Research on the development strategy of air logistics in SZ airport based on AHP

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Abstract

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In the context of the development of global economic integration, air logistics has received attention from governments as well as airports. Shenzhen Airport is at the core of Guangdong-Hong Kong-Macao Greater Bay Area, with superior location advantages. And in the latest national strategic plan of Shenzhen Airport, Shenzhen Bao'an International Airport Master Plan, Shenzhen Airport is positioned as an international aviation logistics hub based on the Greater Bay Area, with aviation business serving Asia and the world, and its nationalized strategy is set to improve and become a nationalized aviation hub.

Therefore, this paper, in this context, studies how Shenzhen Airport will find its own development strategy in the next five years among the airport clusters in the highly competitive Guangdong-Hong Kong-Macao Greater Bay Area. After introducing the purpose, background and significance of the research on the development of air logistics in Shenzhen airport, the research method of this paper is proposed and the framework is sorted out. Secondly, we analyze the current situation of air logistics development in Shenzhen airport in several aspects in detail; then we analyze and summarize the development experience of other two major airports in the Bay Area to provide reference for the development of air logistics in Shenzhen airport; again, we analyze the external industry competition situation of air logistics development in Shenzhen airport by using the Polly Woot analysis; then we analyze the advantages, disadvantages, opportunities and risks of air logistics development in Shenzhen airport by using the SWOT analysis. The internal factors such as strengths, weaknesses, opportunities and risks of air logistics development in Shenzhen airport are analyzed by SWOT analysis, and then AHP analysis is conducted based on the results of SWOT analysis as a guideline layer, and then strategic positioning and strategic development plan are proposed. It is proposed that if Shenzhen Airport wants to win its own development advantage in the competitive airport cluster in the Greater Bay Area, it must make efforts in deepening the advantages of multimodal transportation, integrated airport development, organic integration with industry, deep construction of intelligent airport, expanding the scope of logistics services using its own advantages to play a passenger transport and complementing the shortcomings of the airport's cargo. The final summary.

Key words
Shenzhen Airport; Air logistics; SWOT-AHP analysis; Development strategy

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1 Introduction

In the context of the development of global economic integration, aviation logistics for economic development has an unparalleled advantage over other modes of transportation. In recent years, the strategic positioning of the airport group in the Guangdong-Hong Kong-Macao Bay Area, where Shenzhen airport is located, has been gradually improved, and the development strategy of the airport in the Bay Area has been gradually deepened, so Shenzhen airport will have its own development opportunities in the future, relying on the advantages of the "Special Zone, Bay Area and Free Trade Zone".

However, there are many airports in the Bay Area, and Hong Kong Airport and Guangzhou Baiyun Airport, which are already large international airports, are better developed than Shenzhen Airport, the subject of this study, in many aspects of air logistics business in the Bay Area. Therefore, in the future, in such a competitive aviation environment in the Bay Area, how Shenzhen airport can grasp the development opportunities to form its own competitive advantage is the problem to be solved in this paper. Although there have been many scholars have done research on how to develop air logistics in Shenzhen airport, but most of them gather on a small aspect to put forward specific opinions, for example, Guo Na (2019) in Shenzhen airport air passenger transport development strategy research paper Shenzhen airport development of air passenger transport for specific analysis, and finally put forward a strategic plan to improve the development of air passenger transport in Shenzhen airport. Alternatively, the research method used is either a single quantitative analysis or a single qualitative analysis. For example, Li Jiao (2020) conducted a detailed study on the future development direction of air logistics in Shenzhen airport, and also applied the SWOT analysis to the development strategy of air logistics in Shenzhen airport, which is very inspiring to me.

This paper is based on the previous research on the development of air logistics in Shenzhen airport, including not only air passenger transportation, cargo transportation, but also the related factors affecting air logistics. This paper mainly adopts the method of qualitative analysis, supplemented by quantitative analysis, the factors related to the development of air logistics in Shenzhen Airport in this way to analyze, and finally put forward in detail the strategic plan of Shenzhen Airport to play the development of air logistics in the future.

2 Prolegomenon

This chapter is a specific introduction to the background, purpose and significance of the study on the development of air logistics in Shenzhen Airport, as well as the overall research methodology and and the framework of the thesis used in the thesis.

2.1 Research background, purpose and significance

2.1.1 Background of the study

Along with the development of economic globalization and the further opening of the international air logistics market, air logistics is to stand out from the modern logistics industry with its fast speed, flexibility and high security, and become another important growth point to promote economic development.

The latest information shows that China's total logistics turnover has been ranked in the forefront on the world stage after years of efforts, becoming the second in the world and officially stepping into the ranks of a logistics power. The aviation part of China's logistics started late, but the rapid development of the logistics industry is inseparable from the promotion of aviation logistics, the development of a country's aviation logistics for the promotion of regional and even national economy more to the rapid development of the national and regional economy has the incomparable advantages of other modes of transportation.

In recent years, China has attached great importance to the development of air logistics in response to the new historical pattern of globalization of resource allocation, and Shenzhen is located in the Guangdong-Hong Kong-Macao Bay Area as a bridgehead for the country to participate in global competition, the formation of the Bay Area airport cluster and economic development requires the participation of Shenzhen airport, and the development of Shenzhen airport is crucial to the development of the Bay Area. In the "Outline of the Development Plan for the Guangdong-Hong Kong-Macao Greater Bay Area" issued by the relevant departments of the Chinese government managing aviation business, it is proposed that Shenzhen airport, which belongs to the three world-class aviation hub airport groups in the Greater Bay Area, should accelerate the international competitiveness, develop the airside economy and enhance the passenger and cargo transportation distribution capacity, and put forward clear requirements for Shenzhen airport to strive to develop into an international aviation hub.

2.1.2 Research Purpose

This paper mainly analyzes the advantages, disadvantages, risks and opportunities of the current situation of air logistics development in Shenzhen airport, supplemented by the analysis of the development experience of Hong Kong airport and Guangzhou Baiyun airport in the Greater Bay Area. On the basis of these, combined with the use of AHP analysis, the purpose of this paper is to investigate how to maximize the advantages and minimize the disadvantages of Shenzhen airport in the next five years, how to enhance the competitiveness of the airport in the Greater Bay Area, and to promote the development of the airport into a national planning air logistics hub airport.

2.1.3 Research meaning

As a hub for rapid transportation, airports are an important support point for a regional economy to achieve rapid development. And air logistics, as a special mode of transportation, connects the economies of various regions of a country in the world and even various countries in the world into a whole, promoting the linked development of the world economy. In the national strategic positioning of Guangdong, Hong Kong, Macao and the Great Bay Area to improve the major nodes, Shenzhen as China's most dense and developed city of high precision industries, Shenzhen airport air logistics in this historic period need to adjust their own development direction as well as clear their competitive advantage in the Great Bay Area, which has an important role in driving the growth of the regional economy and promote the development of the national economy.

2.2 Paper Research methods and paper framework

2.2.1 Research method

1.Literature analysis method. Literature study: the research literature of domestic and foreign scholars about international logistics center and aviation logistics center was widely read, and the development elements of international aviation logistics center were summarized inductively, which provided a clear direction for the selection of the topic of this paper;

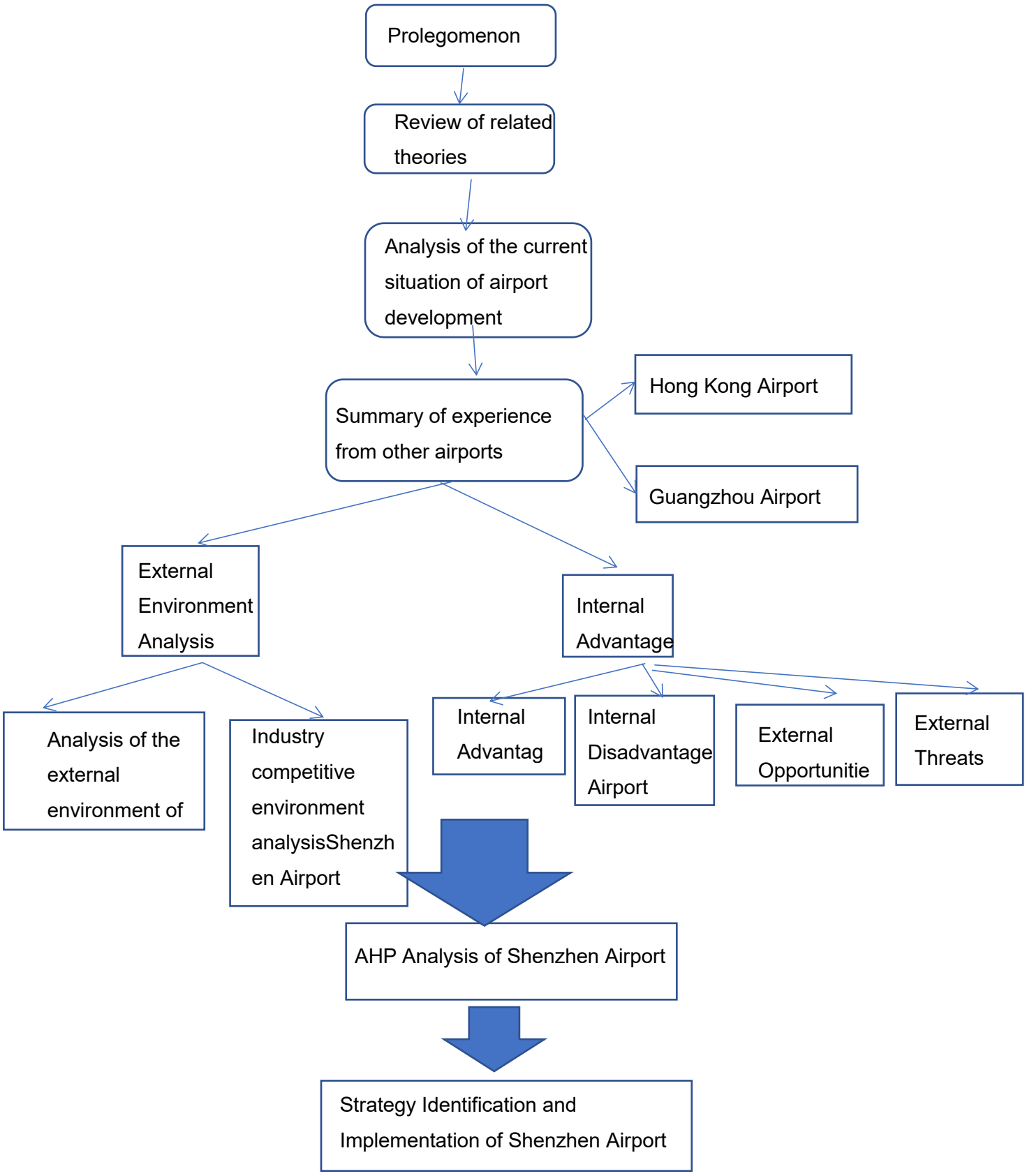
2.Use the Polly Woot analysis method. We analyzed the competitive environment of Shenzhen airport, explored the areas that need to be improved and grasped the current competitive situation.;

3.Use SWOT analysis method. To make a specific analysis of the internal environment of the development of air logistics in Shenzhen airport;

4.A combination of quantitative analysis and qualitative analysis. Based on the SWOT analysis model in the previous chapter, a comprehensive evaluation model is established using the AHP analysis method to analyze in depth the strengths, weaknesses, opportunities, threats and other

aspects of Shenzhen Airport's development of air logistics for the weight of Shenzhen Airport's future development impact. On this basis, the optimal development strategy is derived and the corresponding strategic path is proposed.

2.2.2 The paper framework



3 Review of theories related to air logistics development

While promoting the linkage development of countries around the world, air logistics has also prompted more foreign scholars to study it. They have conducted a lot of research on various aspects of air logistics and the related impact aspects, which gives us experience on the development of air logistics in Shenzhen airport.

3.1 Status of foreign research

With the rapid development of international trade, foreign researchers have put forward guiding ideology and practical strategies for the development of air logistics from all levels, and relevant books are rich and comprehensive, covering all aspects of air logistics.

Standing at the latest point in the innovation and development of global logistics clusters, Professor Jussi Sheffield revealed the internal logic of the formation and development of world-famous logistics clusters in simple terms, and explained the essential reasons for the success of these logistics clusters. (Yossi Sheffi 2015)

In view of the further needs of the development of modern air logistics, Huber et al. emphasized the importance of building air transport logistics hub centers, and put forward a series of models and planning suggestions for logistics hub construction. (Huber S,Klauenberg J,Thaller C 2015,32)

Laura Broccardo analyzes the key nodes and strategic management practice areas of different types of aviation logistics management technology innovation from the perspective of smart city. Qualitative and quantitative analysis is used to carry out differentiated management of aviation logistics technology management in different regions according to the specific characteristics of regional economy and industrial layout. (Laura Broccardo 2019,1589-1602.)

Zhao L proposed the importance of air freight, analyzed and verified the freight identification system, and provided scientific judgment arguments for the selection of air freight mode.(Zhao Lei 2018,1149-1158.)

