

Transportation Integration in the Greater Bay Area: A Strategic Analysis of Guangzhou's Economic Prospects

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Abstract: After 2020, the development of the Guangdong-Hong Kong-Macao Greater Bay Area has garnered significant attention and sparked extensive research and discussions. The Outline of the Development Plan for the Greater Bay Area was officially released on February 18, 2019, marking a new phase in its development. Guangzhou, as the political, economic, and cultural center of Guangdong Province, plays a crucial role in enhancing its transportation advantages within this new development framework. Improved transportation construction can boost Guangzhou's competitiveness in various ways. This paper aims to discuss the opportunities and challenges presented by transportation integration in Guangzhou by comprehensively analyzing the economic structure of the Greater Bay Area, examining the implemented or planned transportation projects since the concept was introduced, and integrating transportation integration theories with Guangzhou's actual circumstances. The study will explore aspects such as policy direction, geographical location, and future planning, concluding with recommendations for Guangzhou's economic development based on its current situation and objectives.

Keywords: Guangdong-hong Kong-Macao Greater Bay Area, Transportation integration, Guangzhou economy.

1. Introduction

In 2019, the release and implementation of the Outline of the Development Plan for the Guangdong-Hong Kong-Macao Greater Bay Area marked the official initiation of this major national regional strategic project. Recently, economic globalization has faced increased challenges, leading to new dynamics in the strategic opportunities for China's development. The international political landscape has changed, and the pandemic has intersected with the goal of rejuvenating of China, presenting both opportunities and challenges. The Greater Bay Area encompasses one of the most dynamic and globally integrated urban agglomerations in southern China and is strategically positioned along the Belt and Road Initiative. Its development aims to consolidate the economic resources and advantages of Guangdong Province, the Hong Kong Special Administrative Region, and the Macao Special Administrative Region to create a more substantial economy. The goals of promoting the Greater Bay Area's development include achieving regional economic integration, fostering high-quality growth, enhancing international competitiveness, and driving innovative development. Building transportation infrastructure is a crucial prerequisite for achieving this regional integration [1].

Regarding the Guangdong-Hong Kong-Macao Greater Bay Area, the disparities in economic development and social systems cannot be resolved quickly. Therefore, promoting integrated urban development through the construction of a transportation network is a practical approach. This strategy facilitates the natural movement of people and resources among the cities in the area, creating a strong internal momentum to overcome institutional and administrative barriers. According to the Outline of the Guangdong-Hong Kong-Macao Greater Bay Area Development Plan, the rail transit network will be fully interconnected, creating a one-hour living circle; the Pearl River Delta airport cluster will operate as a cohesive unit to better compete internationally; and the port area will establish a division of labor to achieve coordinated development. Transportation in the Pearl River Delta will primarily rely on rail systems, supplemented by other transportation options such as regular roads and expressways, resulting in a comprehensive transportation network throughout the urban area [2].

First of all, this paper analyzes the development of Guangzhou economy in recent years, influencing factors and current status, analyzing the reasons for the unsatisfactory conditions, conducts in-depth research on the economic structure of Guangzhou, analyzes the main support points and possible growth points of Guangzhou's economy, and then, from the perspective of transportation, analyzes how to promote the continuous high-quality economic development of Guangzhou under the current location conditions with the help of the construction layout of transportation integration in the construction of the Greater Bay Area. Comprehensive consideration of urban agglomeration theory, urban traffic theory. The theory of transportation location, sustainable transportation theory, transportation planning, TOD, urban transportation integration and distributed supply and other relevant theories combine the actual situation of Guangzhou with the grand plan to discuss the effect of transportation hub and rail transit on economic development. Judge the overall development trend and analyze the advantages and disadvantages.

