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"Guangzhou-Shenzhen" Urban Linkage and Cooperation Study

Yuqi Yang & Mingming An

Business School of Guangzhou Huali College, Guangzhou 511325, Guangdong, China

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Abstract

As important cities in the Guangdong-Hong Kong-Macao Greater Bay Area, the development of Shenzhen and Guangzhou is of great significance for achieving resource complementarity and promoting industrial synergy in the region. Based on data from 2002 to 2022, this paper uses the Euclidean distance measurement algorithm to calculate the gravitational strength between the two cities, and assesses their competitive and complementary relationships through the geographical affinity strength. Combining these relationships, this paper analyzes the directions in which the two cities can achieve complementary development in the future three industries, and proposes suggestions for optimizing their industrial structures and improving government policies.

Keywords

Economic Coordinated Development, Geographical Matching, Urban Cooperation, Government Industrial Restructuring

1. Introduction

In 1986, American renowned economist Milton Friedman once pointed out in his article "The Hypothesis of World City": the world city is the organizational node of the global economy, organizing and connecting regional economies and national economies to form the global economy. Hu Shuqin (2022) analyzed that the level of technological innovation, the input of science and technology education, and the flow of talent have a significant impact on driving urban economic development under the theory of global city network. Cross-regional dissemination of patent knowledge (Yi Wei 2023) will promote the realization of higher-quality regional economic development, while regional integration can effectively promote the cross-regional flow of patent knowledge.

Refer to the 2024 press conference of the State Council Information Office of China to learn about the progress of the Beijing-Tianjin-Hebei coordinated development initiative over the past ten years: (1) Promote high-quality development in key regions to support the construction of a world-class urban agglomeration centered on the capital; (2) Innovate the coordinated development system and

mechanism, and shift the focus from sectoral cooperation to rule-based cooperation. Promote high-quality development in the Guangdong-Hong Kong-Macao Greater Bay Area, with a point (two cities in the mainland, Guangzhou and Shenzhen) leading the way and a surface area (Zhuhai, Foshan, Huizhou, Dongguan, Zhongshan, Jiangmen, and Zhaoqing) to achieve the construction of a world-class urban agglomeration centered on Guangzhou and Shenzhen. The improvement of the innovative coordinated development system and cooperation in key areas between Guangzhou and Shenzhen will promote the industrial complementarity between the core cities and contribute to the enhancement of the overall comprehensive strength of the cities and regions both domestically and internationally.

In 2019, the State Council issued the Guangdong-Hong Kong-Macao Greater Bay Area Development Plan, which stated the following: (1) In terms of spatial layout, build a networked spatial pattern with hubs driving development and corridors providing support; (2) Build an international innovation hub: establish an open regional collaborative innovation hub; optimize the regional innovation environment; (3) Accelerate infrastructure interconnection and integration: build a modern integrated transportation system; (4) Build an internationally competitive modern industrial system: accelerate the development of advanced manufacturing, cultivate and foster strategic emerging industries, accelerate the development of modern services, and vigorously develop marine economy. Under the scientific guidance of the Plan, accelerating industrial cooperation between Guangzhou and Shenzhen based on their existing industrial development status is an urgent issue that needs to be addressed in order to promote the quality improvement of their respective comparative advantage industries and strengthen the economic leadership role of the cities in the regional economy.

Since China implemented its reform and opening-up policy, Guangzhou, as an important exhibition city, has connected domestic and overseas economic and trade activities and absorbed advanced management methods and production processes from abroad, combining them with local and domestic talents to develop into a relatively mature manufacturing city to date. Shenzhen Special Economic Zone, located adjacent to Hong Kong, has relied on domestic production and processing trade activities to focus on developing high-tech industries, digital service industries, and other fields, and has also connected with Hong Kong's financial and logistics services, exerting a certain influence within the Guangdong-Hong Kong-Macao Greater Bay Area. These two important economic development cities complement each other in terms of resources and urban industrial development, and each has its own unique advantages.

Guangzhou, as the economic hub of South China, has rapidly emerged as an important exhibition city, thanks to its unique geographical advantages and rich historical heritage. Guangzhou serves as a bridge connecting domestic and international economic and trade activities, attracting businesses and entrepreneurs from all over the world. In this process, Guangzhou has not only absorbed advanced management concepts and production technologies from abroad, but also utilized local and domestic talents to develop a self-contained industrial ecosystem. To date, Guangzhou has developed into a relatively mature manufacturing city, with a complete industrial chain and supporting facilities,

providing vast development opportunities for domestic and foreign investors.