Through research, Lisa Brekalo believes that the trend of aviation logistics management is logistics strategy and logistics alliance, and proposes that logistics enterprises should achieve leapfrog development through competition and cooperation.(Lisa Brekalo 2011,998-1065.)

Jonathan W. Kohn found that technology, management, scheduling, and warehousing are the core advantages of the United States' air logistics strategy by using the partial least squares structure equation model, and the scholar believes that in order to maximize the development of air logistics,

it is necessary to learn from the advantages of the United States in this regard.(Jonathan W.Kohn 2011,1458-1462.)

Xiaolan Zhang reviews the basic theory and empirical research literature of airport economy, and gives suggestions for the better and faster development of airport economy, which has a good reference for future development .(Xiaolan Zhang 2018,421-424.)

3.2 Status of domestic research

On the domestic side, since aviation logistics was only given attention in China at a very late stage, both the theoretical basis and management experience of aviation logistics in China lagged far behind the research progress of aviation logistics. With the rapid development of national economy and many domestic airports among the world airports, more and more scholars realize the importance of studying the development strategy of aviation logistics, so the literature on aviation logistics has only gradually increased in the past two decades.

Zhang Li and Hu Huaqing researched the association between distance and choice of means of travel, showing that passengers do have different choices between air travel and high-speed rail depending on the distance, which can well explain the diversion of passengers from civil aviation by high-speed rail, but the study also pointed out that the development of high-speed rail will stimulate the civil aviation industry at the same time.(Zhang Li , Hu Hua 2010, 65-70.)

Zhai Shubin and Zhao Hua used SWOT analysis to put forward a strategic implementation path from four aspects: strengthening government support, accelerating infrastructure construction, actively developing the airport industry, and improving the level of informatization.(Zhai Shubin ,Zhao Hua 2013,2.)

Gu Mingli focused on the Zhengzhou Airport Economic Experimental Zone, put forward the target positioning, and provided opinions and suggestions for the implementation of the strategy. (Gu Mingli 2017)

Kang Mengnan used the grey correlation analysis method and AHP to propose the implementation path of air logistics development in Henan Province from the policy, technology and economic levels .(Kang Mengnan 2018)

Jiang Wei summarized the development characteristics of international aviation hubs by analyzing a number of development indicators of 15 global large aviation hubs, benchmarked the development status and development level of the top ten domestic hub airports, and put forward

the development suggestions for China's hub airports to enhance their international competitiveness.(Jiang W 2018,18-22.)

Xia Xue proposed that the SO strategy should be selected by using the SWOT analysis method, and fully learned from the practices and experience of FEDEX and other airlines to systematically build a core strategy represented by "building an aviation logistics park, promoting the integration of logistics e-commerce, and cultivating a plant flow business system".(Xia Xue 2019)

Based on the construction of the Guangdong-Hong Kong-Macao Greater Bay Area, Li Yuan analyzed the opportunities and challenges faced by Shenzhen Airport, and proposed that Shenzhen Airport should plan ahead from four aspects: strategy, resources, policy, and scientific research, actively respond to new challenges, and actively participate in the construction of the Guangdong-Hong Kong-Macao Greater Bay Area.(Li Yuan 2019,07.)

Zhao Tianming proposed countermeasures to improve infrastructure construction, improve operation mode, accelerate information construction, and standardize air cargo market management in view of the problems of imperfect infrastructure support, backward business model, inconvenient information and chaotic air cargo management of air logistics at Shuangliu Airport.(Zhao Tianming 2015,99-101.)

3.3 Review of the domestic and foreign research literature

To sum up, from the history and content of research on aviation logistics theory by foreign and domestic experts and scholars, it can be understood that the international research literature on aviation logistics has gradually increased in recent years, and the research of foreign scholars on the development strategy of aviation logistics has certain reference effect on the development of Shenzhen airport aviation logistics. For example, after understanding the inner logic of the development and growth of the world-famous logistics cluster, it can inspire the development of the Hong Kong-Zhuhai-Macao Bay Area where Shenzhen Airport is located; it can inspire the analysis of aviation logistics by combining quantitative and qualitative treatment; and it can combine competition and cooperation in the process of aviation logistics development, etc. However, due to different social situations and different geographical locations, these strategies cannot directly solve the outstanding problems of air logistics development in Shenzhen airport.

In the aviation logistics-related works of domestic scholars, it is understood that in the academic background and new policy context of recent years, the analysis of domestic scholars focuses on a very small aspect of the development of aviation logistics in one airport, or puts forward relatively general suggestions for the development of the overall aviation industry, or puts forward strategic planning for the development of airport clusters, especially in the hub aspect of the study mostly

stands on the city or In particular, most of the studies on hubs are conducted from the perspective of city or regional planning, and the studies on transportation and transit hubs are also limited to the perspective of land transportation and maritime transportation, and fewer studies are conducted on the development of aviation logistics hubs. This paper, however, proposes a development strategy for the development of Shenzhen Airport into a regional international air logistics hub, which will provide a reference role for Shenzhen Airport in the face of development opportunities in the new era, and also provide some theoretical basis and practical guidance for the development of China's air logistics hub.

4 Introduction to Guangdong, Hong Kong, Macao and the Greater Bay Area and Shenzhen Airport Basics

This chapter is to make a general introduction to the basic situation of Shenzhen Airport in the Greater Bay Area and Shenzhen Airport, and then analyze the current situation of developing air logistics in Shenzhen Airport, focusing on finding the advantages and disadvantages of the current situation of developing air logistics in Shenzhen Airport, so as to pave the way for the subsequent development strategy of air logistics in Shenzhen Airport.

4.1 Basic information about the Greater Bay Area

The Guangdong-Hong Kong-Macao Greater Bay Area consists of two special zones and nine cities, with a total area of about 56,000 square kilometers and a dense population of about 70 million people, making it one of the most open and economically dynamic regions in China, and one of the four largest bay areas in the world. The Guangdong-Hong Kong-Macao Greater Bay Area has 7 civil transport airports, among which 3 large international hub airports in Hong Kong, Guangzhou and Shenzhen dominate. (Zhang Y. 2022.300-306)

4.2 Basic information of Shenzhen Airport

4.2.1 Introduction of Shenzhen Airport

Shenzhen Airport is located on the east coast of the Pearl River estuary, 32 kilometers from Shenzhen, and is a modern large-scale international air port with combined land, sea, air and rail transportation in China. In October 1991, Shenzhen Bao'an International Airport was officially put into operation. Since its opening, Shenzhen Airport has maintained a high growth in passenger and cargo traffic. In terms of passenger traffic, the annual passenger traffic exceeded 10 million for the first time in 2003, making it one of the top 100 airports in the world. It is one of the top 100 large airports in the world and one of the four largest airports and express hubs in China. (SZX 2023).

4.2.2 The current development of Shenzhen Airport

1.Infrastructure

(1)Terminal Building Construction

Shenzhen Airport seizes the opportunity of accelerating the construction of urban transportation network and takes the initiative to strengthen the connection with other transportation modes around the airport and in the city, while not leaving behind the infrastructure construction for the internal airport. Proactive construction promotes the construction of infrastructure between the

terminals within the airport. Especially the landing of passenger facilities, such as the construction of passenger facilities in the T1 terminal of Shenzhen Airport, which is in the government's policy support for the Greater Bay Area, Qianhai expansion project, Shenzhen Airport took the initiative to dock, to achieve the construction of three runways, three terminal areas, a satellite hall "3 + 3 + 1" infrastructure pattern. So far, Shenzhen Airport has 2 high-speed rail, 2 intercity, 5 subway, 1 airport MRT transportation network, such infrastructure construction is to absorb the advantages of transportation from the air to the ground, from the ground to the underground, from land to sea. A comprehensive, multi-level, three-dimensional spatial planning layout of the hub has been formed, which has become an important platform to expand the opening of the Bay Area and accelerate its interconnection.(Xiaorong Dai 2022)

(2)Customs supervision construction

The technology and procedures of the special customs supervision department of Shenzhen Airport are quite perfect, which is a major guarantee for the fast customs clearance speed of Shenzhen Airport. The special supervision department of customs is a project of cooperation between Shenzhen Airport and the state, established in 2000, and belongs to the International Express Operation Center. Its main function is to provide customs clearance and inspection places for customs, inspection and quarantine and other law enforcement departments and international express enterprises. Airport Customs is responsible for all customs operations at Shenzhen Air Port, and has implemented the "24-hour customs clearance" policy since 2016. He can quickly check the special products of Shenzhen Airport, which improves the efficiency of cargo transportation at Shenzhen Airport. Customs also provides a green channel for full-freighter routes, which greatly improves the circulation speed of freighters at Shenzhen Airport, and realizes that by 2020, 19 new full-freighter routes will be added, with an additional capacity of 1,500 tons per week, and promote the development of air cargo business at Shenzhen Airport.

2.Freight development status

(1)Freight route

The cargo skeleton of Shenzhen airport has taken initial shape in recent years, and by the end of 2021, Shenzhen airport has achieved 133 cities for passenger traffic, including 127 domestic ones; the cargo market has maintained its growth trend, with 51 cities for all-cargo flights, including 20 domestic, 30 international and 1 regional one. Airports are aware of the importance of cooperation with cargo companies, among which the cooperation between SF and the airport is an example. Shenzhen airport has opened more than 10 new international cargo routes after the cooperation between SF and Shenzhen airport. Shenzhen Airport also cooperates with other world-renowned

logistics and express companies, among which is Kartar Cargo Airlines. The internationalization of Shenzhen Airport's cargo business is obvious. By 2022, Shenzhen Airport will have 57 cargo destinations, including 36 international and regional cargo destinations.

(2)Air cargo volume

The arrival of the new crown epidemic in 2019 can be said to be the highest blow to the air passenger business in history, but in terms of air cargo, the new crown epidemic does not seem to have a great impact on it, the development trend of cargo is still positive, showing growth, the total amount of cargo and mail at Shenzhen Airport even increased by a larger growth rate between 2019 and 2020, with an annual cargo and mail traffic growth rate of 9% and an increase of 1.399 million tons, squeezing into the top of domestic airports year-on-year, where domestic cargo and mail throughput declined. From the chart statistics, the international and domestic cargo traffic of Shenzhen airport shows a very unbalanced situation. The following statistics show the total cargo volume and domestic cargo and mail throughput of Shenzhen Airport during the 13th Five-Year Plan period and their growth rates.

Table 1：The cargo and mail throughput of Shenzhen Airport during the 13th Five-Year Plan period.

(Data from：szairport.com. Accessed on:May 23, 2023)

Index	2016	2017	2018	2019	2020
Total cargo and mail throughput (10,000 tons)	112.6	115.9	121.9	128.3	139.9
Annual growth rate	11.1%	2.9%	5.1%	5.3%	9%
Domestic cargo and mail throughput (10,000 tons)	81.5	82.2	86.2	87.3	63.6
Annual growth rate	7.7%	0.9%	4.9%	1.2%	1.0%
The increase is based on the cargo volume at the end of 2015.					

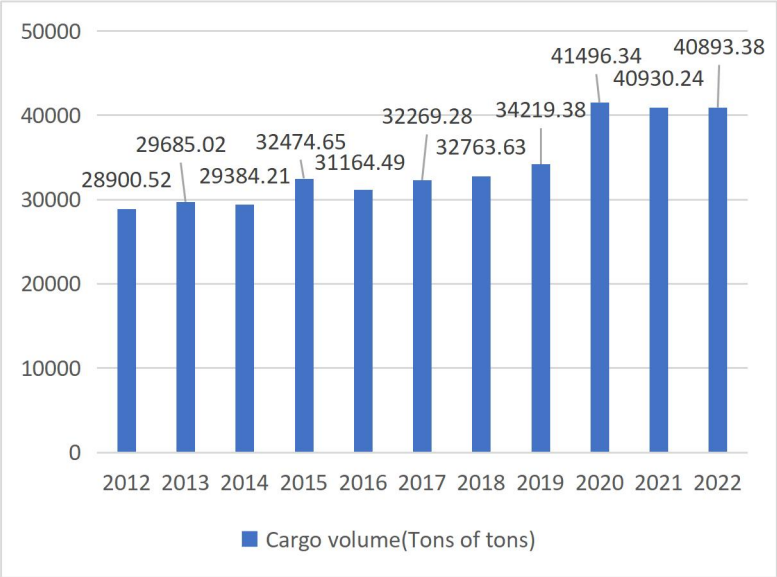


Figure 1:Describe the changes in air cargo volume at Shenzhen Airport in the past decade.

(Data from:Shenzhen Transportation Administration.2022. (sz.gov.cn). Accessed on:April 3, 2023)

(3)The special customs supervision area is relatively complete

The technology and procedures of the special customs supervision department of Shenzhen Airport are quite perfect, which is a major guarantee for the fast customs clearance speed of Shenzhen Airport. The special supervision department of customs is a project of cooperation between Shenzhen Airport and the state, established in 2000, and belongs to the International Express Operation Center. Its main function is to provide customs clearance and inspection places for customs, inspection and quarantine and other law enforcement departments and international express enterprises. Airport Customs is responsible for all customs operations at Shenzhen Air Port, and has implemented the "24-hour customs clearance" policy since 2016. He can quickly check the special products of Shenzhen Airport, which improves the efficiency of cargo transportation at Shenzhen Airport. Customs also provides a green channel for full-freighter routes, which greatly improves the circulation speed of freighters at Shenzhen Airport, and realizes that by 2020, 19 new full-freighter routes will be added, with an additional capacity of 1,500 tons per week, and promote the development of air cargo business at Shenzhen Airport.