2. Literature Review

Many existing literatures in China have fully recognized the importance of transport integration to the economy of the Greater Bay Area, and there are quite a few relevant studies. In terms of the economy of the Bay Area, Zhao Xiande conducted specific research and analysis on the significance of developing the economy of the Greater Bay Area for China, the business layout priorities of the three places, and how to realize complementary advantages, etc. He estimated the challenges faced by the three places in the process of coordinated development and discussed solutions. Guo Wanda elaborated the background source of the concept of the Greater Bay Area, and analyzed the biggest advantages and obstacles of the Greater Bay Area, the scope and spatial form of the Greater Bay Area, and the problems and current situation of the planning of the urban agglomeration of the Greater Bay Area

In terms of transportation theory, Liu Yanping analyzed the transportation construction of the Greater Bay Area from the perspective of urban transportation, sustainable transportation, transportation location, transportation planning [3], transportation integration and other theories, compared it with domestic and foreign urban agglomeration traffic development cases, and put forward policy suggestions to promote the transportation development of the Greater Bay Area. Xu Yajuan analyzed the current status of urban traffic and the connection positioning of stations and put forward relevant suggestions on the integrated connection of traffic stations [4]. Wang Qiuyu, Zeng Gang et al analyzed the current academic research status of the Yangtze River Delta region in the field of economic geography by using knowledge graph visualization technology and explored the research progress of regional integration issues based on systematic literature reading. Liu Jianfeng and Li Fang expounded the correlation and difference between urban agglomeration and metropolitan area development, and discussed urban agglomeration rail transit planning and construction, passenger flow demand characteristics, multi-level integration and connection, and multiple operation

modes. Xia Jiechang and Xiong Qiyan discussed the definition and economic benefits of transportation integration [5,6].

In the case analysis of transportation integration, Klotildi Saliara took Thessaloniki in Greece as a case, analyzed the transportation cost, found out the shortcomings in layout integration, designed the new bus system in detail, and established the new bus network planning with clear roles and distinct hierarchy. Dario Hidalgo analyzed the process of transportation system reform and resource integration in Bogota and Cali, Colombia, as well as the achievements and difficulties [7,8].

The above literature has discussed and studied the impact of the construction of transportation system integration on the urban economy, but there are few systematic discussions on the Bay Area and Guangzhou.

3. Case Description

3.1. Analysis of Guangzhou's economic development

Situated at the mouth of the Pearl River and at the heart of the Pearl River Delta, Guangzhou serves as the central city of the Pan-Pearl River Delta Economic Zone, the Guangdong-Hong Kong-Macao Greater Bay Area, and a key hub for the "Belt and Road" Initiative. In the past 2023 years, the international situation has changed, and foreign trade of Guangdong Province has been hit hard, while domestic demand is weak, but in the face of economic downward pressure at home and abroad, Guangzhou's economy still maintains a not low growth rate. By 2023, the GDP of the region will reach 3,035.573 billion yuan, an increase of 4.6% year-on-year. From the perspective of industry, the primary industry develops steadily, the secondary industry is lower than expected, and some industries in the tertiary industry develop rapidly, but such as commercial real estate industry is significantly depressed. From the analysis of supply and demand, CPI rose 1%, higher than the national 0.2% and the province 0.4% [9]. On the other hand, PPI has dropped significantly, which is caused by insufficient domestic demand, excess production capacity, and downturn in the real estate industry. In 2024, the world economy is still facing downward pressure, there are many uncertainties, and the economic situation is not optimistic. It means that Guangzhou's import and export trade will still be depressed, while domestic demand is weak, and the lack of public confidence is also an important challenge for the economy [10].

3.2. Current situation of traffic construction in Guangzhou

Guangzhou is strategically situated in the center of Guangdong Province, offering advantageous geographical conditions that have established it as a transportation hub for both the province and South China. In terms of railway transportation, Guangzhou boasts Guangzhou South Railway Station, a major railway hub, complemented by Guangzhou East Railway Station, Guangzhou North Railway Station, and the expanding Qingsheng Railway Station in Nansha. This railway network, centered around Guangzhou, extends across a significant portion of the Greater Bay Area, connecting to major cities and nodes, as well as linking to regions such as Beijing, Jiangxi, Hunan, Hainan, and Guizhou.