Meanwhile, Shenzhen, located adjacent to Hong Kong, has rapidly risen to prominence by leveraging domestic production and processing trade activities. Shenzhen has made innovation its core driving force, vigorously developing high-tech industries, digital service industries, and has become one of China's most competitive technology industrial bases. By aligning with Hong Kong's financial and logistics service systems, Shenzhen has further enhanced its strategic position in the global industrial chain. In the construction of the Guangdong-Hong Kong-Macao Greater Bay Area, Shenzhen plays a pivotal role, and its development outcomes have a significant impact on the entire Greater Bay Area.

Guangzhou and Shenzhen, as two important economic development cities, complement each other in resource allocation and industrial development, forming a good situation of mutual advantage and joint development. Guangzhou, with its profound manufacturing base and rich commercial resources, provides strong support for Shenzhen's industries; while Shenzhen, with its outstanding innovation capabilities and scientific and technological strength, injects new vitality into Guangzhou. These two cities have distinctive features and respective strengths, jointly driving the prosperity and progress of the Guangdong-Hong Kong-Macao Greater Bay Area.

In the process of urban coordinated development, the sister city model has become an important form of cooperation between local governments, effectively attracting foreign direct investment and promoting the growth of patent applications. Government policy intervention has practical significance for local industry support and provides directional guidance for industrial adjustment, technological innovation, and education and healthcare. The spillover effects generated by government intervention are more conducive to innovation and technological development in neighboring cities. "

The spatial spillover effects of high-speed rail and transportation infrastructure development between cities significantly influence the elastic growth of urban economies. To a certain extent, these effects facilitate the movement of talent and the migration of residents for leisure purposes, including shifts in production and manufacturing, higher education, and medical services across urban areas.

Economic interactions among cities are often intricately connected through resource flows between enterprises. The internal linkages within firms play a crucial role in fostering the spillover of urban resources (Mao Binhong, 2023), while enterprise-driven talent attraction substantially impacts the locational advantages associated with urban innovation (Luca Verginer, 2020). The effective mobility of talent is contingent upon infrastructural limitations as well as conditions related to transportation, healthcare, and education across cities (Zhang Fen, 2022). When neighboring cities possess complementary resources, it can yield significant benefits for local economic development.

Economic activities between cities are often closely related to the flow of resources between enterprises. The internal linkage among multi-site enterprises across regions plays an important role in building urban resource spillovers (Binhong Mao, 2023). Meanwhile, the attraction of talent by enterprises has a significant impact on the location advantage of urban innovation (Luca Verginer (2020). The effective flow of talent depends on the limitations of infrastructure, transportation, medical

care, and education between cities (Fen Zhang, 2022). If nearby cities can achieve resource matching, it will better promote urban economic development.

Industrial clusters are pivotal in fostering regional economic development, facilitating resource spillover, and enhancing transportation, logistics, and infrastructure construction (Changwook Kim 2023; Jian Wang 2022; Yahong Liu 2024). The dynamics of regional enterprises and industrial resources encompass the flow of resources, urban hierarchies, developmental stages, directional resource flows, and policy adaptations.

In the context of urban economic spatial disparities and their evolution, the interplay between industrial development and the economic growth of adjacent cities is particularly significant (Xiaojin Huang, 2024). Transformative innovation policies serve a crucial supportive function in fostering regional economic advancement as well as promoting green economic development (Markus Grillitsch, 2019).

The interconnection and interdependence between urban industries in China have played a positive role in upgrading the urban industrial structure (Xue Gao, 2021). The flow of resources between the first, second, and third industries has enhanced the comprehensive strength of cities (Dandan Wu, 2022). By building infrastructure, integrating supply chains, and facilitating industrial transfer, urban agglomerations can effectively integrate adjacent cities, thereby extending the spillover effects of cities to surrounding areas, which has a significant positive impact on the economic development of nearby cities (Huang D., 2022).

Therefore, the nearby cities (or sister cities) - Guangzhou and Shenzhen, as the frontier cities of China's reform and opening up, have played an important role in regional coordination and development. The urban planning and government policies of Guangzhou and Shenzhen (Ji X, 2020; Haoxin Li, 2022) provide guidance for their respective spatial planning, industrial development planning, and transportation planning. In the implementation process, spatial planning combines geographic location characteristics and industrial development needs to provide necessary financial support, land preferential policies, and tax exemptions and other industrial support policies.