3.Current situation of passenger transport development

(1)Passenger throughput

Throughout the history of passenger development, Shenzhen Airport became the fourth largest airport in China in 1996; in 2003, the passenger throughput of Shenzhen Airport exceeded 10 million passengers; in 2015, the annual passenger throughput of Shenzhen Airport exceeded 39.72 million passengers, with 14 countries and regions and 123 navigable cities; in 2016, under the national "13th Five-Year Plan", the positioning of Shenzhen Airport changed to "international hub airport"; in 2017, the passenger throughput of Hong Kong, Guangzhou and Shenzhen Airport was about 72 million, 65 million and 45 million respectively. In 2016, under the national "13th Five-Year Plan", the positioning of Shenzhen airport changed to "international hub airport"; in 2017, the passenger throughput of Hong Kong, Guangzhou and Shenzhen airports were about 72 million, 65 million and 45 million respectively, and the growth rate of Shenzhen airport was obvious; in 2019, the annual passenger throughput of Shenzhen airport exceeded In 2019, the annual passenger throughput of Shenzhen Airport will exceed 50 million, the annual passenger and cargo throughput will rank among the top 30 in the world, and the international passenger route network will reach more than 50 cities in the world; in 2020, the international passenger throughput of Shenzhen Airport will be 5.5 million, accounting for no less than 10% of the total passenger volume; in 2022, the international routes will reach 60, the annual passenger throughput will exceed 50 million, and during the peak period, there will be an average of one flight in more than one minute. In 2022, the number of international flights will reach 60, and the annual passenger throughput will exceed 50 million, with an average of one flight taking off and landing in just over one minute at the peak. According to the development status, the annual passenger throughput can reach 80 million by 2030. Below are specific statistics on the passenger throughput of Shenzhen airport in the past ten years, which shows that the passenger throughput of Shenzhen airport has been severely hit by the epidemic.

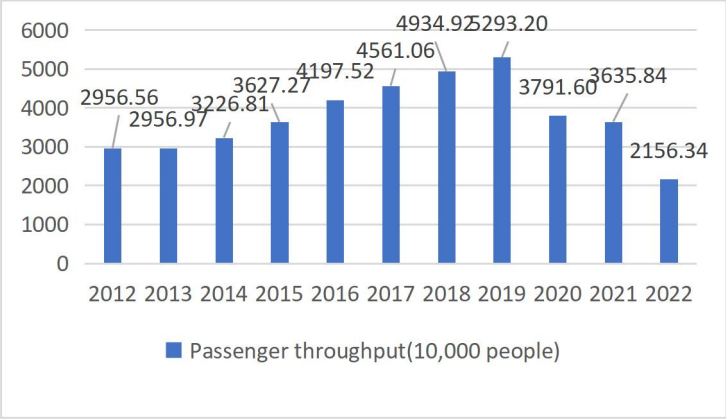


Figure 2: Describe the change in passenger throughput of Shenzhen Airport in the past ten years

(Data from:Shenzhen Transportation Administration.2022. (sz.gov.cn).Accessed on:April 3, 2023)

(2)Passenger route network

Throughout the history of the development of passenger routes in Shenzhen airport, the development of international routes in Shenzhen airport has lagged behind.In 2016, Shenzhen Airport's international passenger routes achieved a breakthrough of zero, and passenger transportation was carried out with more than 10 cities in the Americas and Europe; During the three-year period from 2016 to 2018, Shenzhen Airport opened more than 10 new international passenger routes every year. However, as of 2018, Shenzhen Airport operated only 12 international passenger routes; The main cooperative airports are still not wide enough, only connecting to Shanghai, Beijing, Taipei, Singapore, which are several globally influential Asian airports; In 2019, the airport's passenger routes achieved an important breakthrough in connecting 50 cities around the world; By 2023, Shenzhen Airport's international passenger route network has reached 20 cities in 17 countries around the world; Shenzhen Airport has nearly 190 domestic and foreign routes to 134 cities and operates 50 international passenger routes. From the data of recent years, although Shenzhen Airport is making continuous efforts in international routes, its international business still needs to be improved.

(3)Potential passenger sources for passenger transport development

Based on the narrow regional location of the Bay Area, coupled with the Bay Area within the scope of Hong Kong, Macau, Guangzhou, Shenzhen, Zhuhai five major airports, the distance between the airports is only about 100 kilometers, the airport density is very high. This from another point of view, other cities are also likely to become the source of Shenzhen airport passengers. Shenzhen airport's passenger sources are mainly located in the east coast of the Pearl River, and there is a great potential to expand the passenger sources. According to the review of relevant literature, it is known that as of 2019, according to the survey results, Shenzhen airport passengers have a strong local character, with 80% of passengers from Shenzhen. Guangzhou, despite having Baiyun airport, is still the third city from which Shenzhen airport passengers come (Ouyang X.G., He Shaochen, Sun Panfeng. 2020,9.) From this phenomenon, it is known that Shenzhen airport still has its own strong advantage in some aspects to attract passengers from other cities. Shenzhen airport should turn the disadvantage of having more scattered and concentrated passenger resources in the Greater Bay Area, and the distance between airports is not very close to each other, into an advantage to attract passengers.

On the other hand, Shenzhen's passengers are also a potential source of passengers for other airports, which will further intensify the competition among airports in the Greater Bay Area, and without macro control, it will become an impossible task to build an international airport cluster.

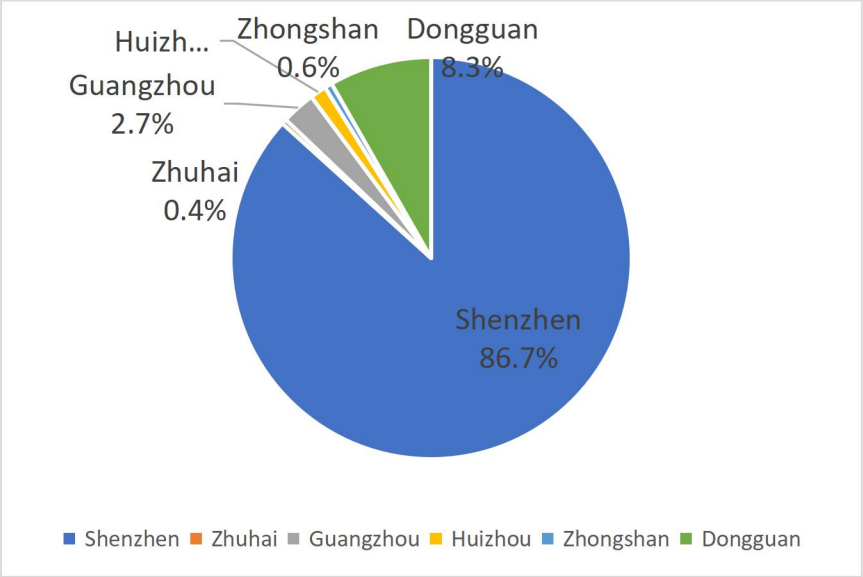


Figure 3：Statistics on the source of passengers at Shenzhen Airport

(Data from:CCA. 2019. www.caac.gov.cn. Accessed on:April 8, 2023)

4. Close contact with the cities with developed high-tech industries

The development of the airport is inseparable from the development and support of the local industrial economy. From the interview transcript of the airport manager, we can learn that the airport has begun to engage closely with cities with high-tech industries and high-tech industries around the world. The relevant person in charge of the airport pointed out, "In recent years, in the layout of the route network, Shenzhen Airport has focused on the cities where the global financial center and science and technology innovation center are located with Shenzhen's industrial correlation and compatibility, and has achieved navigation with cities including London, Paris, Frankfurt, Brussels, Los Angeles and other cities, which has strengthened the economic and trade exchanges between Shenzhen and major economic, scientific and technological and innovation centers in the world, and continuously enhanced the supply level and support capacity of international routes to enhance Shenzhen's comprehensive opening to the outside world.

5. Cooperate with large logistics companies and airlines at home and abroad

According to the survey, we can know that there have been more than 5,900 well-known logistics enterprises at home and abroad, such as SF Express, FedEx, and Lufthansa, gathered in Bao'an

District, where the airport is located, and there are not only transportation facility operators such as Shenzhen Airport and Dachanwan Wharf, but also base airlines registered in Bao'an such as Shenzhen Airlines, Donghai Airlines and SF Airlines, forming a group structure of various logistics formats such as the world's top 100 logistics regional headquarters enterprises, A-level logistics enterprises, and third-party fourth-party logistics enterprises. It provides a solid industrial foundation for the cargo business of Shenzhen Airport. (Miao Tianfeng 2012.28-33.)

5 Hong Kong and Guangzhou airports air logistics development experience

Shenzhen airport wants to break through its own aviation logistics development bottleneck, need to draw experience from the other two international airports in the same big bay area, so that in the formulation of their own development strategy can be more experienced and pointed.

5.1 Hong Kong Airport

Located not far from Shenzhen Airport, Hong Kong Airport is located at Chek Lap Kok on Lantau Island in the New Territories and covers an area of about twelve thousand square kilometers. As early as 2018, the Hong Kong airport has reached cooperation with more than ninety airlines to establish round-trip routes, so that the Hong Kong airport is able to fly to more than one hundred and fifty cities, able to reach the cities where half of the world's people are located, and only takes a maximum of five hours and these are closely related to the advantages he has since its development.

5.1.1 High level of informatization

Hong Kong Airport is not only conveniently located in the transportation network, but also has a high level of information technology. HKAA is constantly working on adopting the latest technology. The Airport Authority of Hong Kong (AAHK) understands that the enhancement of transportation capacity is the key to the competitiveness of Hong Kong Airport among other hub airports, and it is also the key to the operation of Hong Kong Airport. Recently, the AAHK has started to develop the "Third Runway System" and "Upgraded Dual Runway System" to enhance the capacity and operational efficiency of HKIA. (Bai Mengyun, Geng Songtao, Yan Rong 2023, 1-10.)HKIA has also created a Super Cargo Terminal, which not only has a high level of functional integration, but also a high level of operational efficiency and automation, making it an important infrastructure for HKIA as an international air cargo transshipment center.

5.1.2 High navigation efficiency of goods

Hong Kong Airport not only has a convenient transportation network and superior geographical location, but also has a high level of informatization. The Hong Kong AA is constantly striving to adopt the latest technology. Hong Kong Airport understands that increasing its capacity is the reason why Hong Kong Airport is competitive among many hub airports and is the key to its operation. Recently, the Hong Kong Airport has begun to develop the "Third Runway System" and the "Upgraded Dual Runway System" to enhance the capacity and operational efficiency of Hong Kong Airport. Hong Kong Airport has also built a super cargo terminal, which not only has a high degree of functional integration, but also has an operational efficiency and automation level, which

has become an important infrastructure for Hong Kong Airport as an international air cargo transshipment center.

5.1.3 Leveraging policy advantages to create an airport city

Hong Kong Airport makes use of Hong Kong as one of the world's most open and economically free free trade ports to expand the hinterland of Hong Kong Airport's air cargo sources, so that many exported goods are transported from Hong Kong Airport to foreign countries, adding a lot of mainland goods to Hong Kong Airport. Hong Kong Airport also takes advantage of the Hong Kong free trade port area to attract many foreign goods into China, because Hong Kong has the advantages of simplified customs tariff system and tariff reduction and other policy conditions for shipping, attracting many goods companies from all over the world to enter China from Hong Kong. At the same time, due to historical reasons, Hong Kong Airport has a complete international legal system, financial, banking and insurance systems, which is evidence that Hong Kong Airport uses its policy advantages to develop itself.

5.1.4 The enlightenment of Hong Kong Airport to the development of Shenzhen Airport

1.Improve the airport's attention to information technology construction. Through the understanding of Hong Kong airport and research know, Hong Kong airport can be successful for a large part of the reason depends on the importance of the airport information technology, information technology is the key to improve the airport transportation capacity.

2.Communicate information from all sides of the airport, strengthen the construction of information technology platform, the airport communication into a whole. Hong Kong airport can become an international cargo hub airport, to a large extent because the Hong Kong airport focus on connecting all parties in the airport, like the airport's cargo system and customs and freight forwarding companies to share information between the three is no longer a separate individual, but can achieve the effect of 1 + 1 + 1 > 3.

3.with the policy advantage of the development of the airport. Hong Kong airport can become the world's top cargo airport because the Hong Kong airport to make full use of policy advantages, and the policies provided on the basis of mining their own unique advantages to attract goods through this so as to improve their own cargo traffic and business capacity.

