



Research on the Development of Pearl River Delta Urban Agglomeration Based on Big Data Technology

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Abstract

Through the analysis of big data of enterprises, this paper studies the industrial development pattern, external contact pattern and internal urban contact network of the Pearl River Delta. And through the mining of network big data, such as public comment data, microblog check-in data, this paper evaluates the quality of construction land, road traffic, environmental pollution, public service facilities and open space in the Pearl River Delta, and reveals the high-quality built space and non built space that may become a hot spot in the future. Based on the analysis of "big data", this paper shows the main characteristics and existing problems of the development of the Pearl River Delta in a more comprehensive, profound and real way, and lays the foundation for the planning to put forward targeted solutions.

Keywords: *Pearl River Delta; big data; urban agglomeration*

1. INTRODUCTION

In response to the national "One Belt And One Road" strategic deployment, following the multi-level network development trend of the PRD urban agglomeration, with the Pearl River Estuary Bay Area and Guangzhou and Shenzhen two major central cities as the regional development center, the rise of the west bank and the optimization and upgrading of the east bank of the Pearl Rive, build a spatial structure of urban agglomeration with "one bay, two cores, two belts and six axes", promote the integration of the PRD, and radiate the revitalization and development of the eastern and northwestern regions of Guangdong.

2. THE STATUA AND FUNCTION OF THE PRD IN THE HISTORY OF NATIONAL OPENING

The PRD lies in the southeastern corner of the Chinese mainland, it's east, west and north are surrounded by mountains such as Lianhua Mountain, Luofu Mountain, Jiulian Mountain, Tianlu Mountain, Yunwu Mountain and arc-shaped mountains of Nanling. It had been isolated from the center of gravity of national

political and economic development for a long time. At the same time, lying on the coast of the South China Sea, the PRD had the closest accesses to the sea to Southeast Asia, Oceania, the Middle East and Africa and other places [1]. These regional conditions made it become the birthplace of the Maritime Silk Road and play an important pivotal role in China's maritime trade and cultural exchanges between China and foreign countries.

The unique geographical location is "Partial in the corner but unimpeded overseas", it makes the regional development of the PRD always under the dual influence of national power and globalization: on the one hand, the shift of national economic center of gravity and the injection of national power have profoundly affected the regional development and opening up of the PRD for more than two thousand years, on the other hand, the "western civilization spreading eastward" on the sea is also intertwined with this process, building the cities and shaping the culture of the PRD together.

2.1 The shift of national focus and the opening up of the PRD

In the early stage of China's establishment, the focus of China's construction is inclined to the "third-tier areas", the PRD was regarded as the national defense front and

implemented the "closed-door policy", and the development of international trade was blocked for a time[2]. After the reform and opening up, Shenzhen, Zhuhai and other special economic zones were established and entrusted with the important mission of "fighting our way out" [3]. The PRD was transformed from the "frontier of national defense and remote areas" into the "frontier of opening up", relying on Hong Kong and Macao, it attracted international industry and capital transfer, participated in global production division, and formed a pivotal strategic position in the country's economic and social development as well as the overall situation of reform and opening-up.

2.2 Globalization and the remolding of the regional pattern of the PRD

In the long historical period before the Ming Dynasty, relying on its position as a foreign trade port, Guangzhou became the birthplace of the Maritime Silk Road. The cities continued to expand, and the regional pattern of the PRD was a long-term urban system with Guangzhou as the single center. The regional connection was weak within the region, but the opening up was very frequent. After the Ming Dynasty, with the advent of the "age of great navigation", the "great geographical discovery" and the global maritime trade were launched on a large scale, which had a strong impact on the reconstruction of the regional pattern of the PRD.

In 1553, the Portuguese rented Macao under the pretext of trade. By 1563, the number of Portuguese living in Macao had gradually increased to nearly one thousand. As a result, Macao gradually emerged as an international trade port and led to the eastward migration of the political, economic and cultural center of Lingnan. The "Governor-General's Mansion of Guangdong and Guangxi" moved from Wuzhou to Zhaoqing in 1564 and then to Guangzhou in 1746. Under the influence of Guangzhou and Macao, market towns along the Pearl River, especially on the west bank, began to grow, Chen Cun, Shilong and other four famous towns in Guangdong sprang up accordingly [4]. The regional pattern of the PRD had gradually formed a "T-shaped" axis structure with Guangzhou-Macao as the double center, Zhaoqing-Foshan- Guangzhou- Shilong-Huizhou as the east-west axis, and Guangzhou-Chencun - Shunde-Xiangshan-Macao as the north-south axis.