The close integration between cities has created favorable conditions for talent mobility (Thomas Kemeny, 2017). Guangzhou, a cultural and economic city with a rich historical and cultural heritage and a long tradition of economic development, has accumulated rich experience in the development of diverse industries such as culture, education, international exchange, and service and manufacturing industries. Shenzhen, known as "China's Silicon Valley," has invested heavily in both government and enterprises to attract and encourage talent mobility in the promotion of knowledge-based economy. Guangzhou and Shenzhen have achieved synergistic promotion and integration in education, healthcare, transportation, international logistics, and business activities.

As important cities in Guangdong Province and the Guangdong-Hong Kong-Macao Greater Bay Area, Guangzhou and Shenzhen exert significant radiating effects on smaller cities in the surrounding areas based on their core status. The cooperation and industrial complementarity between the two cities will effectively play the role of core cities and positively drive the development of marginal areas.

Therefore, this study aims to explore the interconnected relationship between Guangzhou and Shenzhen, with the hope of improving government policy intervention content and adjusting urban industrial development to some extent.

2. Theory and Methods

2.1 Theory of Gravitational Strength between Two Cities

As two of the more developed cities in the Guangdong-Hong Kong-Macau Greater Bay Area, Guangzhou and Shenzhen have a strong interdependence and complementarity in terms of geographic location and economic development. Based on theories such as regional economics, urban geography, and the basic gravity model, we used the economic interdependence formula proposed by Taoya (2018) to calculate the gravitational strength between the two cities:

$$R_{ij} = \frac{\sqrt{p_i V_i}}{D_{ij}^2} \times \frac{\sqrt{p_j V_j}}{D_{ij}^2} \quad (1)$$

R_{ij} represents economic related quantities. P_i and P_j represent the population sizes of cities i and j , respectively; V_i and V_j represent the Gross Regional Product (GRP) of cities i and j , respectively; D_{ij} represents the geographical distance between cities i and j .

$$F_{ij} = \frac{R_{ij}}{\sum_{j=1}^n R_{ij}} \quad (2)$$

F_{ij} represents the degree of affiliation between two cities, i.e. the strength of their geographical match. This reflects the performance of the gravitational force between cities i and j during the observation period. The specific standard for measuring the intensity of the force is as follows:

Table 1. Intercity Gravitational Relationships

$0.1 \leq F_{ij}$	$0.03 \leq F_{ij} < 0.1$	$0.01 \leq F_{ij} < 0.03$	$0.003 \leq F_{ij} < 0.01$	$F_{ij} < 0.003$
Stronger	Strong	Average	Weak	Weaker

2.2 Theory of Economic Coordination between Two Cities

When studying the economic cooperation and development between Guangzhou and Shenzhen, the Euclidean distance method was used to measure the geographical matching degree, and the variables were scaled without units.

$$GR' = (GR - \overline{GR}) / S_{GR} \quad (3)$$

GR' is the result of GR dimensionless processing; \overline{GR} represents the average value of the data set; S_{GR} represents the standard deviation of the GR data set. E, G, and T have also been processed using the dimensionless method. The formula for calculating the actual economic distance between cities is as follows:

$$D = \sqrt{(GR'_i - GR'_0)^2 + (E'_i - E'_0)^2 + (G'_i - G'_0)^2 (T'_i - T'_0)^2} \quad (4)$$

GR stands for Gross Regional Product (GRP abbreviation); E represents the employment population (in millions), used to measure the scale and development changes of employment in the region; G represents the municipal government fiscal expenditure, representing the expenditure of the region in education, science and technology, health, government-funded expenditure, and security; T represents the total value of import and export trade, reflecting the vitality of trade and the ability to enter and exit resources.

Table 2. Interdependent Relationships between Cities

$1.0 \leq D'$	$0.5 \leq D' < 1$	$-0.5 < D' < 0.5$	$-1.0 < D' \leq -0.5$	$-1.0 < D'$
Complementary strengths	Complementary moderate strengths	Weaknesses	Strong	Stronger

Standardizing D yields D', where D'_i is positive if there is complementarity between the two cities, with a larger value indicating stronger complementarity. If D'_i is negative, it indicates competition between the two cities, with a smaller negative value indicating stronger competition.

3. Analysis

Shenzhen and Guangzhou, two important high-tech industrial and manufacturing cities in the Bay Area, play a crucial role in the development of the Bay Area economy. This paper studies the current economic development, industrial advantages, and complementarities of the "Shenzhen-Guangzhou" two cities, and analyzes the synergistic effects of the two cities on the development of the Bay Area economy. It also proposes suggestions for promoting the optimal development of these two cities' industries.