5.2 Guangzhou Baiyun Airport

Guangzhou Baiyun Airport, also located in the Hong Kong-Zhuhai-Macao Bay Area, is currently one of the largest, most functional and most informative civil airports in China today. While its

capacity for air traffic and transit is at the forefront of the country, its comprehensive competitive advantage has been strengthened, making it the air traffic and transit base for many domestic and foreign airlines.

5.2.1 Take advantage of policies to develop international routes

The location of Baiyun Airport is the largest foreign trade area in South China, and the development of regional aviation logistics has a large space. The state attaches great importance to the development of aviation logistics and has promulgated a number of policies to promote the development of the aviation industry. The latest five-year plan of the country states that the focus will be on expanding the depth and breadth of the "Guangzhou Road" to form a 4-hour air traffic circle in Southeast Asia and a 12-hour air traffic circle worldwide .(Miao Tianfeng 2012.28-33.).The Guangzhou Municipal Government also attaches great importance to the economic development of Baiyun Airport and the surrounding areas, not only integrating them into Guangzhou's overall development strategy of "southward expansion, northward optimization, eastward expansion, and westward linkage", but also advocating unified planning, focusing on the use of land and resources, and adopting a progressive development strategy in the planning of the economic zone, so as to strongly enhance the competitiveness of the airside economic zone and the The airport has also adopted a progressive development strategy to enhance the competitiveness of the airport economic zone and the efficiency of each functional area. Guangzhou Baiyun Airport has taken advantage of the development given by the government to expand its international routes.

5.2.2 Improve airline network

With the continuous development of domestic regional airline network, Baiyun Airport routes have covered 220 destinations worldwide with over 300 routes to all large and medium-sized cities at home and abroad, forming a hub-and-spoke route network. (Ouyang X.G., He Shaochen, Sun Panfeng. 2020,9.) And this is inextricably related to the route network of Guangzhou Baiyun Airport communicating the medium and large airports around the airport. These airports are particularly typical of Chengdu, Chongqing, and Wuhan, all of which are directly connected to Baiyun Airport and have a high density of scheduled flights, and there is no shortage of international airports at these airports. The connection with these airports also means an increase in international routes to Guangzhou Baiyun Airport, which provides a favorable front-end passenger source and supply market for Baiyun Airport to build a pivotal airport.

The opening of international routes has not lagged behind either. 13 new international routes have been opened in recent years, the number of international and regional destinations has reached 60 after the addition of 6 new ones, the number of international flights has increased to 731 per week,

passenger transit has been developed rapidly, and the cargo handling capacity of the airport's cargo terminal has been significantly increased to over one million tons, making Baiyun Airport the most important international cargo airport in South China.

5.2.3 Inspiration of Baiyun Airport to Shenzhen Airport

1.Use policy advantages to develop international routes

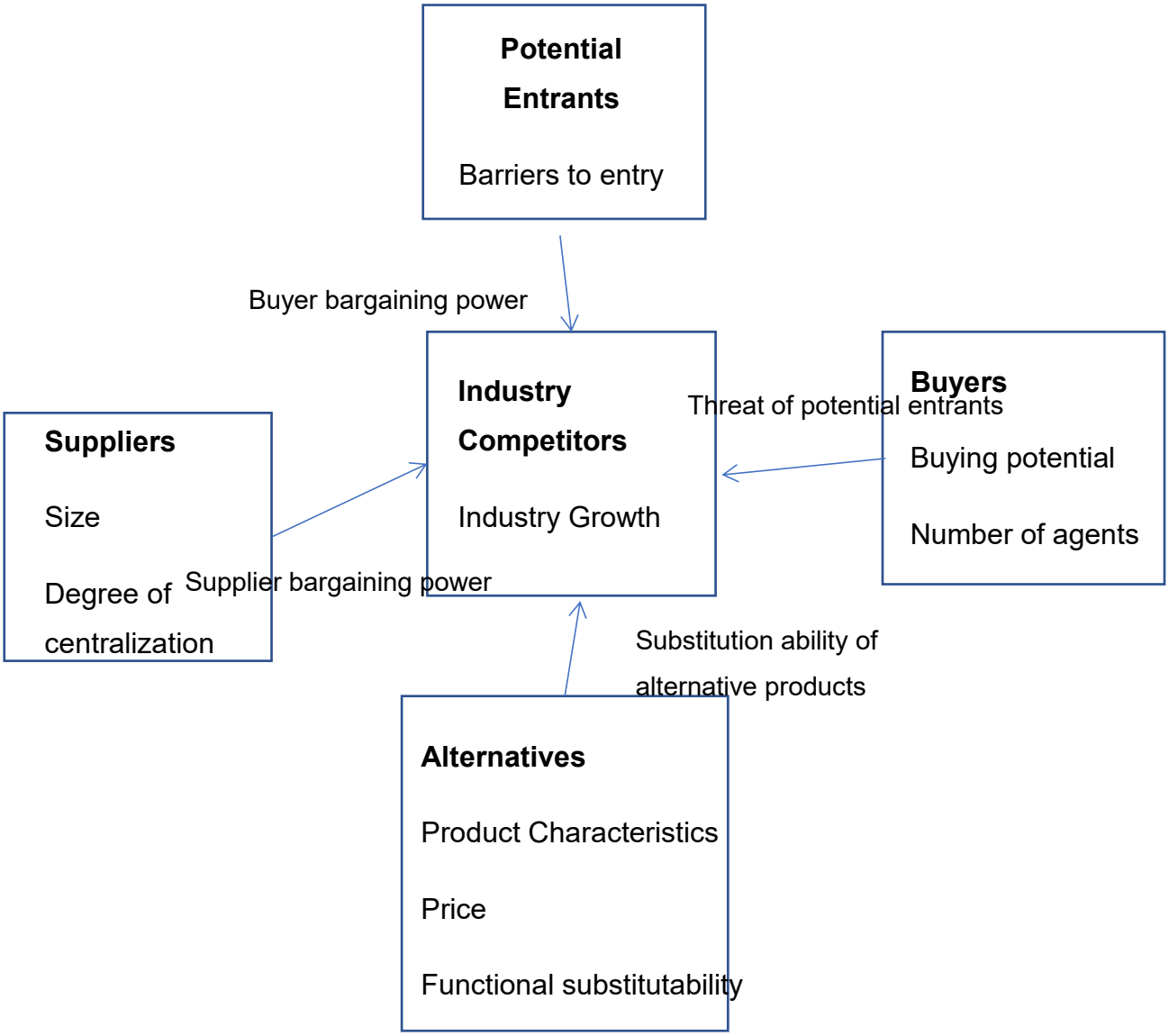
Local airport as a relatively small unit needs to rely on government policy support, especially in the international route airport should grasp the good situation of the country's foreign development, using policy advantages to send international business.

2. Focus on the connection with the surrounding large international airports to improve their own route network

Guangzhou Baiyun Airport makes full use of the large airports all around to communicate with each other's route network, so as to further develop its own international network routes, which has a lot to do with Guangzhou Baiyun Airport becoming the largest trade area in South China.

6 Analysis of the external environment of aviation logistics at Shenzhen Airport

This chapter focuses on a specific analysis of the external environment in this aspect of the competitive dynamics of the industry for the development of air logistics at Shenzhen Airport. The following is an analysis of the interaction of the five market forces for the development of air logistics at Shenzhen Airport, to provide a guarantee for the accurate formulation of development strategies. The following is the analysis model of the Polly Woot analysis for the development of air logistics in Shenzhen airport.



6.1 Supplier bargaining power

The main suppliers of the aviation airport industry include aircraft provider airlines, aviation fuel suppliers, fuel companies, security service companies, equipment maintenance enterprises, various equipment manufacturers, etc. This article focuses on the bargaining power of airlines that have the greatest impact on airport profitability and the bargaining power of oil companies. In recent years, with the increase of national policy support for the aviation industry and the promotion of tourism and other factors, the aviation industry has developed rapidly, and the role of airports in passenger travel has become more and more important. The resulting emergence of a large number of airlines, they need to cooperate with the airport to make a profit, the airport is more and more selective so the airport in the negotiation process is more and more advantageous, the supplier bargaining power is weak.

From the relevant data, it can be seen that the pricing power of non-shipping fees and other fees is in the hands of airports, while shipping fees are basically in a monopoly state. For a long time, China National Aviation Oil Corporation has been the sole supplier of all domestic airline companies. And Chinese airlines have a uniform domestic pricing, which is higher than the international average. Therefore, CNOOC has a lot of autonomy in terms of price, quantity, quality, and timing of supply. This makes the current system of airline operations in China prevents airlines from having any negotiations at the airport.

6.2 Buyers chaser bargaining power

In the civil aviation industry, airport purchasers mainly include airlines, transit passengers, transport cargo owners and resident commercial entities. Most of the airport revenue comes from airline flight takeoff and landing fees and service fees for transit passengers, both of which are restricted by national pricing, and the airport has low bargaining power. For cargo, after the implementation of the open skies policy, many air cargo agents have formed logistics companies, such as SF Logistics, which has got rid of the mode of using airport aircraft to transport cargo in 2009. And the field of air cargo sales is different from air passenger transport, which can be sold directly to passengers through direct sales on the Internet and other means, while the air cargo business can only rely entirely on cooperation with logistics service providers. So in this case, airlines are passive in the bargaining process, so they are often restricted by agents and cannot obtain the maximum benefit.

Thus the impact of national pricing, air cargo agents forming their own fleets, and the agency of Internet dealers has had a serious impact on the profitability of airports.

6.3 Threat of potential entrants

It is often difficult for new entrants to enter a certain industry, especially aviation, because they, like airlines already in this field, will be affected by multiple barriers in the aviation industry, which has more barriers than other industries. Economies of scale and cost advantages are two well-known barriers closely related to the cost of the aviation industry. A large number of capital needs, especially manpower, fuel, marketing and other aspects of the cost is very high, but the level of profitability is low, aircraft, aviation materials and other inventory assets are large, occupying a lot of funds. Therefore, compared with other industries, the civil aviation industry is generally a special industry with relatively high entry costs and exit costs. Therefore, to a certain extent, there are fewer potential entrants in the aviation industry.

6.4 The threat of an alternative

The threat of substitutes is in part a competition between the same mode of transportation or different modes of transportation. In recent years with the continuous breakthrough of high-speed rail technology, especially in the decade of 2010-2019, the share of high-speed rail passenger traffic / railroad passenger traffic has climbed from 8% to 64.4%. And weather reasons, civil aviation resources shortage and various other objective reasons can lead to airlines often travel delays, cancellation situation, become a criticism of passenger travel. In terms of highway, Shenzhen is one of the 45 highway hub cities in China, has formed "seven horizontal and 13 vertical" high speed road network system, is building "ten horizontal and 13 vertical" high speed road network.

However, the advantages of highway and railroad transportation methods are in the short and medium-haul transportation of large goods, the impact on air logistics is also mainly focused on this aspect of the business, the transport advantages of air logistics lies in the long-haul transportation of lighter goods. Shenzhen airport's air logistics market must be around the medium and long distance, to meet the timeliness and convenience, and use its own advantages, in the competition with highways, railroads, waterways and other means of transport to gain a competitive advantage.

Table 2: Statistics on the five major speed-up processes of Chinese railways

(Data from: Civil Airports Production Statistics Bulletin. 2019. https://www.mot.gov.cn. Accessed on: May 1, 2023)

Sequence	Time	Speed(km)	Scope
First time	1997.04.01	90-140	Beijing-Shanghai, Beijing-Guangzhou, Beijing-Harbin three main lines
Second time	1998.10.01	140-160	Beijing-Shanghai, Beijing-Guangzhou, Beijing-Harbin three main lines
Third time	2000.10.21	140-160	Longhai, Lanzhou-Xin, Beijing-Kowloon and Zhejiang-Gan lines
Fourth time	2001.10.21	140-160	Larger cities and most areas of the country
Fifth time	2004.04.18	160	Line up to 7700 km
Sixth time	2007.04.18	200	Major national trunk lines

6.5 He power of the industry competitors

Among the five competitive forces, competition between industry competitors is the most important. The Pearl River Delta, where Shenzhen Airport is located, has been distributed with two major hub airports, Guangzhou Airport and Hong Kong Airport, plus the entire distribution of Shenzhen Airport shows a three-pronged situation.

6.5.1 In terms of air cargo traffic

Hong Kong Airport is a leader in air cargo in the Bay Area, and after 100 years of rapid growth, it reached 4.81 million tons of cargo in 2019 and has been the world's top airport for 10 consecutive years. Guangzhou Airport, on the other hand, was one of the first major international airports established in China.With an annual cargo throughput of 4.81 million tons in 2019, making it the world's largest international airport for ten consecutive years. Guangzhou Airport is one of the first international hub airports in China, and as of 2019, the air cargo volume of Guangzhou Airport has reached 1.92 million tons, ranking 17th in the world. Shenzhen International Airport only began to open in 1991, and it was not until after 2000 that the speed of cargo transportation began to accelerate, and the cargo throughput in 2019 was 1.28 million tons, ranking 23rd in the world. In terms of cargo, Shenzhen Airport is less competitive than competitors in the same industry.(Wang, H. 2022)

The following chart shows the air cargo share of major airports in Guangdong, Hong Kong and Macau Bay Area in 2020 and the comparison of specific cargo throughput. From the data, we can see that the cargo transportation capacity of Shenzhen airport is very different from other airports in the Bay Area, especially Hong Kong airport, and the cargo transportation capacity of the Greater Bay Area far exceeds that of other airports, although the cargo transportation capacity of Shenzhen airport has improved every year, but there is still a big gap with the cargo transportation capacity of other airports.