For road transportation, which is the most important mode of transit, key highways include the Guangzhou Ring Expressway, the Pearl River Delta Ring Expressway, the Hong Kong-Zhuhai-Macao Bridge, Nansha Bridge, and the Shenzhen-China Corridor. These routes play a vital role in enhancing connectivity within the Greater Bay Area.

In terms of air transportation, Guangzhou is home to Baiyun Airport, a world-class facility. Efforts to develop the Guangzhou New Airport are advancing, with projects for additional runways and T3 terminals at Baiyun Airport gradually being implemented. Additionally, Guangzhou Port serves as the core of maritime transport, with ongoing efforts to develop the Nansha port area further

3.3. Current status of transport integration in the Guangdong-Hong Kong-Macao Greater Bay Area

Since 2022, Guangdong has implemented the Outline of the Development Plan for the Guangdong-Hong Kong-Macao Greater Bay Area, advanced the Bay Area Connectivity Project and deepening the construction of a one-hour Transportation Circle within the region. The focus has been on developing a world-class airport and port cluster, fostering a robust "big integrated market," and promoting the efficient flow of various production resources and factors, all while enhancing industrial synergy among cities. The aim is to accelerate the Greater Bay Area's transformation into a world-class urban agglomeration.

With Guangzhou as the core, significant efforts are underway to expand intercity rail services, integrate suburban railway lines, and strengthen connections with major trunk railways, gradually forming a three-tiered transport network of national railways, intercity rail, and urban rail transit. The goal is to ensure that major cities can be reached within one hour by 2035.

In terms of road transport, by the first half of 2023, the expressway network in the Guangdong-Hong Kong-Macao Greater Bay Area has exceeded 5,100 kilometers, achieving a density of 9.3 kilometers per 100 square kilometers. This surpasses the metropolitan areas of New York and Tokyo, making it the most extensive network in the world among Bay Areas [2].

For cross-sea corridor construction, since the Hong Kong-Zhuhai-Macao Bridge opened on October 24, 2018, progress has been steady. Key passages—including the Huangpu Bridge, Nansha Bridge, Humen Bridge, and the Guangzhou-Shenzhen-Hong Kong high-speed rail—have connected the northern and southern parts of the Pearl River Estuary, facilitating communication and exchange between regions.

In terms of air transport, the Greater Bay Area Airport Cluster, featuring Hong Kong International Airport, Guangzhou Baiyun Airport, and Shenzhen Bao'an Airport as major international aviation hubs, has developed alongside other nodes like Zhuhai and Macao. This has created a collaborative development pattern characterized by complementary roles and resource sharing, resulting in a world-class airport cluster.

Regarding ports, the division of labor and cooperation among different ports has led to differentiated development, with each port showcasing its unique characteristics.

4. Analysis on the Problem

4.1. Current situation of Guangzhou's transportation integration construction

The integration of comprehensive transportation system is the state of integrated and coordinated development between various components of the transportation system, as well as between the transportation system and its external environment, including the integration of transportation facilities and technologies, as well as the coordination of transportation services and policy systems [3]. In other words, from the perspective of destination, it can be divided into urban integration and out-of-city integration. From the perspective of integration objects, it is divided into hardware integration such as physical connection, technology docking, transfer, etc., and software integration such as policy docking, customs clearance procedures, approval procedures, etc. Next, this paper will analyze the construction of Guangzhou's transportation integration from these four perspectives.