3.1 Gravitational Strength: F_{ij} Calculation - Geographical Match

According to formulas (1) and (2), set P_i as the population size of Guangzhou city, V_i as the GRP of Guangzhou region; set P_j as the population size of Shenzhen city, V_j as the GRP of Shenzhen region. The geographical distance between the two cities is 118.8 kilometers. Combining formulas (1) and (2), the following F_{ij} calculation results are obtained:

Table 3. Geographical Matching Analysis between Guangzhou and Shenzhen

Year	F_{ij}	Performance	Year	F_{ij}	Performance
2002	0.007286063	Weak	2013	0.049327445	Strong
2003	0.008875362	Weak	2014	0.055240128	Strong
2004	0.010802596	Average	2015	0.062461341	Strong

2005	0.01282996	Average	2016	0.071193333	Strong
2006	0.015610667	Average	2017	0.081773738	Strong
2007	0.018894984	Average	2018	0.091205992	Strong
2008	0.022455177	Average	2019	0.103190328	Stronger
2009	0.024990154	Average	2020	0.110725909	Stronger
2010	0.0301425	Strong	2021	0.012530084	Average
2011	0.03673444	Strong	2022	0.131586966	Stronger
2012	0.042142832	Strong			

F_{ij} is affected by the economic development situation of the cities (GRP), the population size of the cities and the distance between the two cities. F_{ij} measures the intensity of economic ties between cities:

- 1) During the period from 2002 to 2009, the gravitational intensity of Guangzhou and Shenzhen evolved from relatively weak to an average performance.
- 2) From 2010 to 2022, for the most part, the gravitational intensity between the two cities shifted from strong to relatively strong over time.

Both cities have undergone adjustments in government policies, changes in industry strategic development directions, economic crises, energy pressure and other predicaments. Under the guidance of government policies for infrastructure improvement and industrial assistance, the comprehensive economic strengths of the two cities are comparable, and the population growth is commensurate with the economic development speed of the two cities.

3.2 Coordinated Development Intensity: Calculation of D' Value - Economic Structure

The regional GRP, the number of employed people at the end of the year, the general public budget expenditure, and the total volume of import and export (in billion US dollars) of Guangzhou and Shenzhen are respectively substituted into Formula (4) to obtain the following D' -value data:

Table 4. Economic Structure Analysis Values for Guangzhou-Shenzhen

Year	D'	Performance	Year	D'	Performance
2002	1.581739215	Complementary strengths	2013	0.672168007	Complementary moderate strengths
2003	1.416633403	Complementary strengths	2014	0.856777555	Complementary moderate strengths
2004	1.188338703	Complementary strengths	2015	1.025789542	Complementary strengths
2005	0.99663929	Complementary moderate strengths	2016	3.887110897	Complementary strengths
2006	0.75212924	Complementary moderate strengths	2017	1.265817709	Complementary strengths
2007	0.528922683	Complementary moderate strengths	2018	1.22977112	Complementary strengths

2008	0.337207254	Weaknesses	2019	1.143194755	Complementary strengths
2009	0.449149011	Weaknesses	2020	1.137207011	Complementary strengths
2010	0.227981273	Weaknesses	2021	1.737994928	Complementary strengths
2011	0.521377978	Complementary moderate strengths	2022	1.597022876	Complementary strengths
2012	0.532248366	Complementary moderate strengths			

D' represents the level of economic cooperation between the two cities. The competition and complementarity between the two cities can be observed from Table 4 as follows:

1) **Weaknesses stage:** From 2008 to 2010, in the context of the global financial crisis, the cooperative relationship between the two cities was rather weak. In an effort to maintain the basic stability of the economy and the number of employed individuals, the willingness for mutual cooperation among cities and enterprises across cities was relatively low.

2) **Complementary moderate strengths and Complementary strengths stage:** Except for the period from 2008 to 2010 when the relationship between the two cities was rather weak, the other years exhibited a relatively strong complementary relationship or a strong complementary relationship. The feature of mutual economic development between the two cities was quite remarkable.

From 2002 to 2022, the degree of geographical matching between the two cities with an actual transportation distance of 118 kilometers has transformed from weak to strong, and the universality of economic complementarity is relatively strong. During this period, Guangzhou and Shenzhen identified their respective industrial advantages through policy implementation and gradually entered the stage that was conducive to their own economic development planning. These two cities have discovered unique paths in their respective economic development directions.