After the Industrial Revolution, technological advances such as the steam engine made maritime trade more frequent on a global scale and accelerated the process of globalization. After the Opium War, Hong Kong was occupied by the British imperialists and Guangzhou, Jiangmen, Gongbei (Zhuhai) and other places were established as commercial ports. Guangzhou, on the original basis, moved forward into the direction of modern industrial and commercial, trade and finance center and transportation hub, and evolved into a multi-

functional and comprehensive economic center. Hong Kong, which mainly engaged in entrepot trade, gradually became the commercial and trade center and industrial center of modern East Asia, while Macao gradually declined, and the original regional "double center" pattern was replaced by Hong Kong. Then the Canton-Kowloon Railway was built, which further promoted the development of towns on the east bank of the Pearl River. Urban spatial pattern of the PRD changed greatly, it formed the new structure of "T-shaped" axis with Guangzhou-Hong Kong as the double center, Zhaoqing-Foshan -Guangzhou-Shilong-Huizhou as the east-west axis, Guangzhou-Kowloon Railway as the north-south axis.

Since the reform and opening up, the PRD has become a key region to attract overseas capital and industrial transfer. Starting from the "three industries, one supply, one supplement" industry, Shenzhen and Dongguan have gradually developed into the national economic center city and the world factory, creating the miracle of China's economic take-off. Driven by economic growth, the construction of various development zones and new areas has been accelerated, and a large number of migrants have flooded into the PRD. The urbanization process in the PRD has been rapidly promoted, and the region has gone through such stages as village and town industrialization, urban regionalization and regional networking. It has gradually formed the largest "Mega-City Region" in East Asia.

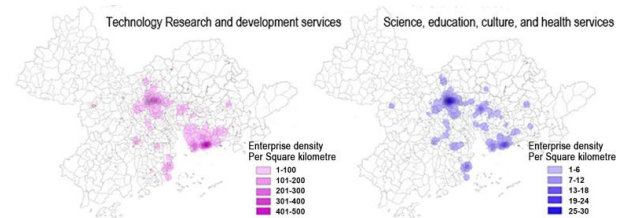


Figure1. Spatial distribution of service enterprises in the Pearl River Delta

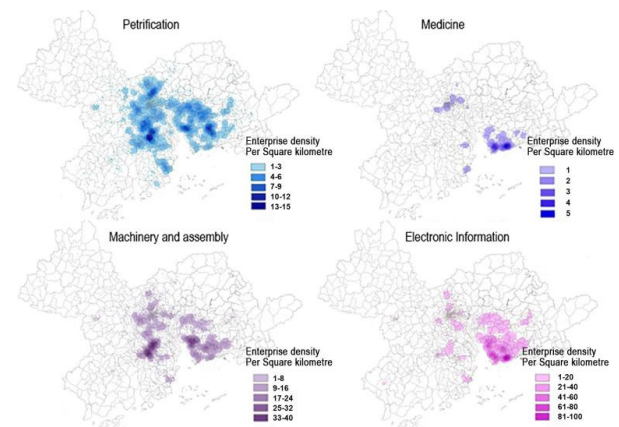


Figure2. Spatial distribution of manufacturing enterprises in Pearl River Delta

3. THE MISSION AND FUNCTION OF THE PRD FROM THE STRATEGIC PERSPECTIVE OF “ONE BELT AND ONE ROAD”

According to the “Vision and Actions for Joining the Silk Road Economic Belt and the 21st Century Maritime Silk Road” jointly issued by the National Development and Reform Commission, the Ministry of Foreign Affairs and the Ministry of Commerce, “One Belt And One Road” can be summarized as the strategic layout of political, economic and cultural dimensions. In political dimension, the “three sectors” of opening to the outside world should be built, which are oriented to Southeast Asia and East Asia[5]; In economic dimension, build a pattern of economic and trade cooperation with the “Six Economic Corridors” as the main body, such as China-Mongolia-Russia, New Eurasian Land Bridge, China-Central Asia-West Asia, China-Pakistan, BCIM, and China-Indo-China Peninsula[6]; In cultural dimension, build a “Multicultural Blending” pattern of influence of Chinese civilization and values.