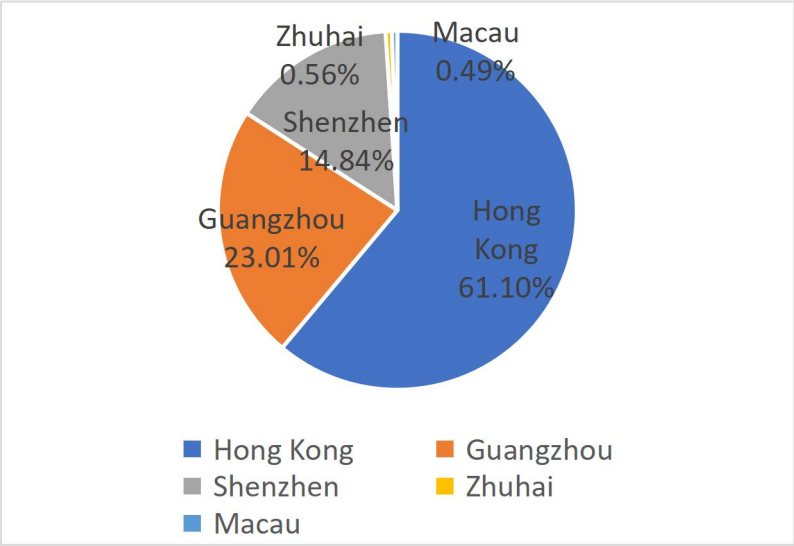


Figure 4: Statistics on the market share of Guangdong-Hong Kong-Macao airport cargo

((Data from: Civil Airports Production Statistics Bulletin. 2022. https://www.mot.gov.cn. Accessed on: May 2, 2023)

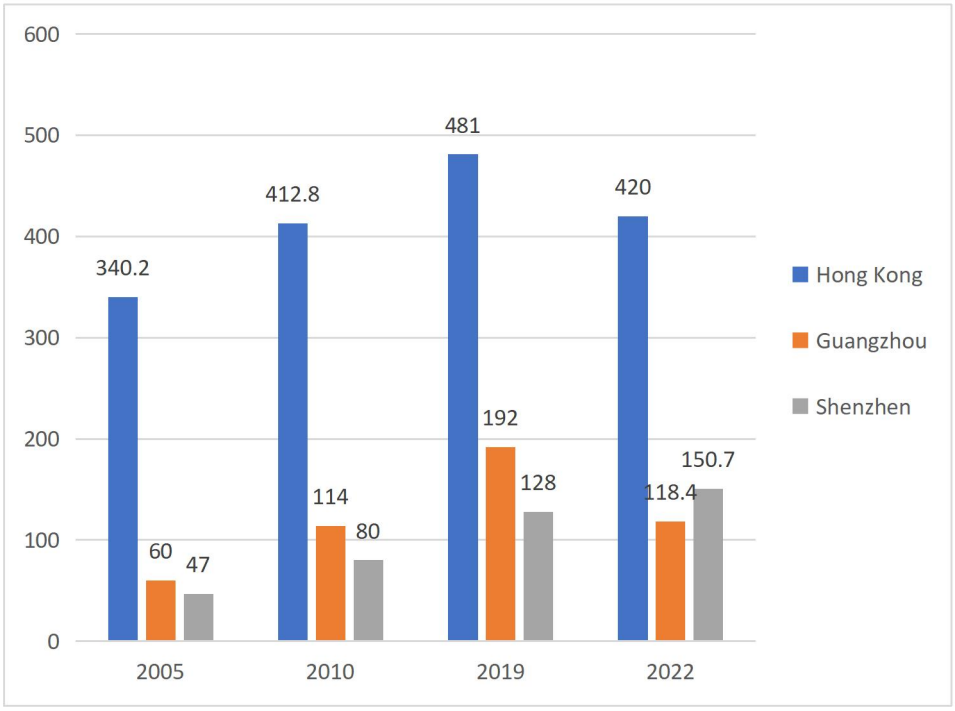


Figure 5: Rough statistics on cargo throughput at Hong Kong, Guangzhou and Shenzhen airports over the past 20 years.

(Data from: Civil Aviation Administration's "Civil Aviation Airport Production Statistics Bulletin" and official snapshots of each airport)

6.5.2 In terms of air-line passenger transport

Guangzhou Baiyun Airport and Hong Kong Airport are also ahead of Shenzhen Airport in terms of air passenger traffic. In the Greater Bay Area airports, in terms of the ability of international links, as well as the number of routes and route distribution, China's Hong Kong Airport has an absolute advantage, but in recent years, Guangzhou Airport, with the strong support of the national and provincial governments, including the drive of Southern Airlines, has formed its own development path, in the layout of international and domestic routes have a strong comprehensive advantage. Shenzhen airport is in the middle of Hong Kong and Guangzhou airport, by Hong Kong and Guangzhou airport on both sides of the sandwich, urgent need to find in their own advantages and play to the maximum in the face of regional fierce competition situation.

In 2015, the passenger throughput of Guangzhou Airport was far ahead of Hong Kong Airport, but as of 2019, the passenger throughput of Hong Kong Airport has been close to Guangzhou Baiyun Airport, at this time Shenzhen Airport is still lagging behind in passenger throughput.In the future, Shenzhen Airporshould take advantage of the airport's proximity to the passenger hinterland and its proximity to Hong Kong airport to develop air passenger transport.

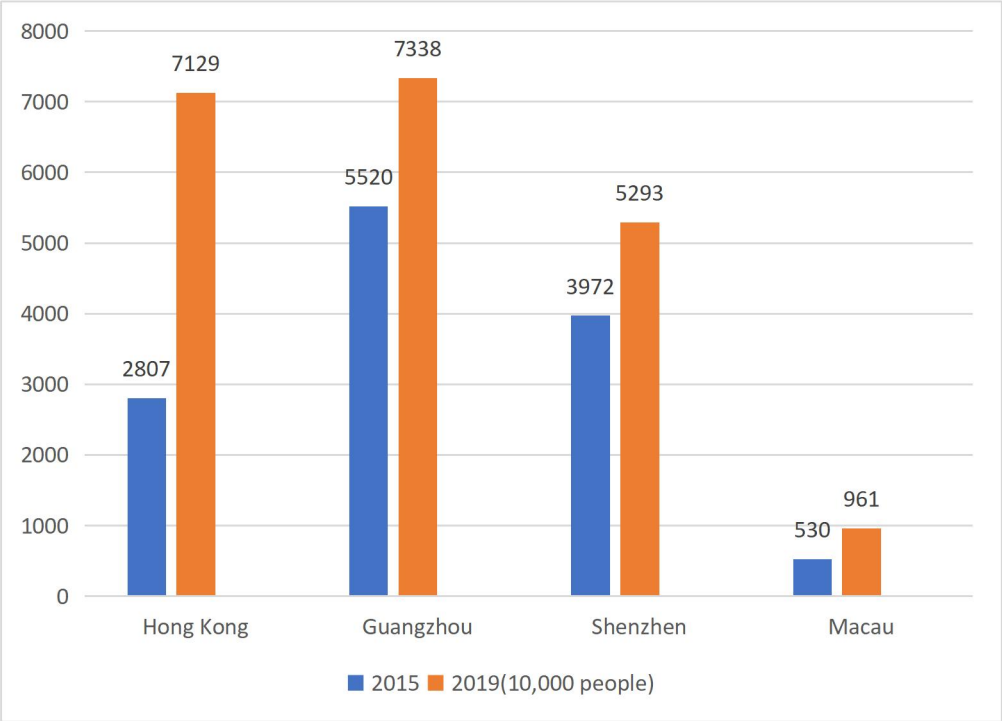


Figure 6:Statistics on the passenger throughput of airports in the Greater Bay Area in recent years

(Data from: Civil Airports Production Statistics Bulletin. 2019. https://www.mot.gov.cn. Accessed on: May 2, 2023)

6.5.3 Route network

According to the air traffic situation of the airports in the Greater Bay Area, the major airports in the Bay Area have not yet formed a good cooperation with each other in terms of network route layout. In terms of international routes above, according to the flight plan statistics in February 2019, Hong Kong airports have routes to more than one hundred and sixty airports around the world, and the number of international airports accounts for about 120, accounting for about seventy percent of the total. Guangzhou and Shenzhen airports, on the other hand, have mainly domestic routes compared to Hong Kong airports, and although they are higher than Hong Kong airports in terms of the total number of routes, there are obviously few international routes. The airports in the Greater Bay Area have not yet formed a good cooperation model among themselves and are developing their own aviation business.

Table 3：Compare the number of routes in and out of the Guangdong-Hong Kong-Macao airport cluster

(Data from: China Civil Airports Association. 2019. http://www.chinaairports.org.cn/. Accessed on: May 5, 2023)

Airport Name	Domestic air access (pcs)	Foreign passages (pcs)		Total (one)	Number of direct flight points (pcs)
		Asia	Intercontinental		
Hong Kong Airport	49	74	45	168	162
Macau Airport	31	27	1	59	58
Guangzhou Airport	142	58	25	225	182
Shenzhen Airport	134	30	20	184	164

6.6 Chapter summary

In this chapter, we analyze the competitive situation of Shenzhen Airport, and analyze the industry environment facing the development of air logistics in Shenzhen Airport from the external environment in depth. The Porter's Five Forces model is used to analyze the core competitive forces in the development of the air transportation industry, the impact of airlines, jet fuel companies, airline freight forwarders, as well as railroads, roads and other airports on the development of air logistics at Shenzhen Airport, focusing on the impact of Hong Kong Airport and Guangzhou Baiyun Airport in the Bay Area on the development of passenger and cargo business at Shenzhen Airport. The opportunities and challenges facing Shenzhen Airport are discussed in the context of the external environment. Guidance is provided for the SWOT analysis and the strategy selection section that follows. The analysis methods used in this section are complementary to the SWOT analysis used in Chapter 5, providing a strong and realistic support for the development of strategies.

7 Internal environment analysis of aviation logistics of Shenzhen Airport

This chapter is to analyze the internal environment of Shenzhen airport air logistics business, mainly using SWOT analysis, and these factors will be used as the main object of analysis for AHP hierarchy analysis in the next chapter.

7.1 Internal advantage (Strengths) analysis

7.1.1 Transportation advantages of multimodal transport

In September 2020, in order to strengthen the hub function and improve competitiveness, the Ministry of Transport emphasized in its opinion on supporting Shenzhen's pilot project to build a transportation power, that Shenzhen Airport should respond to the national call to "actively optimize the customs clearance environment at ports and develop air-bus, air-sea, air-rail and other intermodal services." Strengthen the construction of infrastructure such as the east hub of the airport and the airport terminal, and build a multimodal travel chain of "aviation + bus/rail/sea".(Yajing Wang 2023, 005.)

The air-to-public transport of Shenzhen Airport is composed of building terminals in the cities around the airport and directly connecting passengers from the terminal to the airport through airport buses; Air-rail intermodal transport is mainly through the opening of public transportation between the airport and the railway hub, such as direct buses or subways; Air-sea combined transport, the airport terminal opens 5 water routes to Guangzhou, Zhuhai, Zhongshan, Macao and Hong Kong airports, and has two port terminals in Zhuhai Jiuzhou Port and Zhongshan Port to provide long-distance check-in services for domestic passengers, and Shenzhen Airport has expanded its radiation range on the west bank of the Pearl River.(Ouyang X. G.,Deng Y. 2022, 151-153.)

With the implementation of large-scale infrastructure such as the Hong Kong-Zhuhai-Macao Bridge and the Guangzhou-Shenzhen-Hong Kong High-speed Railway around Shenzhen, as well as the completion of diversified and three-dimensional transportation modes such as the Ganzhou-Shenzhen Passenger Corridor, the Shenzhen-Mao Railway, and urban rail transit, the transportation convenience of the airport will be greatly improved, and the city cluster in the Greater Bay Area will make great strides towards a high level of connectivity.

7.1.2 Excellent regional location

Shenzhen Airport is located in the Bay Area hinterland, Hong Kong Airport wants to contact the Pearl River Delta hinterland areas need to be coated through the Shenzhen-Hong Kong cross-border ports, Guangzhou Airport is located relatively north, and the core hinterland distance is far, Shenzhen Airport is undoubtedly closer to the air travel demand occurred. The establishment of its 1-hour traffic circle, so that the Pearl River east coast area air cargo and the airport closer to further accelerate the airport and the aviation market between the link, Shenzhen airport should take advantage of the excellent geographical location.