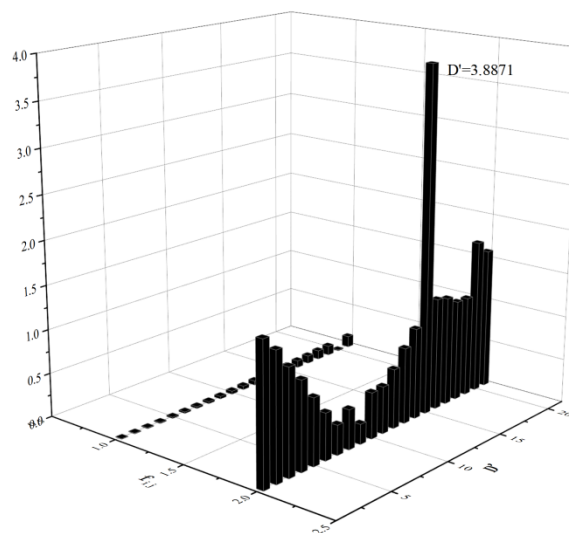


Figure 1. Graphs of the Trends of Two Cities, F_{ij} and D' .

Combining the F_{ij} and D' data, a 3D stacked bar chart was created, as shown in Figure 1:

F_{ij} represents the gravitational intensity between the two cities and maintains relatively stable development characteristics. D' represents the collaborative development of the two cities. D' undergoes more changes compared to F_{ij} . Except for the adjustment stage of the economic crisis, it performs well in other years and can reflect the increasing complementary demands between the two cities. Based on the guidance of the 12th Five-Year Plan for National Economic and Social Development of the People's Republic of China (2011-2015): Under the early efforts of the government to fulfill its responsibilities in economic regulation, market supervision, social management, and public services, especially in 2016, the complementary feature of the two cities was particularly prominent, specifically manifested as a complementary value of 3.8871.

3.3 The Development of Three Industries in the "Guangzhou-Shenzhen" Urban Development Process

Since 2010, the main industries of development in Guangzhou and Shenzhen, two cities, have been as follows:

Table 5. The Industrial Distribution in Guangzhou, Shenzhen and Other Cities

Industry	Guangzhou Industrial Content	Shenzhen Industrial Content
PI	Agriculture, livestock and aquaculture farming, leisure agriculture, and agricultural product processing.	There is currently no dominant first-tier industry content; it is characterized by fresh retail and e-commerce, agricultural services, agricultural finance, and genetic agriculture.
SI	Automotive Industry, Electronics Industry, and Petrochemical Industry	Electronic components, smart manufacturing, and the construction industry.
TI	Modern business and business services, international logistics services, cultural and tourism services, science and technology services, financial services, and education and medical services.	Cultural Industry; High-Tech Industry; Logistics Industry; Financial Industry; Biopharmaceutical Industry; Digital Economy Industry; High-end Equipment Manufacturing Industry; New Materials Industry; Ocean Economy Industry; Green and Low-carbon Industry; International Logistics Manufacturing Industry Service Related Ratio is Lower

From Table 5, it can be seen that there is a significant complementary relationship between the two cities in the three industries. In particular, Shenzhen has demonstrated a good leading role in the high-tech field, and its scientific and technological innovation has a strong guiding role in the development of mid-end products, which is of great importance to the progress of Guangzhou's manufacturing industry. At the same time, Shenzhen's financial and biopharmaceutical industries provide important support for Guangzhou's financial services and enterprise financing, medical services. Furthermore, due to the relatively synchronized economic development of the two cities, they have formed a stronger complementary relationship, and the demand between them has become

increasingly urgent.

Based on the comparison of the industrial development status of Guangzhou and Shenzhen in Table 6, we conducted data normalization for the GRP, primary industry, secondary industry, and tertiary industry of both cities from 2002 to 2022. The normalized stacked chart of industrial data for both cities reveals that:

