-tech industrial clusters, such as high knowledge innovation industry high-end producer services became a mainstay of the economy of Hong Kong. Since its return, it has invested in Guangdong through its manufacturing outsourcing, with Guangzhou and Shenzhen as its scale system connection objects. From Guangdong and Hong Kong producer services within the competitive advantage of industry analysis, the advantage of service trade industry on the mainland are mainly concentrated in natural resources, labor intensive industries, among them, the only weak comparative advantage, tourism, construction, transport services are no comparative advantage, the overall advantages of high-end producer services in Hong Kong was obviously higher than that of the mainland, the most competitive industry sectors have focused on capital and technology-intensive industries, especially in transportation, finance, consulting services, advertising services, and other business services, producer services both present strong complementary effect, echo effect and the trickle-down effect.

4. Empirical data research on the evaluation of world urban system

4.1 Empirical data sources for world city evaluation analysis

Empirical correlation data of world urban architecture evaluation can be divided into three levels:
The first is to study the material basis of the world urban network. The resource condition advantage of the city itself turns to the regional resource network outside the city, which is reflected in the connection strength and spatial pattern of air passenger flow, port logistics and Internet information flow data. Its characteristics are as follows: with the improvement of traffic conditions and economic development level, the proportion of tourism and leisure in the aviation network is in a declining trend, while the APS business flow guided by the producer service industry becomes the main part of the aviation passenger flow. As a knowledge-intensive industry, producer services provide technical consultation, information service, marketing planning and other knowledge and information sharing for manufacturing enterprises, and provide relatively complete and powerful support for business process tasks.

The second is to study the centers (financial and business clusters) and nodes (multinational companies) of the world's urban network, and use the internal enterprise layout and scale data of multinational companies to obtain enterprise contact data, so as to analyze the structural characteristics and evolution mechanism of the urban network system under the influence of globalization. For example, GaWC research organization established the evaluation system of inter-city connection network based on the internal connections of the top 100 transnational corporations and their branches, which is one of the core evaluation systems of the world urban system (figure 2).

Third, the "elite" industrial organizations (high-tech parks, technology industrial parks) in the world urban network, knowledge, as an endogenous variable of economic growth, plays an irreplaceable role in the creation of wealth. The role of knowledge in urban economic development mainly reflects the improvement of human capital and the promotion of urban industrial transformation and upgrading, that is, the transfer of urban industrial structure from the low end of the value chain to the high end, so as to enhance urban competitiveness. The spatial organization and network characteristics of the world urban network are studied by analyzing the spatial flow of the science and technology industry, such as the knowledge industry parks in universities and the proportion of the output value of high-tech products.

Figure 2. chain network model of urban network system (data source: Taylor, p. j. Specification of the world city network [J]. Geographical Analysis, 2001, 33(2), 181-191.)

4.2 "Flow" interaction of high-end producer services
On the three levels of the producer services empirical data research, can show different sensitivity to different resources and elements of different industry, producer services industry internal differences lead to the large differences in gathering location choice, such as: highway intersection node, harbor, airport and rail hub, etc., in these places of the world urban space agglomeration form integrated warehousing, logistics services, in the regional spatial structure is comprehensive, harbor, airport transport hub cities, thus a specialized division of labor; Second, the location selection of multinational companies and their branch structures. From the perspective of industry, they are often closely related to the original urban scale structure of commercial office, business finance and other industries, forming the spatial structure of CBD center, business center and financial center. Three mainly on knowledge intensive high-tech park, the technology industry park, of human capital on the demand is higher, this kind of industry in colleges and universities or research institutions around the general distribution, itself hierarchy characteristic is not obvious, mainly by geographical conditions and human resources factors, policy factors, structure of regional space scale have the function of the restructuring.

4.3 The relationship between urban industrial resource flow and spatial dynamic agglomeration of high-end producer services in the world

In the new urban hierarchy of the world, high-end producer services not only flow from high grade cities to low grade cities, but also flow among cities of the same grade. This supply-demand relationship is the inevitable result of the industrial division and cooperation between cities, as well as the development of service specialization and differentiation. The economic benefits of production services and trade activities and their agglomeration have promoted the formation of various horizontal and vertical economic links between cities of different levels, which, together with the accompanying spatial effects, have strengthened the hierarchical structure.

As far as producer services themselves are concerned, service enterprises are constantly gathering in space, forming industrial clusters, industrial clusters, etc., which play an increasingly important role in urban social and economic development, thus promoting the transformation of urban functions. Different agglomeration modes produce different urban functions. From a macro perspective, producer services and manufacturing agglomeration are similar in space. The dual agglomeration of producer services and manufacturing produces complementary effect, echo effect and trickle-down effect at the same time.

Under good economic effect, first of all, the producer services through complementary effect between the manufacturing city in the world to promote transformation, upgrade and specialized division of labor, and weak or manufacturing base in regional central city but there are geographical advantages of small and medium-sized cities, the producer services and manufacturing mainly echo effect and trickle-down effect, the world city metropolitan area regional land price rising, outsourcing manufacturing are moved, producer services constantly centripetal gathered at the same time, which result in the spatial differentiation of industry, due to the different condition of its resources, infrastructure, lead to redistribute the elements in this area, Thus the evolution of regional spatial structure.

5. Conclusions

Most of the world cities in the modern sense are cities with certain influence in the international political, economic and cultural life, and are strategic centers of resource gathering and allocation with international significance. The network structure of its evaluation system can be divided into several empirical "flow" data related to each other, mutual influence and even mutual staggered level of research. In just a few years, big data science and technology has been pushed onto the historical stage and honored as the fourth scientific paradigm after empirical science, theoretical science and computational science. With the breakthrough of data collection,
analysis and visualization technology, the empirical data analysis presented by massive data can more directly show the concept of "flow network" of regional spatial structure evolution.

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