As far as airports are concerned, many are built on the edge of the city, while the Shenzhen airport is close to the central area of Bao'an and the Guangdong Free Trade Pilot Zone Shenzhen Qianhai Shekou area, west and Guangdong Free Trade Pilot Zone across the sea, is located in the core of Shenzhen for Guangdong, Hong Kong and Macao Bay Area, Guangzhou, Shenzhen, Hong Kong and Macao Science and Technology Innovation Corridor and the intersection of the Shenzhen-China industrial development corridor, only a dozen kilometers from the city center, the location conditions are unique.(Zhao, Nan-Qi, Zhou, Li-Ya, Chen, Xiao-Mei, Tan, Ru-Shi, Liu, Xin-Yu 2022, 125-131.)

7.1.3 Regional economy and industrial drive

The area around Shenzhen Airport has a strong industrial foundation, and Shenzhen's total economic output has surpassed Guangzhou and Hong Kong, becoming the first in Guangdong and the third in the country. According to the development of Shenzhen's GDP in the past ten years: in 2011, Shenzhen's GDP broke the trillion mark for the first time, in 2016 it reached the two trillion mark, and then exceeded 3 trillion yuan in 2021, and Shenzhen's GDP reached 3.24 trillion yuan in 2022, ranking among the top 10 cities in the world [36]. The government's financial situation is relatively good, which has a backing guarantee for the development of the airport, and there is sufficient financial support for infrastructure construction and major project investment.

The airport is located in the Baoan District in 2020, the city's total GDP ranked fourth, reaching 1,384.687 billion yuan, in the industrial base is counted as one of the country's strongest economic strength, the most innovative and dynamic region. In the past two years, the main driving force of Shenzhen's economy has developed to the software industry, and the software economy attaches great importance to the speed of navigation and the flow of information, which will inevitably be more dependent on the airport, and the demand for Shenzhen's airport will be greater.

In addition, the entry of technological giants such as Huawei, Tencent, and Lenovo has boosted the development of Shenzhen Airport's electronic information industry, while the new generation of

innovative industries such as information technology, aerospace, and intelligent equipment, and the collection of high-end resources in the industrial chain have provided sufficient conditions for the innovation and upgrading of airport services in the future. The figure below is the statistical table of Shenzhen's total GDP and per capita GDP from 2015 to 2022, from which we can more intuitively see Shenzhen's economic strength.

Table 4: Statistics on Shenzhen's urban GDP and per capita GDP in the past 8 years

(Data from: Shenzhen Statistics. 2022. http://tjj.sz.gov.cn. Accessed on: May 5, 2023)

Projects	2022	2021	2020	2019	2018	2017	2016	2015
GDP (billion yuan)	32387.68	30664.85	27670.24	26927	24221.98	22490.06	19492.6	17502.86
GDP per capita (yuan)	183171.66	174628.38	159309	203489	189568	184068	167411	157985

7.1.4 It has a large airport passenger transport business scale

According to relevant information, from the opening of 28 years, Shenzhen Airport has transported a total of more than 560 million passengers. Among them, from 2003 to 2016, Shenzhen airport passenger business continued to grow rapidly, the annual passenger throughput climbed from 10 million to 40 million. 2015-2019 period Shenzhen airport passenger traffic to the region increased rapidly, in 2015 passenger traffic to the region of 106. By the end of 2021, Shenzhen airport will have 133 passenger traffic areas, including 127 domestic ones.

Then in the national "13th Five-Year Plan" will be upgraded to Shenzhen Airport ""international aviation hub", in the background of such times, international business in three years international passenger volume has more than doubled. Among them, the number of passenger traffic at Shenzhen Airport grew rapidly from 2015 to 2019 (39.72 million passengers in 2015), surpassing Hong Kong to rank second, which is quite competitive in terms of air passenger traffic. As of 2019, Shenzhen airport passenger traffic reached 52.93 million passengers, and Shenzhen airport has a large scale of air passenger traffic.

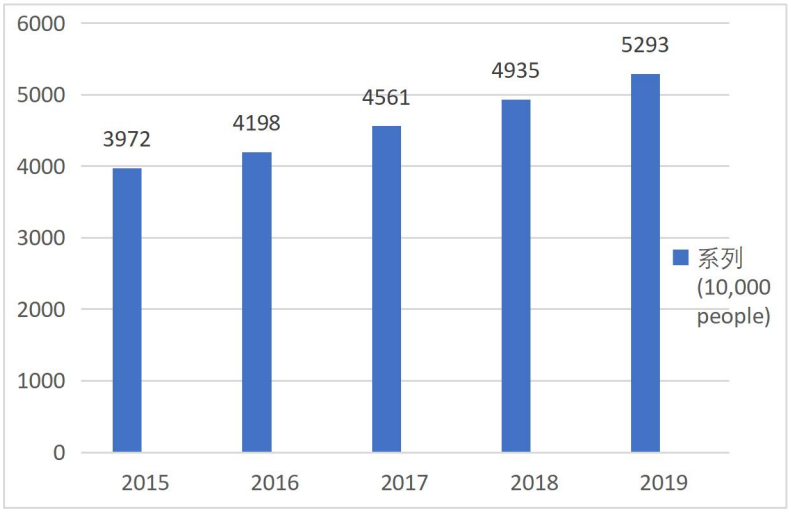


Figure 7:Comparison of passenger traffic at Shenzhen Airport from 2015 to 2020

(Data from: China Airports Network. 2020. https://www.ceicdata.com. Accessed on: May 9, 2023)

7.1.5 The air logistics platform is beginning to take shape

With the continuous improvement of public facilities in Shenzhen airport, from the beginning of the twenty-first century, there have been logistics companies, courier companies have settled in Shenzhen airport. 2012, Yuan Tong Express Shenzhen transit center was officially opened, in 2015, SF South China transit center was officially opened, while the Shenzhen airport is also the headquarters of SF Express location. Postal, Yuan Tong and other domestic direct well-known private courier companies have established independent transfer and sorting centers in Shenzhen Airport. At the same time Shenzhen Airport's international business is also growing, is the United Parcel Express Company (UPS) industry curve link industry replaceability degree influence real degree Asia Pacific transit center. Shenzhen Airport's aviation logistics platform is taking shape.

7.2 Internal disadvantage (Weaknesses) analysis

7.2.1 Lack of main base airlines

Basically, large international aviation hub airports at home and abroad are built with their own main base airlines, the construction of airports and the development of base airlines are complementary, the modernization of the airport promotes the rapid development of airport business, with the development of the main aviation will bring more routes, waypoints, airport passenger and cargo traffic will also increase, but Shenzhen Airport does not have its own main base airline.

From 2010 to 2017, the number of base airlines at Shenzhen Airport increased from 22 to 51. Among them, airlines with large market shares are Shenzhen Airlines, China Southern Airlines and

Hainan Airlines (see figure). From the data of 2018, Shenzhen Airlines accounted for 26.9%, China Southern Airlines accounted for 24.3%, and Hainan Airlines accounted for 11.4%. Other airlines below 20% do not analyze much. The three airlines belong to different airline alliances, and they compete with each other, and it is difficult for airlines to form good synergies.

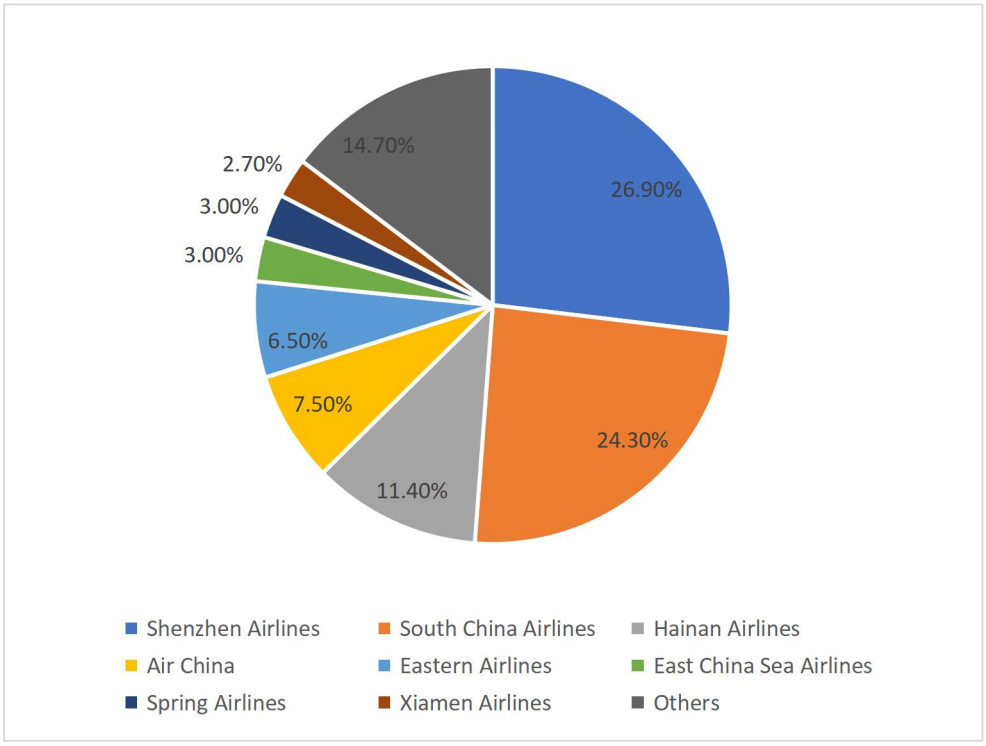


Figure 8: Statistics on the market share of passenger throughput of airlines at Shenzhen Airport in 2018

(Data from: OAG database. 2018.https://oag.cn. Accessed on: May 9, 2023)

7.2.2 International business has become a weakness of the airport development

As of 2015, Shenzhen airport has only 11 international passenger cities, and the intercontinental long-haul routes are blank, so international business has gradually become the "short board" of Shenzhen airport. To some extent, this not only has an impact on the development of Shenzhen airport, but also does not match the strategic positioning of Shenzhen city. In the three airports, Shenzhen airport from the throughput, international routes, international transit in these three aspects are obvious shortcomings.

In terms of throughput, Shenzhen Airport's international passenger throughput increased significantly in 2019, with international passenger throughput exceeding 5 million passengers, but the gap between international passenger throughput and the other two airports is obvious; international passenger traffic will still account for only 10% of the passenger flow by 2020. The

international service capacity is also reflected in the core indicator of passenger transit rate, which is only 4.2% of the passenger throughput of Shenzhen airport in 2020. In order to quickly play a "latecomer" advantage in Guangdong, Hong Kong and Macao, it is necessary to give full play to the "world-class airport cluster" economy of scale effect.

In terms of international routes, among the airports in Guangzhou, Shenzhen and Hong Kong, Hong Kong is an international shipping center with more than 120 airlines providing shipping services, making it possible for Hong Kong airport to connect to 220 destinations around the world; Guangzhou is the largest international transit airport in South China, with 78 airlines stationed at Baiyun Airport by 2020. However, by the end of 2015, Shenzhen Airport had only one international city, and intercontinental routes were blank.

In terms of international transit, Shenzhen airport has very few international transit passengers, with only 2.075 million passengers transiting through Shenzhen airport in 2018, accounting for only 4.2% of the Guangdong-Hong Kong-Macao Bay Area, while the transit rate of Hong Kong airport is as high as 28.10%. The airport as the gateway to the city will greatly boost the consumer and tourism industries of the region and the country if it can attract a large number of passengers to transit here. The current situation in the Bay Area is that domestic and international passengers will prefer Hong Kong Airport or Guangzhou Airport for transit, and Shenzhen Airport is less attractive for transit passengers. Therefore, Shenzhen airport should focus on improving transit service capacity, reducing transit time and attracting international passengers.

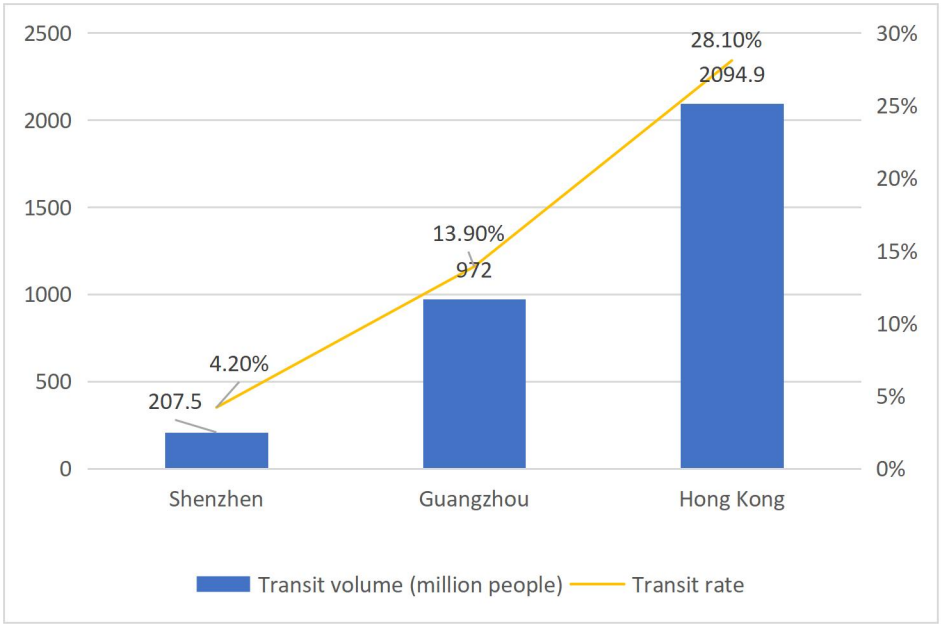


Figure 9: Statistics on passenger traffic and transfer rates at Shenzhen, Guangzhou and Hong Kong airports in 2018

(Data from: OAG database.2018. https://oag.cn. Accessed on: May 9, 2023)

7.2.3 Airport air cargo has become a short board of development

According to the data, as of 2018, Shenzhen Airport has only 7 passenger and cargo base carriers in operation; as of 2019, Shenzhen Airport operates a total of 242 fixed routes, including 166 domestic routes, 4 regional routes and 72 international routes, respectively, compared to 2010, an increase of 65, 1 and 45; thus we can see that the scale of domestic routes is growing fast, but the international business above still needs to be improved. By 2022, Shenzhen Airport will rank third in total cargo throughput in China, with domestic cargo and mail throughput ranking first in China, and there is still much room for development of cargo business.