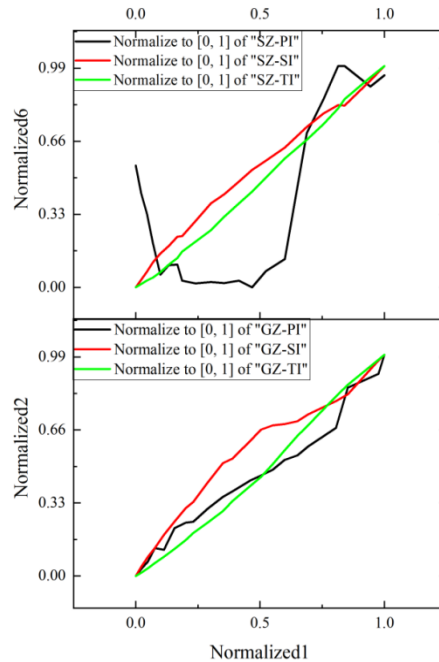


Figure 2. Graph of Industrial Comparison between Guangzhou and Shenzhen

1) Agricultural First-tier Industry Cooperation Relations

The first industry in Shenzhen manifests itself in the form of services within the residents' consumption life, such as the publicity and promotion of e-commerce platforms, the empowerment of agricultural science and technology, and other aspects. Owing to the limited land and water resources available for the first industry in Shenzhen and Shenzhen's inclination towards being a high-tech city, it requires the support of the first industries from surrounding cities. Consequently, the first industry in Shenzhen is relatively weak.

Shenzhen can expand the upstream agricultural product supply base for itself and enhance cooperation with the supply bases. Guangzhou has a relatively solid agricultural foundation and a relatively stable development of its primary industry. It can carry out agricultural high-tech development cooperation with Shenzhen at an appropriate time and introduce high and new technologies to empower the primary industry.

The primary industry of Guangzhou can supply agricultural products to Shenzhen, and the primary industry of Shenzhen is manifested in the form of service industry. Thus, Guangzhou can enhance the development of technological agriculture and green and environmentally friendly agriculture to offer

high-quality agricultural products to Shenzhen. Shenzhen, in the forms of retail e-commerce and financial agriculture, will provide technical support and guidance for improving the quality of agricultural products from Guangzhou, as well as offer cooperation in the promotion of domestic and foreign products.

2) Secondary Industry Cooperation Relations

The second industries of both Shenzhen and Guangzhou have achieved good development. Nevertheless, their development directions vary. Shenzhen takes high-tech industries and architectural design as the main components of its manufacturing sector, while Guangzhou mainly focuses on the transformation and upgrading of traditional manufacturing industries. The research, development and production of electronic components and intelligent manufacturing in Shenzhen exert a considerable facilitating effect on Guangzhou's automotive and electronics industries.

3) Third-party cooperative relationships

Shenzhen mainly centers on healthcare, financial services, cybersecurity services, logistics services, and so forth. Guangzhou mainly focuses on education, culture and tourism, the manufacturing of household products and beauty products, international logistics services, and the like. Guangzhou and Shenzhen can form a strong alliance in international logistics services. In aspects such as cultural tourism and international trade fair services, Guangzhou has a relatively significant radiation impact on Shenzhen. The trade in service types provided by Shenzhen's financial industry, biopharmaceutical industry, digital economy industry, high-end equipment manufacturing industry, new materials industry, marine economy industry, etc., will offer substantial assistance to industries such as agriculture, healthcare, education, and manufacturing in Guangzhou. Under the differentiated development of the two cities, cross-industry knowledge flows and cooperation can be achieved, enhancing the maturity of each city's industries.

4) Collaborative relationships with urban characteristics

Guangzhou is a city with a long-standing accumulation of history, culture and economic development; Shenzhen is a high-tech city with the title of "China's Silicon Valley". The roles and division of labor of the two cities in international trade activities are different:

Although the development speeds of the two cities are similar, the GRP output of Guangzhou is far higher than that of Shenzhen. Based on the current development situations of the two cities, it is known that Guangzhou has a relatively long history of economic and cultural development and presents a more prominent domestic market characteristic. Shenzhen, as a nascent city with high added value in high-tech industries and its adjacency to Hong Kong and Macau, enjoys a superior geographical advantage for foreign trade activities. Despite having a lower GRP than Guangzhou, its secondary and tertiary industries are developing rapidly and the quality of industrial development is favorable. Strengthening industrial complementarity, talent exchange, and cooperation between the two cities will be conducive to enhancing their comprehensive strength domestically and internationally.

4. Discussion

4.1 Strengthen the Government's Intentions for Cooperation in the Comprehensive Urban Development of Guangzhou-Shenzhen

During the course of seeking their respective development paths, the two cities are required to enhance cooperation and interaction. In China, the government assumes a significant role in facilitating, promoting, and guiding economic development, urban planning, etc. The cooperative attitude, intention, and urgency among municipal governments will exert an influence on the cooperative efficiency between urban industries.