3.1 *The new historical mission*

The PRD is one of the earliest birthplaces of China's Maritime Silk Road and the only region where marine trade has never been interrupted in the history of the Maritime Silk Road. It has always maintained close economic, trade and cultural ties with countries along the Maritime Silk Road. According to statistics, there are more than 15 million overseas Chinese in the “One Belt And One Road” countries along the route whose ancestral home is Guangdong, accounting for half of the Chinese mainland's total overseas Chinese, and the trade scale between Guangdong and the “One Belt And One Road” countries accounts for more than 22% of the country [7]. As a pilot zone of China's reform and opening up, an important engine of economic growth, and the opening node facing the Pacific Ocean and the Indian Ocean, the PRD is endowed with the important mission of “One Belt And One Road” construction as “vanguard and main force”. It will undertake new missions on three levels in the construction of “One Belt And One Road”.

3.1.1 *A hub connecting internal and external markets.*

One of the purposes of “One Belt And One Road” strategy is to reduce domestic excess capacity and promote enterprises to “go global” by strengthening economic and trade exchanges among the “One Belt And One Road” countries, to promote the transformation of China's economic development pattern and industrial structure. Compared with the inland provinces, the PRD has a developed cross-border trade service function. Relying on overseas Chinese resources, it has formed a

broad social connection network with the “One Belt And One Road” countries. With the transfer of processing and manufacturing industries to the east and northwest of Guangdong and Pan-Pearl River Delta provinces, the enhanced production service functions of cities in the PRD will attract mainland products from the PRD to the international market, which will continue to strengthen the strategic position of the PRD in both the international and domestic markets.

3.1.2 *A showcase for China's peaceful rise.*

China's remarkable economic take-off over the past three decades of reform and opening up has set a good example for many other developing countries. “One Belt And One Road” inherits the historical tradition of harmonious and friendly exchanges along the maritime and land silk roads, shares China's successful experience of reform, opening-up and peaceful rise with more developing countries, and passes on the Chinese values and international norms of “connectivity, openness, inclusiveness and win-win cooperation” to the world [8]. As the epitomizing of the achievements of China's reform and opening up, the PRD witnessed the glorious course of China's transformation from backwater to prosperity through economic development, such as the Shekou industrial zone in Shenzhen and the Taiping handbag factory in Dongguan. It will undoubtedly be the best window to show China's peaceful rise.

3.1.3 *The strategic fulcrum of “South-South cooperation”.*

Deepening “South-South Cooperation” with developing countries is an important part of the construction of “One Belt And One Road”. The PRD has a long tradition of trade with countries in Asia, Africa and Latin America. In recent years, the proportion of purchasers from “One Belt And One Road” countries to all purchasers in the Canton Fair has been increasing year by year. Guangzhou and other cities in the PRD have increasingly become gathering places in China for people from African and Middle Eastern countries, and the PRD has gradually formed a “global circuit” to contact southern countries [9]. This is also the unique form of international connections of the PRD which is different from the Beijing-Tianjin-Hebei and the Yangtze River Delta. Therefore, the PRD can play an important strategic role in the national “South-South Cooperation” by taking advantage of its long-established business tradition and social infrastructure network oriented to countries in Asia, Africa and Latin America.

3.2 *Enhancing the function of urban agglomeration*

After the concentrated development for more than 30 years of reform and opening up, the PRD has become a

manufacturing base with significant influence in the world, and initially possesses the scale level of a world-class city cluster, with its industrial system of complete categories and complete industrial chain. However, compared with Bosworth of the United States, South Central England, and Pacific Coast of Japan, the PRD still lags far behind in modern services, scientific and technological innovation and international exchanges. To actively participate in the construction of "One Belt And One Road" is the inevitable requirement for the PRD to respond to the national strategy, and the key is to cultivate the function of urban agglomeration with international influence.