First is transportation system inside Guangzhou. Guangzhou is one of the largest cities in the world with a long history of development. From the perspective of development track, Guangzhou expands outward from the north bank of the Pearl River as the core, which is a relatively traditional development mode. High-polluting industries and population spread outward with the expansion of the city. Due to the limited space on the east and west sides, the main suburbs of Guangzhou are

concentrated in the north and south, forming a narrow and long shape. At the same time, due to the large population, the north-south commute in Guangzhou will cause great pressure on the traffic. In recent years, Guangzhou has consciously promoted the transportation construction connecting the north and the south, such as the rail transit construction such as the extension of subway Line 9 and Line 3, the addition of bus frequency and other means to relieve pressure, and the promotion of shared bicycles to solve the connection problem of the last kilometer, thus forming one of the largest urban transportation systems in the world and building the largest underground transportation network in China. Secondly, Foshan as a satellite city of Guangzhou, Guangzhou is also continuing to promote the construction of connecting Foshan, with Line 18, Guangfo Line and other rail transit, while building several connecting highways. In terms of policy, it has also relaxed the restrictions on Foshan license plates entering Guangzhou. In Guangzhou, the government is trying to promote the construction of TOD, connecting various existing business districts and building new business centers by relying on transportation hubs. Guangzhou's developed public transportation network has become a strong condition for the construction of TOD.

For the transportation integration outside Guangzhou, that is, Guangzhou and other cities in the Greater Bay Area, good results have also been achieved. As Guangzhou is located in the central core of the Greater Bay Area, Guangzhou must be the core when the Greater Bay Area is built into a "one-hour living area". The first is the road traffic, due to the dense water system in the Pearl River Delta, bridge construction is the focus of construction, and a number of cross-river Bridges and cross-sea Bridges have been added. At the same time, to create a one-hour life circle, high-speed rail transport must become the main mode of public transport. In this regard, Guangzhou takes Guangzhou South Railway Station as the core, and Guangzhou East and North Railway stations respectively share passenger and freight functions, forming a railway network covering the Greater Bay Area. This network includes transportation outside the Bay Area, between cities, and within the city, and can transport Bay Area residents to every corner of the Bay Area by rail. In terms of air transport, Guangzhou Baiyun Airport is an air transport hub in southern China, which is connected by several subways to other parts of Guangzhou and other hubs. In general, from the perspective of travel circle, the Greater Bay Area has formed a commuter circle structure of the main city (15km), urban commuter circle (30km), urban exchange circle (50km), intercity exchange circle (100km) and external exchange circle (150km), as well as the corresponding rail transit types, spatio-temporal objectives and travel characteristics.

4.2. Opportunities and challenges faced by Guangzhou

In the era of globalization, informatization, and urbanization, production factors are rapidly flowing between cities, and regional characteristics are becoming increasingly prominent. Urban agglomerations are gradually emerging as new units of competition. Urban agglomeration theory suggests that the future trend involves large cities serving as cores that radiate and drive the development of smaller cities, transforming them into regionally influential and competitive urban clusters on the international stage. The construction of the Guangdong-Hong Kong-Macao Greater Bay Area represents a new attempt to foster a comprehensive open pattern in the new era and a new practice in advancing the "One Country, Two Systems" initiative.

According to the Outline of the Development Plan for the Guangdong-Hong Kong-Macao Greater Bay Area, the rail transit network will be fully interconnected, forming a one-hour living circle. The airport cluster in the Pearl River Delta will operate as a cohesive unit to better confront international competition, while the port area will establish a division of labor to achieve coordinated development. Transportation in the Pearl River Delta will primarily rely on rail systems, supplemented by ordinary roads and expressways, resulting in a comprehensive transportation network in the urban area. This

will make travel, living, and working in the region more convenient. However, it will also present numerous opportunities and challenges for Guangzhou.