Based on the government work report and the foregoing analysis herein, it is evident that the positioning of the urban industrial development directions of Guangzhou and Shenzhen, two first-tier cities in China, is relatively clear, and the data indicates a strong complementarity. The governments of the two cities should, on the basis of the original inter-city cooperation, proactively formulate government plans for urban cooperation that are conducive to collaboration and mutual benefits, provide guidance in government decision-making for the future development of the cities, and offer strategic directions for the development of enterprises, thereby continuously optimizing the development of the overall comprehensive strength of the cities.

4.2 The Main Directions and Ways of Governmental Cooperation Integration

1) Main direction

The Guangzhou government supports the interaction and development of the cultural industry between Guangzhou and Shenzhen through policies. It offers policy subsidies to Shenzhen enterprises participating in international exhibitions in Guangzhou, strengthens resource complementarity with Shenzhen in the medical service industry and high-tech industry, exploits the advantages of traditional Chinese medicine, integrates the development advantages of modern pharmaceutical industry, and promotes high-quality traditional Chinese medicine service industries domestically and internationally. In the field of education, it nurtures high-end R&D personnel and technicians for front-line production in the manufacturing industry, providing talent assistance for the development of the manufacturing industry in the Guangzhou-Shenzhen area.

The development policies of Shenzhen's high-tech industry are integrated with the development demands of Guangzhou's manufacturing industry. Cooperation in domains such as healthcare, industrial and civilian manufacturing, and marine economy is strengthened and facilitated. The entire process of "research and development - production" is implemented and optimized, promoting the structural upgrading of the manufacturing and service industries in both cities.

In the development of the international logistics service industry, facilitate the optimization of Guangzhou Baiyun International Airport, Shenzhen Yantian Port, and the Shenzhen-Hong Kong Passage. Enhance cooperation and integration in the development of free trade zone policies, clarify the advantages and complementarities of each city's free trade zone, avert adverse competition within the region, realize complementarity among free trade zones, and refine the economic roles of the free trade

zones of the two cities in the Belt and Road Initiative. Provide policy guidelines for the mutual promotion of general cargo trade and the international logistics service industry.

2) Collaboration Methods

The governments should make well-organized industrial plans, choose the development and upgrading paths of their main industries in a prioritized and focused manner, actively engage in inter-governmental communication and cooperation with the counterpart, and achieve effective communication of the intentions for industrial and economic development directions of both sides. After communication, they should actively integrate resources, implement the specific directions for cooperation they desire, and realize substantive communication as well as policy promulgation and implementation.

Through internal communication among government departments such as the Industry and Commerce Department, the Finance Department, the Foreign Trade and Economic Cooperation Department, and the Customs Department, the government takes the lead in guiding industry associations to develop industrial contents in stages and with targeted goals, and adjusting the speed and efficiency of the industry. Position the industry's role in the domestic economic cycle and the international economic cycle, and urge enterprises to identify their own industrial advantages in the domestic and international economic context. Encourage cooperation and innovation between Guangzhou and Shenzhen, and maintain the competitiveness of enterprises.

Industry associations actively convey the working spirit of the government, exert their leadership and cohesion, and prioritize the collaborative innovation efforts of leading enterprises, while encouraging enterprises with relatively weaker capabilities to innovate actively. Cross-industry exchanges are conducted among multiple industry associations to achieve the objective of optimizing the industrial structure and improving the quality and speed of industrial development. The government and industry associations should actively incorporate the suggestions of enterprises in practice. For the difficulties encountered, effective communication can be realized through industry associations or government mailboxes. Regarding communication and feedback channels, industry associations and the government should establish efficient response mechanisms, enabling enterprises to proactively solve problems and analyze doubts when they arise. Enterprises should actively participate in support projects initiated by the government. The government offers substantial start-up capital support for projects in the early development stage. Enterprises should actively prepare their own qualifications, patents, and other resources to be well-prepared for applying for government-supported projects.

4.3 Improve the Direction of Industrial Complementarity among Cities

1) The main existing advantage industries in Guangzhou

Featured agriculture, logistics (the function of international aviation hub, the construction of a coastal new town of international standard), the development of productive services and manufacturing (industrial districts, the automobile and electronics manufacturing industry, the food processing industry, etc.), high-tech industry agglomeration belts (agglomeration belts of artificial intelligence and

digital economy industries), culture and tourism, globally renowned exposition-type cities.

2) The main existing advantage industries in Shenzhen

Shenzhen has implemented the industrial development strategy of "promoting leading industries, upgrading traditional industries, and supporting innovative industries", optimized the industrial layout structure, strengthened the cultivation of high-tech industrial clusters, and facilitated industrial upgrading (such as in medical care, internet services, high-tech electronic products, etc.). It has also upgraded industrial functional areas, optimized logistics industries (such as ports, aviation, railways, and land ports), the financial sector, the cultural industry, tourism, social undertakings development, and public facilities.