3.2.1 Cultivate the service function of headquarters.

Relying on Hong Kong, the PRD has integrated into the global division of labor system dominated by western countries since the reform and opening up, and staged its economic take-off. In recent years, with the transformation of Hong Kong's entrepot trade and the expansion of the PRD's channels of foreign trade and economic relations, the relationship between Hong Kong and the PRD's "front shop and back factory" has gradually changed, and Hong Kong's position in the PRD's foreign trade has also begun to weaken. "One Belt And One Road" strategy will start a new round of expanding and opening up, and promote domestic enterprises to "go global" and grow into global multinationals. According to Sassen's research, globalization leads to the geographical and spatial dispersion of economic activities, that enlarges the scale of enterprise income, meanwhile brings increasingly complex management affairs. That decentralized economic activities are affected by service complexity, market uncertainty, transaction timeliness, etc. [10], requires the PRD cities to actively promote the development of modern service industry, cultivate the headquarters service function to participate in global competition, and carry out the "synchrony" integration of the management, coordination, support and finance functions in the global operation network of enterprises.

3.2.2 Improve the function of scientific and technological innovation.

From a global perspective, the ability of scientific and technological innovation has increasingly become a key indicator to measure the competitiveness of urban agglomerations. Major world-class urban agglomerations attract high-end talents and international migration, and create tremendous economic benefits while leading the trend of scientific and technological development by creating an environment of economic freedom, social openness and frequent cross-border exchanges. In recent years, the PRD has actively created an innovative environment, especially in the construction of enterprise

innovation capacity and the market transformation of research results and other aspects it has made remarkable achievements. With Shenzhen and Guangzhou as the leading cities, the PRD has gathered more than 6,000 high-tech enterprises. Huawei, ZTE and other enterprises rank among the top in PCT international patent applications in the world, nurturing and forming the largest innovation cluster in China. However, compared with Bosworth in the United States, South Central England, Pacific Coast of Japan and other world-class urban agglomerations, the PRD still lags far behind in its basic innovation capability. Facing the major opportunities and challenges of the new round of global scientific and technological revolution and industrial transformation, as well as the trend changes and characteristics under the new normal of economic development, the PRD is in urgent need of innovation-driven transformation of its development mode and transformation from "the world's factory" to a global innovation center. On the one hand, we should give strong support to the construction of innovation infrastructure such as universities and research institutions, appropriately guide the construction and distribution of new research and development institutions, and promote industrial transformation, upgrading and innovative development in the region. On the other hand, we need to take the creation of national independent innovation demonstration zone as an opportunity to build space and carriers for innovation, foster innovation communities in the PRD, and shift the development of urban agglomerations from elements-driven to innovation-driven.

3.2.3 Strengthen the function in foreign relations.

The Manchester School of "relational economic geography", represented by Dicken et al., proposed a spatial perspective of global production network analysis, emphasizing the importance of social institutions and cultural embedment in global connectivity and international interaction [11][12]. With the promotion of the "One Belt And One Road" strategy and the expansion of the trade pattern of the PRD From traditional markets in Europe and America to emerging markets in Asia, Africa and Latin America, the PRD should not only strive for some national functional platforms, but also emphasize non-governmental exchanges and cooperation. On the one hand, relying on the China Import and Export Commodities Fair, it can strive for setting up the "China South-South Cooperation Center", expand cultural and sports exchanges, government exchanges and cooperation, and other functions on the basis of the existing business exchange functions, organize and hold regular summit forums at the level of countries along the "21st Century Maritime Silk Road", build the Forum for Cooperation between China and Portuguese-speaking Countries on the basis of the Hengqin New Area jointly

built by Zhuhai and Macao to carry out strategic cooperation with the Portuguese-speaking countries through Macao, relying on the Guangzhou Friendship Ports Alliance, expand friendly ports of countries along the Maritime Silk Road and establish the 21st Century Maritime Silk Road Friendship Cities Forum, to strengthen exchanges between friendly port cities, further strengthen trade relations, cultivate Port Alliance Headquarters Base, and provide permanent business premises for shipping enterprises. On the other hand, it can also rely on the long tradition of commercial exchange between the PRD and Southeast Asia, Africa and Latin America, as well as the large number of overseas Chinese and people living and visiting in Asia, Africa and Latin America, and other social foundation, further strengthen the role of industrial associations and chambers of commerce in exchanges and cooperation, deepen cooperation in the construction of industrial parks and in investment and financing, set up small language majors of countries along the Maritime Silk Road in colleges and universities and cultivate professional talents to deepen cultural exchanges and cooperation among countries along the Maritime Silk Road.