4.2.1. Opportunity

The most intuitive benefit of promoting the integration of construction and transportation is to shorten the circulation time of personnel and materials and save a lot of time costs. The connection optimization in Guangzhou can effectively extend the distance of population flow per unit time, and the population and resources will be willing to migrate to further places, which changes the spatial layout of the city, improves the land utilization rate of Guangzhou, and is conducive to reducing the cost of urban expansion and urban load. At the same time, each TOD hub will also facilitate people's travel and shopping, improve the quality of life, and bring economic benefits. Therefore, the construction of urban transportation integration is an important livelihood project.

regional development

The integration of Guangzhou's external transportation will bring huge benefits. Connecting various cities through various transportation modes will greatly enhance the transportation accessibility of the Greater Bay Area, affect the flow of urban resources and production factors between cities, reduce the cost of passenger transportation and freight transportation, and make the transportation of goods more convenient. Thus, to a certain extent, it can restrain the fluctuation of commodity prices so it will promote regional economic integration, improve the anti-risk ability of the economy, and stimulate the economic development of Guangzhou. Transportation integration shortens the access time between Guangzhou and other cities, effectively promotes the regional integration process between Guangzhou and surrounding cities, enables cities to coordinate division of labor and cooperate to improve efficiency, effectively promotes the differentiated development of Guangzhou and other cities, and achieves efficient economic development.

Industrial upgrading

The construction of transport infrastructure can significantly improve the rationality and scientific of Guangzhou's industrial structure, facilitate the development of industrial clusters, promote the coordinated development of the industrial chain in the Greater Bay Area, and at the same time, transport infrastructure construction can play a driving role in industrial upgrading. The completion of the Bay Area inner city rail has promoted the redistribution of capital and labor, which is conducive to attracting talents and capital in Guangzhou and promoting the development of high-tech industries by virtue of its superior location conditions.

4.2.2. Challenges

Everything has two sides, the construction of transportation integration will bring opportunities, but also bring challenges to Guangzhou. First of all, at the social level, Guangzhou is more convenient to travel to other cities, and the liquidity of talents and funds is improved. On the other hand, international metropolises such as Shenzhen and Hong Kong are sometimes more competitive in terms of work benefits, policy environment, development opportunities and cluster effect, which will cause a huge siphon effect on surrounding cities. Enterprises, capital, and talents will be attracted by its favorable conditions, the completion of the Shenzhen-China channel, resulting in Shenzhen more convenient to attract foreign business talents, and a series of preferential policies and low living costs in the surrounding cities, will also create a huge gravitational pull, will siphon on the border of Guangzhou. Guangzhou's industry, capital and talents will be lost, which will also have an impact on local enterprises and the real estate industry.

Secondly, in recent years, the global economic situation has deteriorated, and the growth rate of the domestic economy has slowed down after the impact of the epidemic. Industries such as real estate

and other important financial sources have been severely hit, and local governments have been under certain financial pressure. And transportation construction requires a large amount of financial funds. Transportation construction may need to mobilize a lot of resources, including human, material and financial resources. This may affect the allocation and prioritization of resources in other areas of the Guangzhou Government, and there may be a reduction or adjustment of investment in other areas.

At the same time, transportation construction usually requires a lot of land for the construction of roads, Bridges, tunnels and other infrastructure. This may lead to a large consumption of land resources and damage to the ecological environment, including vegetation destruction, soil erosion, soil erosion and other problems, and have a negative impact on the local ecosystem. Traffic construction during construction may produce noise and vibration pollution, especially road traffic noise during construction and after traffic operation. This can affect the quality of life of nearby residents and even affect people's health. In addition, traffic construction and operation may increase the number of motor vehicles and traffic flow, leading to the increase of air pollutant emissions, which will affect the air quality of surrounding areas, aggravate the problem of air pollution, and pose a threat to human health and the environment.

5. Countermeasures to promote Guangzhou's economic development under the construction

5.1. In-depth exchanges and cooperation with surrounding cities

As a city with a long history and cultural deposits, Guangzhou has its own unique industrial foundation and development advantages. Guangzhou can enhance its competitiveness and attract more resources and talents to stay and develop in Guangzhou by strengthening technological innovation, brand building and market expansion of its own industries. Guangzhou can share the development achievements and resources of both sides by strengthening cooperation and interaction with surrounding cities. It can strengthen the connection with surrounding cities in transportation, talent flow, industrial cooperation and other aspects to achieve complementary advantages and common development. Guangzhou can also enter the Hong Kong and Macao markets with the help of convenient transportation, and then it can introduce commodities to the world through Hong Kong and Macao. Hong Kong is an international financial center, and the transportation construction of the Greater Bay Area links Guangzhou with Hong Kong, which is conducive to Guangzhou attracting Hong Kong investment and boosting the development of local enterprises.