With the restructuring of the economy and the accelerated transfer of manufacturing industries in the Bay Area, there has been a certain degree of reduction in general cargo sources for aviation business. With the logistics layout of the e-commerce industry with sub-regional shipments, it has caused a large diversion for air cargo in Shenzhen. There is no good cooperation among airport cargo operators, leading to serious internal segmentation, resulting in a low level of overall service. This also leads to troublesome and time-consuming cargo handover procedures and uneven service levels, which largely affects customer satisfaction of airport cargo operations.

7.3 External opportunity (Opportunities) analysis

7.3.1 Undertake the spillover business of Hong Kong Airport

Hong Kong's international freight business is more, and domestic and foreign import and export of goods also rely heavily on the Hong Kong airport. Shenzhen is geographically adjacent to Hong Kong, and it is more convenient to undertake the spillover business from Hong Kong airport. The development of cooperation between Hong Kong and Shenzhen in aviation has been continuing. 2019's new crown epidemic brought an opportunity for Shenzhen airport to undertake international business from Hong Kong airport, because the customs clearance procedures for foreign goods going in and out through Hong Kong airport were troublesome, plus Hong Kong airport was farther away from the domestic market compared to Shenzhen airport, in this context Hong Kong airport's international aviation business received a great impact, Shenzhen airport During the epidemic period, Shenzhen airport took up a lot of overflow business from Hong Kong airport.

7.3.2 The government's strong support for air cargo development provides new growth opportunities

In 2016, the local government started to support the opening of international routes to Shenzhen Airport, opening and encrypting 19 new international routes, and completing direct flights to Europe, America and Australia on the originating routes. According to statistics, the number of passengers on international routes increased by 34.3% year-on-year that year.

Although the cargo business of Shenzhen Airport started late, the construction of cargo-related facilities has been considered simultaneously since the beginning of the airport construction, which shows that the Shenzhen government has considered the development of air cargo business at Shenzhen Airport in advance. Conquest's emphasis on the development of Shenzhen Airport can also be seen from the implementation and planning of policies, including good returns in facility construction, route subsidies, the introduction of large logistics companies, and the development of the hinterland market.

7.3.3 The international aviation market will become the focus and bright spot of the future industry growth

The progress of science and technology is inseparable from the development of high-tech companies, and the development of high-tech companies makes Shenzhen a city with very developed high-tech industry, so Shenzhen is also the procurement center of many multinational companies in South China, and the international market development potential of Shenzhen Airport is huge.

By the end of 2018, Shenzhen Airport had 45 international passenger cities and 18 intercontinental cities; During the epidemic in 2019, there were 45 cities with international passenger transportation, and the annual international cargo volume reached 460,000 tons, a year-on-year increase of 30.8%; In 2020, international passenger routes are also constantly making breakthroughs, achieving important breakthroughs in reaching 50 cities around the world; In 2021, in terms of air transport services, Shenzhen Airport will continue to strengthen the international and Asia-Pacific market radiation, and encrypt the route network of the main nodes of the 4-hour aviation circle and the 12-hour aviation circle; In 2022, Shenzhen Airport added many new ASEAN passenger and cargo routes, with 83 passenger and cargo flights per week; In 2023, the current Shenzhen Airport route network will have more than 60 international passenger inbound and outbound flights per week, a year-on-year increase of nearly twofold.

7.3.4 Logistics and express delivery trend is obvious

The development of the network economy has promoted the rapid development of various e-commerce platforms such as B2C, C2C and O2O, making China's express business has been in a state of rapid growth in recent years. According to the data of the National Postal Management Association, according to the information released by the State Post Bureau 2021, the express business volume continued to grow in 2019-2021, with the annual completed express business volume of 63.5 billion, 83.3 billion and 108.3 billion pieces respectively, representing an increase of 25.3%, 31.2% and 29.9% over the same period of the previous year.

Since this year, China's express business volume has been growing rapidly. The State Post Office monitoring data show that as of 8 a.m. on April 6, China's express business volume exceeded 30 billion pieces this year, a pace that is 18 days ahead of reaching 30 billion pieces in 2022 and 99 days ahead of 2019 (Wang, H. 2022). As of 2020, Shenzhen has become one of the regions with the largest express business volume, the most concentrated enterprises, the largest number of employees and the highest business income in the country, which is an extremely strong impetus to the development of air cargo at the airport.

7.4 External threat (Threats) analysis

7.4.1 The tight airspace and time resources bring challenges

Guangdong, Hong Kong, Macao and the Greater Bay Area is one of the top few regions in the country in terms of passenger traffic, but is located around the mouth of the Pearl River brings together many large international airports, so it is also one of the tightest airspace resources, which brings great competition and challenges to the Shenzhen airport. The three major airports in the Bay Area are only 100 km away from each other in a straight line, which is at least 200 km away from each other compared to other airports in the region, and the airspace resources in the Bay Area are very scarce.

Coupled with the high demand for passenger traffic efficiency in the core of the Bay Area, airports choose to sacrifice cargo operations to improve the transportation efficiency of passenger operations. However, this has a very negative impact on the international development of air cargo. In order to meet the efficiency of air passenger business, the cargo business is often scheduled to the airport at night, which cannot meet the business transportation requirements of many countries around the world, and cannot realize the requirements of China's air cargo specialization.

7.4.2 Competition in surrounding large aviation hubs remains fierce

The airspace resources in the Guangdong-Hong Kong-Macao Greater Bay Area are already tight, and the competition for airports in the Bay Area will further escalate under the promotion of the general environment and policies. In particular, the increasingly perfect transportation network around Shenzhen Airport will have a certain impact on the pattern of east-west coastal connections. For example, the opening of the Shenzhen-Zhongshan Passage and the Shenzhen-Mao Railway will greatly increase the radiation of Shenzhen Airport to cities on the west coast such as Zhongshan and Zhuhai. The population and aviation market potential covered by Shenzhen Airport in one hour will be better than Guangzhou Baiyun Airport, intensifying the hinterland competition between Baiyun Airport and Shenzhen Airport. At the same time, the international resources of Hong Kong Airport are better than those of Shenzhen Airport, and Shenzhen Airport is closer to the domestic market, and the resources of the radiated hinterland market are better, and the two will inevitably have considerable competition in international and domestic resources. Competition in the Greater Bay Area will continue to intensify in the future.

7.4.3 High-speed rail and road networks divert domestic air freight

Shenzhen is a city with abundant highway resources, and a high-number network system of seven horizontal and thirteen vertical has been formed in the city, and it is still being improved. In terms of high-speed rail, China's high-speed rail network has completed the all-round coverage of the east, west, south and north, basically realizing the integration of high-speed rail and airports, coupled with the characteristics of low transportation costs of the railway itself, objectively the domestic aviation general cargo has a large diversion, railway freight for the airport freight industry hit seriously. Among them, Shenzhen North Railway Station, Futian Station, Shenzhen Pingshan Station and other high-speed railway stations are one of the main flow directions of passenger diversion at Shenzhen Airport.

7.4.4 The new business model of "Internet +" has had an impact on aviation cargo

With the rapid development of the Internet economy, people are more and more concerned about the speed of freight, merchants and factories and other commodity providers are constantly exploring how to reduce transportation costs, and more and more merchants and goods providers will tend to build warehouses in the target market to provide goods and services nearby. For those products that require a large amount of air resources to transport, commodity providers and cargo bearers are increasingly inclined to build their own fleets, which has a great impact on the development of air cargo business.

8 Determination of Shenzhen Airport aviation logistics development strategy

In the previous chapter, SWOT analysis was used to focus on qualitative analysis, while quantitative measurement of internal and external environment and strengths and weaknesses could not be carried out. Therefore, this chapter will combine the results of SWOT analysis with the hierarchical analysis (AHP) to quantitatively analyze the strengths and weaknesses of the internal and external environment, and finally select a strategy by combining qualitative and quantitative methods to develop a strategic plan for the development of air logistics in Shenzhen Airport. The combined AHP-SWOT analysis method is used to strengthen the integrity and linkage between things.

8.1 Establish a hierarchical model

8.1.1 Build an evaluation model for hierarchical data

In this paper, we use AHP-SWOT evaluation method to take the advantage s, disadvantage w, opportunity o and threat t parts of Shenzhen airport air logistics development as the criterion layer, and the influence factors corresponding to the previous 4 parts as the decision layer to build the data level evaluation structure model of Shenzhen airport air logistics, as shown in the following table.

Table 5: An evaluation structure model was established for the development of air logistics at Shenzhen Airport.

Group	Influence factor
Strengths	S1: Transportation advantages of intermodal transport S2: Impact of regional location S3: Driven by regional economy and industry S4: It has a large scale of airport passenger business S5: The air logistics platform is beginning to take shape
Weaknesses	W1: Home base airline missing W2: International business has become a shortcoming in airport development W3: Airport air cargo has become a development shortcoming

Opportunity	O1: Undertake spillover business at Hong Kong Airport O2: Strong government support for air cargo development provides new opportunities for development O3: The trend of express logistics is obvious
Group	Influence factor
Threaten	T1: Tight airspace, time-to-time resources and competition for new airports around it pose challenges T2: Competition from large aviation hubs around is still fierce T3: High-speed rail and road networks divert domestic air freight T4: The new business model of "Internet +" has had an impact on aviation cargo

8.1.2 Construct a judgment matrix

1. According to the research content of this paper and the use of the method, it was decided to construct the two-two judgment matrix using the 1~9 scale method proposed by Satie. The table of 1~9 scalar method proposed by Satie is shown in the appendix.

(See Appendix 1 for the 1~9 grade method proposed by Satie)

Using the importance scale of the judgment matrix, the relative importance of each element at each level in the data level evaluation structure model of Shenzhen Airport air logistics is judged, and the judgment matrix of each layer index is obtained.

Table 7: Establish a judgment matrix for each condition layer

	S	W	O	T
S	1	5	6	4
W	1/5	1	5	3
O	1/6	1/5	1	5
T	1/4	1/3	1/5	1

8.1.3 The calculation process of each indicator of the benchmark layer

1. The product square root method is used to calculate the geometric average of each row of the judgment matrix (wi)

$$\overline{w_i} = \left(\prod_{j=1}^{n} a_{ij} \right)^{\frac{1}{n}} \qquad i, j=1, 2. \ldots, n$$

Get *W1=4 W2=2.3 W3=1.1041 W4=0.4458*

2. Normalize the geometric mean of each row to obtain the feature vector

$$W i = \frac{\overline{w i}}{\sum_{j=1}^{n} \overline{w_j}} \quad i ,j=1,2....,n$$

The calculation result of the weight coefficient obtained for the benchmark layer indicator is as follows:

S:0.48 W:0.275 O:0.192 T:0.053

3.Calculate the maximum eigenvalue of the judgment matrix ㅅ MAS

$$\lambda \max = \frac{1}{n} \sum_{i=1}^{n} \frac{\sum_{j=1}^{n} a_{ij} w_j}{w_i}$$

From this, it is calculated that ㅅ *mas* = 4.255

4.Consistency inspection

(Random Consistency Index RI table in Appendix 2)

The CR formula for calculating the consistency indicator CI and consistency ratio is as follows:

$$CI = \frac{\lambda \max - n}{n-1}$$

When n=2, the 2nd order positive reciprocal inverse matrix is always consistent, so the consistency test is not necessary. When n is greater than 2, the consistency of the matrix is expressed by CR. CR=CI/IRI is taken as Table 4 The 1~9 scaling method proposed by Satie is shown in Appendix 1.

CI=4.355-4/4-1=0.085

When n=4 RI=0.90, CR:0.085/0.90=0.094 is less than 0.1

CR<0.1, therefore, the criterion layer indicators judge that the matrix and the consistency test meet the requirements.