4. SPATIAL RESPONSE OF THE PRD BASED ON "ONE BELT AND ONE ROAD" STRATEGIC LAYOUT

4.1 Two big sectors, form a new pattern of opening up

Implement national strategies such as the "One Belt And One Road" and Pan-Pearl River Delta regional cooperation, follow the trend of the integrated development of the PRD and its neighboring regions, promote the development of urban agglomerations "linking the south with the west", and build a more open spatial pattern of urban agglomerations. To the south, with the "21st Century Maritime Silk Road" as the link, relying on the developed port, shipping and international trade network, further strengthen the trade and cultural exchanges with the countries bordering the South Pacific and the Indian Ocean, and strive to become the main hub and important gateway of China to the international market in the south. To the west, take the Pearl River-Xijiang Economic Belt and the Guangdong-Guangxi-Guizhou High-speed Railway Economic Belt as links, actively integrate the "Pan-Pearl River Delta" into the "Silk Road Economic Belt", connect with emerging markets in Asia and Europe, expand the inland hinterland of the "Pan-Pearl River Delta" and enhance regional integration through infrastructure construction and trans-regional cooperation. Advance the development of the Foshan, Guangdong-Guangxi-Guizhou High-speed Railway Economic Belt Cooperation Pilot Zone (Guangdong Garden), foster and strengthen the gateway functions of Jiangmen and Zhaoqing, and turn the west

bank of the Pearl River into a modern equipment manufacturing base and a demonstration area for the development of a new type of urbanization to support the Silk Road Economic Belt.

4.2 One bay dual core, build a world-class center

Further enhance the overall development level of Guangzhou-Shenzhen central cities and the Pearl River Estuary Bay Area, and promote the interconnected development of the Bay Area and surrounding areas through strengthening the construction of facilities. Strengthen the concentration of high-end functions in the Bay Area, carry out diversified international exchange activities, and work with Hong Kong and Macao to build a Guangdong-Hong Kong-Macao Greater Bay Area that is high-end, ecologically livable and highly integrated.

4.2.1 Strengthen the aggregation of high-end functions.

Taking Nansha District of Guangzhou, Qianhai District of Shenzhen, Hengqin District of Zhuhai and other state-level new districts as the new functional core of the Bay Area, and Cuiheng New Area of Zhongshan, Marina Bay New Area of Dongguan, and Shenzhen Airport New City as the emerging functional nodes, build a high-end functional agglomeration area around the Pearl River Estuary Bay Area. Strengthen cooperation with emerging economies in Asia, Africa and Latin America, especially ASEAN countries, and set up platforms of capital, technology, management and services needed by enterprises in the PRD region to "go global". Led by the pilot free trade zone, further enhance its role as a hub in providing services, and strive to build itself into a center that radiates to Southeast Asia in investment, science, technology, education, cultural and sports exchanges, and medical services. Actively improve the environment for innovation, including innovation policies, innovation culture and intellectual property rights protection, and build an important platform for knowledge and technology innovation in the world.

4.2.2 Set a good model area of living.

Coordinate the relationship between development and protection, strictly control the ecological corridor and coastal resource in the Bay Area, prevent the disorderly spread of construction land, reduce the damage to natural ecology and landscape caused by development and construction activities, and improve the attractiveness of the Bay Area to high-end industries and talents through high-quality ecological environment and bay view. Guide all kinds of production and living resources to gather in the most efficient nodes and hubs, realize reasonable regional functional division of labor, optimal allocation

of public resources, and high standard allocation of infrastructure and public services, so as to build the Bay Area into the premier area for living and working in the PRD and a model area of high-quality living with international reputation.

4.2.3 Promote the integrated development of the Bay Area.

Based on the PRD expressway network, the Guangzhou-Shenzhen-Hong Kong Passenger Line, Guangzhou-Zhuhai Intercity, Guangzhou -Dongguan-Shenzhen Intercity, Shenzhen-Maoming Ailway, Guangzhou -Foshan-Jiangmen-Zhuhai Intercity and other major transportation facilities network should be fully used to build a complex and fast transportation corridor around the Bay Area and improve the traffic efficiency among various groups in the Bay Area. Through direct bus express lines and rail transit, strengthen the Bus Rapid Transit Link between the Bay Area and surrounding cities, industrial clusters and functional nodes, so as to improve the spatial integration level of the Bay Area.