3) Guangzhou-Shenzhen Future Industry Complementary Directions

Shenzhen can actively collaborate with Guangzhou in domains such as high-tech industries, international logistics services, and financial services. As an established manufacturing city, Guangzhou can offer a superior manufacturing production environment for Shenzhen. Additionally, Guangzhou's educational resources, cultural and tourism resources, and international exposition resources will, to a certain extent, drive the economic development of Shenzhen. The educational resources, cultural and tourism resources, as well as international exposition resources of Guangzhou will, to a certain extent, promote the economic development of Shenzhen.

The complementary resources of the two cities have significant roles in facilitating population mobility, enhancing the quality of employment, improving social welfare, optimizing elderly care services, upgrading the quality of logistics services, promoting industrial development through finance, and promoting industries through expositions.

4.4 Optimize Talent Exchange and Mobility Programs

The high-speed railway between Guangzhou and Shenzhen provides excellent transportation conditions for talent mobility, and both cities have abundant talent resources. Guangzhou has good educational and training institutions, while Shenzhen provides ample practical job opportunities.

It is suggested that the two cities should strengthen cooperation among research institutes, think tanks, and universities, and engage in in-depth exchanges in areas such as production management, product development, and industrial development. At the same time, promote interaction between enterprises and college students, and guide enterprises to actively provide social practice opportunities for on-campus interns to enhance their practical skills and create a good environment for talent reserves. In addition, the government should actively publicize relevant measures in terms of talent subsidies and housing policies, and provide support for retaining and cultivating talent based on the characteristics of the city.

4.5 Strengthen Folk Cultural Exchanges

Strengthening cultural exchanges between cities can bring numerous benefits, such as promoting economic growth and innovation, enhancing social cohesion, and fostering global citizenship. By leveraging government support, partnerships between cultural institutions, public awareness

campaigns, and incentives, combined with technological means, cities can build vibrant, inclusive, and globally connected communities.

Guangzhou, a historically rich cultural city, boasts a rich cultural heritage and should combine culture and tourism to promote cultural dissemination. Shenzhen, on the other hand, is a young and dynamic city that can promote online and offline cultural promotion by integrating traditional culture into online games and modern theme parks.

Guangzhou and Shenzhen should enhance exchanges and cooperation in areas such as traditional culture preservation, red gene promotion, Lingnan characteristics, and intangible cultural heritage. This will facilitate in-depth communication on the connotations of these elements and their commercialized expressions (such as tourism, product development, and service provision). This not only enhances the overall cultural content of the Guangdong-Hong Kong-Macao Greater Bay Area but also enables the two cities to play a leading role in typical cultural construction at the international and regional levels.

5. Conclusion

The development of a city is inseparable from the industrial complementarity of the surrounding cities. The development of a city requires the combination of its own advantageous industries, location characteristics and other elements to achieve rapid growth of its own advantages; meanwhile, it can also drive the economic development of the surrounding cities, form a location advantage, and facilitate better attraction of foreign investment.

It is proposed that under the guidance of government policies, based on regional characteristics, urban population policies, urban development foundations, and resource conditions, cities should develop their own characteristic industries in combination with those of surrounding cities. The formulation of respective policies among cities should also follow the approach of "integrating one's own advantages and leveraging external advantages" to develop their priority industries.

Guangzhou and Shenzhen, as two important cities in the Guangdong-Hong Kong-Macao Greater Bay Area, their complementary development can not only make up for their shortcomings in certain industries, but also have significant implications for the overall economic strength of the Greater Bay Area to reach a new level. At the same time, as a complementary case of first-tier cities in China, it has important reference value for the cooperation of other cities in China.

Urban development is closely associated with government policies (national policies and urban policies). In China, in the comprehensive planning and development of cities, the government can not only provide the correct guidance but also offer multi-faceted financial support. The coordinated development of the two cities will not result in a competitive relationship. Instead, it will mutually promote and enhance their capabilities, providing rather favorable support for the economic development of eastern Shenzhen and the westward development of Guangzhou.

Although there are numerous advantages during the process of urban linkage and cooperation, it also faces several challenges, such as uneven resource allocation, conflicts of interests, and difficulties in

policy coordination. In the future, with technological advancements and policy refinements, urban linkage will be further deepened and become a significant force promoting the regional urbanization process.

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