5.2. Improving supporting policies for transportation integration

Address the technical standards and management software challenges to achieve integrated operations and management of rail transit, along with a unified ticketing system, while promoting the construction of convenient transfers and public transportation services. Develop a common commuter payment tool system for the Greater Bay Area, implementing a shared transportation card or QR code to facilitate transportation and commuting across the region. Enhance the quality of passenger travel services and work towards a one-ticket passenger transport service system in the Greater Bay Area.

For freight transport, establish an efficient freight service system, optimize the transport structure, and encourage the shift of bulk and medium to long-distance cargo from road to rail and water transport. Promote the development of an intermodal freight service system in the Greater Bay Area and streamline procedures. Additionally, improve the international transport service network to enhance the region's capacity to provide global transport services. The government strengthened supervision over related projects [11,12].

5.3. The government strengthened supervision over related projects

A large amount of transportation construction requires the government to provide a large amount of funds, and will bring a lot of pollution, the government needs to strengthen the supervision of each project, reasonable arrangement of planning, to minimize the impact on other projects and the people's livelihood. Conduct preliminary investigation and demonstration of engineering construction projects in the early stage, evaluate the feasibility and risks of the project, and reduce the problems and risks in the process of project construction. Equipped with professional regulatory personnel, training of regulatory personnel to improve their regulatory capabilities and levels. Supervise all stages of the construction project, including design, construction, acceptance and other links, to ensure that the project is carried out in accordance with the contract agreement and relevant standards. Strengthen the disclosure of construction project information, accept social supervision, respond to social concerns and problems in a timely manner, and improve the transparency and credibility of supervision. Ensure that funds are used legally and reasonably and reduce environmental damage and nuisance.

5.4. Promote the reform of its own industries

The goal of the Guangdong-Hong Kong-Macao Greater Bay Area is to establish a city cluster of nine plus two, enabling it to engage with the world and compete internationally. The integrated development of transportation within the Greater Bay Area will effectively stimulate Guangzhou's industries and accelerate the adjustment and transformation of its industrial structure. While Guangzhou's traditional pillar industries may face pressures for transformation and upgrading, emerging industries will also require additional support and nurturing, presenting challenges for the city's industrial upgrading and economic transformation.

To address these challenges, Guangzhou should proactively deepen supply-side structural reforms, strongly support the growth of emerging industries, and promote technological advancements in traditional sectors. It is essential to develop well-informed industrial development plans that clarify the direction and objectives of industrial restructuring. Under government guidance, efforts should be made to strengthen oversight and regulation of industrial development, fostering the optimization and upgrading of the industrial structure.

6. Conclusion

By analyzing the construction status of the Greater Bay Area and the comprehensive situation of Guangzhou, this paper analyzes the opportunities and challenges faced by Guangzhou in this development wave. The transportation integration of the Greater Bay Area provides unprecedented opportunities for Guangzhou's economic development, but also brings certain challenges. With the promotion of transport integration, Guangzhou has the opportunity to further enhance its regional competitiveness, promote the coordinated development of industries, attract more investment and talents, and promote the urbanization process and the improvement of residents' quality of life.

To make full use of these opportunities, Guangzhou needs to take active measures in transport infrastructure construction, policy coordination, industrial upgrading, talent introduction and green development, further deepen cooperation with other cities in Guangdong, Hong Kong and Macao, and jointly promote high-quality development of the regional economy. By effectively addressing the challenges of transport integration, Guangzhou will play a more important role in the overall development of the Guangdong-Hong Kong-Macao Greater Bay Area.

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