4.3 Two belt six axis, strengthen the overall competitiveness

4.3.1 Promote integrated development of the eastern and western banks of the Pearl River.

Speed up the construction of transport infrastructure such as the Shenzhen-Zhongshan Channel and Humen Second Bridge, strengthen the influence of the Guangzhou-Shenzhen Dual-Core and the Bay Area on the west bank, and narrow the development gap between the east and west banks of the Pearl River. First, accelerate the revitalization and development of the west bank. Further develop the Pearl River-Xijiang Economic Belt and the advanced equipment manufacturing industrial belt on the west bank of the Pearl River, and guide the flow of population and other factors to the west bank of the Pearl River. Relying on the arterial traffic, connect the three cities of Zhuhai, Zhongshan and Jiangmen, and the major platform on the west bank, build the overall competitive advantage through "developing with collaboration ". Coordinate the layout of major projects and infrastructure in the west bank, build integrated functions hub with airports, ports and railways, and accelerate the rise of the west bank region. Second, promote the upgrading and development of the east bank. Take the eastern region of Guangzhou, Dongguan Water Town Economic Zone, Songshan Lake High-tech Zone, Yuehai Yinpin Cooperation Innovation Zone, Huizhou Tonghu Ecological Wisdom Zone, and Ring Daya Bay New Area as the fulcrums, implement the innovation-driven development strategy and accelerate the transformation and upgrading of regional industries.

4.3.2 Establish six development axes to promote regional integration.

First, with the Pearl River Estuary Bay Area as the core, relying on the regional strategic transportation corridor, connect central cities, major functional platforms and node towns at all levels, radiate the outer cities, and build urban development axis, such as (Hong Kong) Zhuhai-Gaolan Port-Daguan Gulf (Jiangmen)-Yangjiang- West Guangdong, Shenzhen-Zhongshan-Jiangmen-Yangjiang- West Guangdong, Guangzhou-Foshan-Zhaoqing-Yunfu-southwest China, Guangzhou-Qingyuan-Shaoguan-central China, Dongguan -Huizhou-Heyuan-Northeast Guangdong, Shenzhen- Ring Daya Bay (Huizhou)-Shanwei-East Guangdong. Second, with Guangzhou, Foshan, Shenzhen, Dongguan and other integrated urban areas as the core and six urban development axes as the framework, promote the integrated development of the three metropolitan areas.

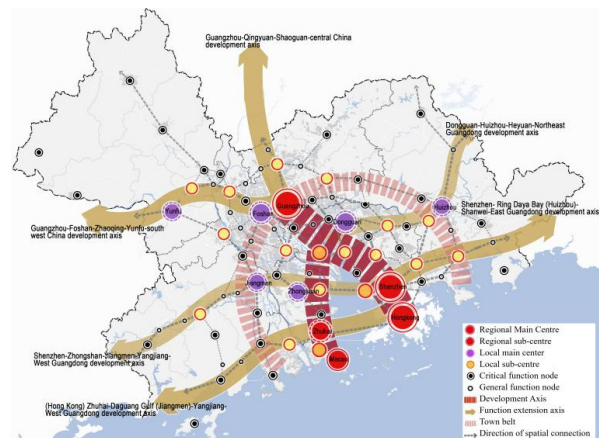


Figure3. PRD spatial structure under "One Belt and One Road" Strategy

5. CONCLUSION

The "One Belt And One Road" strategy is a major strategy for China to actively participate in globalization as a great power. While building a new pattern of multi-dimensional opening up, it will also have a far-reaching impact on optimizing the domestic development pattern, expanding new space for economic development and solving the problem of unbalanced regional development. The PRD area as an important birthplace of the Maritime Silk Road, at the forefront of China's opening to the outside world, has a long tradition of foreign economic and trade exchanges. Actively participating in the construction of "One Belt And One Road" is the inevitable requirement that the PRD responds to national strategy, it will also provide a major opportunity for the PRD to enhance its international influence and build a world-class city cluster.

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