5.Consistency test results

Table 9: Count the weight of each metric at the benchmark layer and the results of the conformance test

	S	W	O	T	weight
S	1	5	6	4	0.48
W	1/5	1	5	3	0.275
O	1/6	1/5	1	5	0.192
T	1/4	1/3	1/5	1	0.05
Consistency test Maximum λ=4.255 CI=4.355-4/4-1=0.085 cr:0.085/0.90=0.094 Less than 0.1. Pass the consistency check					

8.1.4 Comprehensive weights

Similarly, the computer consistency of the weights of each criterion layer is tested to obtain the comprehensive weights.

Using the results of a single ranking of all indicators at the same level, the weight of the importance of all factors at this level can be calculated for the previous level, which is the total weight. The results of this example are shown in Table 6, and the total weight in the table is the comprehensive weight of each indicator relative to the target layer.

Table 10: The weight of each part of the AHP analysis is statistical

Benchmark layer	Benchmark layer weights	Subbenchmark layer	Subbenchmark layer	Total weights
S	0.48	S1	0.1244	0.0311
		S2	0.5138	0.128
		S3	0.3164	0.079
Benchmark layer	Benchmark layer weights	Subbenchmark layer	Subbenchmark layer	Total weights
		S4	0.061	0.015
		S5	0.0432	0.01
W	0.275	W1	0.745	0.186
		W2	0.202	0.05
		W3	0.053	0.013
O	0.192	O1	0.745	0.186
		O2	0.202	0.05
		O3	0.053	0.013
T	0.05	T1	0.272	0.068
		T2	0.272	0.068
		T3	0.364	0.091
		T4	0.092	0.023

From the above analysis, Shenzhen Airport's aviation logistics development advantages are very prominent, with the proportion of S accounting for 48% of the total; But at the same time, there are many threats to the development of air logistics at Shenzhen Airport, and threats account for 27.5% of the total weight.

8.2 Determination of air logistics development strategy

The AHP model is used to assign the value of the SWOT model, and the data is obtained based on the experience of experts in related fields, and the data with large deviation are deleted while a large amount of data is obtained, so as to obtain a more scientific judgment matrix and more accurate weight.

8.2.1 Build a SWOT analysis matrix

Based on the summary of the development experience of excellent airports in Chapter 4 and the analysis of the internal and external environment and industry environment of the development of air logistics at Shenzhen Airport in Chapter 5, the SWOT analysis matrix of the development strategy of air logistics of Shenzhen Airport is obtained, as shown in the table:

Table 11:Analyze the various parts of the SWOT strategy

Internal environment Development External	Advantage(s) (1) Transportation advantages of multimodal transport (2) The impact of regional location (3) Driven by regional economy and industry (4) It has a large scale of airport passenger business (5) The aviation logistics platform is beginning to take shape	Disadvantages (W) (1) The main base airline is missing (2) International business has become a shortcoming in the development of airports (3) Airport air cargo has become a development shortcoming
Opportunity (o) (1) Undertake the spillover business of Hong Kong Airport (2) Strong government support for air cargo development	SO growth strategy While giving full play to the advantages of multimodal transport and large passenger transport scale, with the support of government policies,	WO Toratic Strategy Relying on the current opportunities of Shenzhen Airport to develop air logistics, undertake the spillover business of Hong Kong Airport,

provides new opportunities for development (3) The trend of logistics express delivery is obvious	air logistics will be linked with regional location, economy and industry, and the development of air passenger and cargo industry will be accelerated; Comply with the trend of express logistics and accelerate the construction of air logistics platform; Attach importance to the undertaking of spillover business at Hong Kong Airport.	the support of government policies, and the obvious trend of logistics express to reverse the shortcomings of the airport's main airline, international business and cargo business.
Threat (t) (1) Challenges posed by tight airspace, time resources and competition for new airports in the surrounding areas (2) Competition in surrounding large aviation hubs is still fierce (3) High-speed rail and road networks divert domestic air freight (4) The new business model of "Internet +" has an impact on aviation cargo	ST Adaptive Strategy Under the current development advantages of the airport's passenger transport industry, we will continue to communicate with a variety of surrounding transportation networks to form integrated development with high-speed rail and highways. Build your own competitiveness based on regional economy and location advantages.	WT defensive strategy In view of the lack of main base airlines and the impact of the Internet+ business model on airport business, we will explore a different way to build an airport logistics platform and a collection of multiple airlines. Focus on the development of air passenger transport and maximize their strengths.

8.2.2 Construction of SWOT quadrilaterals and calculations

According to the weights calculated by AHP, the weights corresponding to the known criterion layer are: S: 0.48, W: 0.275, O: 0.192, T: 0.05, take W, T is negative. According to the results of AHP analysis, the strategic selection is made for the advantages S, disadvantages W, opportunity O, and threat T to As shown in the figure, a SWOT quadrilateral is constructed for the development of air logistics at Shenzhen Airport, where the origin is G.

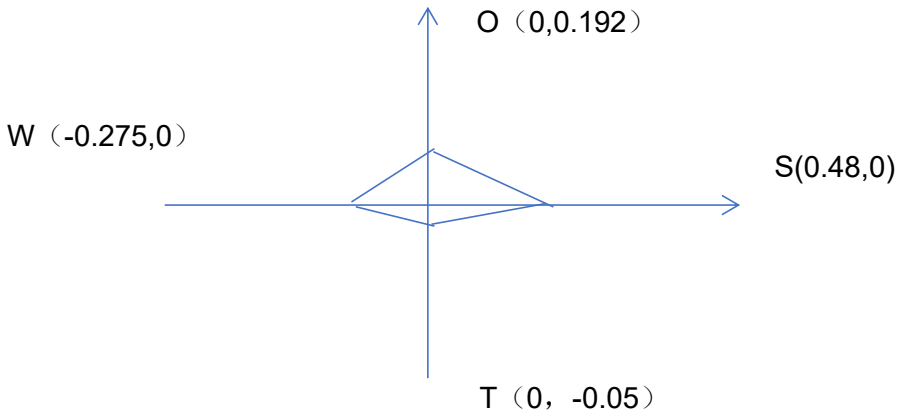


Figure 10: SWOT analysis of air logistics development in Shenzhen Airport

2. Calculate the SWOT quadrilateral according to the figure:

S△SGO=1/2*0.48*0.192=0.046

S△0GW=1/2*0.275*0.192=0.0264

S△WGT=1/2*0.275*0.05=0.0068

S△TGS=1/2*0.48*0.05=0.012

From the above calculation, it can be seen that S△SGO>S△0GW>S△TGS>S△WGT

Therefore, the order of strategic choices is: SO development strategy> OW twisting strategy> TW defensive strategy> ST adjustment strategy

3. Coordinate axis

At the same time, find the point P (0.3775, 0.121) with coordinates [(S+W)/2, (T+O)/2], put it in the coordinate system with SW as the horizontal axis and OT as the vertical axis, and select the corresponding development strategy according to the position of the P point.

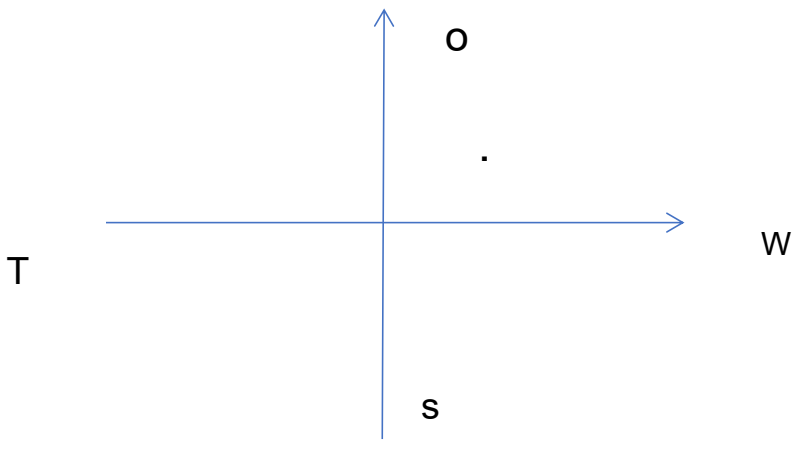


Figure 11: Shenzhen Airport Strategic Choice Map

From the summary of the above two figures, it can be seen that the development of air logistics at Shenzhen Airport should take the SO development strategy as the preferred strategy, that is, internal advantages and external development opportunities as the focus of development later, while taking into account the common development of other strategies.

9 Strategic Principles, Positioning and Objectives of Shenzhen Airport's Air Logistics Development

This chapter will gather the previous chapters on the development of air logistics in Shenzhen Airport to summarize the experience of other airports and the results of the internal and external environment analysis to apply, based on which the strategic plan for the development of air logistics in Shenzhen Airport in the next five years is proposed.

9.1 Strategic principles for the development of air logistics in Shenzhen Airport

9.1.1 Principle of synergistic development of airport cluster

Based on the overall development of Guangdong, Hong Kong, Macao and the Gulf region, it is necessary to effectively improve the co-ordination of airspace planning, fully consider the airspace resources, market demand, social benefits, traffic connection and other factors in the Yangtze River Delta region, promote a reasonable regional layout, clear positioning, orderly construction and staggered development, and prevent homogeneous competition and disorderly competition.

9.1.2 The principle of mutual promotion of air logistics and economy

As a bridge linking the region and the world, air logistics has been highly valued by the country and the region, because the ultimate purpose of developing air logistics is to make it serve the development needs of related industries. For this reason, the development of air logistics hubs should be planned around the supply chain organization needs of specific industries. So as to build its inherent hub network, sound hub service functions.

9.1.3 The principle of airport wisdom

With the development of information technology, people for the convenience of the wisdom of the level of increasingly high, the airport only in line with the development trend of the times, in order to obtain a place inside the tide of development. The level of wisdom determines the level of competitiveness of the airport.

9.2 Strategic Positioning of Shenzhen Airport Air Logistics Development

The strategic positioning of the airport: to build an international wisdom aviation hub facing the Asia-Pacific and radiating the world by virtue of the location advantage and the advantageous industrial construction to unite other airports in the Bay Area. With a modern industrial base and aviation economy to promote each other, the important gateway to open up the inland region to the outside world, modern aviation city.

9.3 Shenzhen airport air logistics development of strategic objectives

1.In the next five years, Shenzhen will adhere to the simultaneous development of air passenger and air cargo, build a high-quality and innovative international airport center, and play a leading role in the world-class airport cluster in the Greater Bay Area.

2.The airport will be built into the core city of the Greater Bay Area rail network, accelerate the construction of high speed road network planning and the unique transport advantages of air-sea intermodal transport to build a high speed corridor between Shenzhen and neighboring cities;

3.It will also build a world-leading transportation integration wisdom platform, enhance the level of multi-modal networking and joint control of sea, land, air and railway, and improve the wisdom of the airport.

10 Strategic implementation of air logistics development at Shenzhen Airport

Based on the strategic choices in the previous section of this section, the strategic plan for the future development of air logistics of Shenzhen Airport in this article is specifically put forward.

10.1 Deepen the benefits of multimodal transport

In the SWOT analysis of Shenzhen Airport above, it is mentioned that Shenzhen Airport has the development advantages of multimodal transport, based on the selected development strategy SO, should focus on the development advantages of Shenzhen Airport to the maximum. Therefore, the next step will be to promote the development of multimodal transport at Shenzhen Airport and put forward specific suggestions.

10.1.1 Air-to-air combined transport

Shenzhen Airport has a good awareness of multimodal transport in recent years, the airport's air transport was initially linked by the airport bus as a capillary, and the airport bus of Shenzhen Airport has established a good connection with the transportation hub of the surrounding cities. In the future, with the continuous development of airports, air-bus combined transport needs to be further developed, for example, while further enriching capillaries, airports should strengthen cooperation with highways linking major source areas around airports, airports subsidize highway tolls, reduce the cost of passenger fares to the airport, cooperate with local tour groups, and increase the probability of foreign passengers taking flights.

10.1.2 Air-rail combined transport

The east hub project of the airport is a typical project that vigorously communicates between the airport terminal and the transportation hub, and strives to communicate with the railway, supplemented by other projects, so as to achieve the effect of reducing the time on the passenger road. In terms of freight, we have built our own truck flight company, used truck flights to connect major railway hubs, combined with the advantages of railway transportation, and increased the probability of undertaking railway cargo. Use truck and flight companies to build a systematic integrated platform to form systematic freight capillaries with full traceability. With the further expansion of the international business scope of Shenzhen Airport, on the one hand, international goods can be shipped in bulk at the airport and then sent to nearby provinces and cities by truck; On the other hand, perfect cargo facilities can attract more aviation-related foreign trade enterprises, thereby promoting the development of airport cargo business. In the future, with the continuous development of railway transportation, airports and railways will inevitably form transportation subjects that differ according to the transportation distance and cargo type. Airports

should continue to strengthen the connection with railways to form a benign overall transportation atmosphere that integrates air and rail.

10.1.3 Air-Sea Combined Transport

Air-sea intermodal transport, as an exclusive feature of Shenzhen airport, is to communicate with the terminals of the cities around Shenzhen through the water bus. With the advantage of no traffic jam as well as high transport volume of sea transport, Shenzhen airport is able to improve its competitiveness in the surrounding cities to a large extent through the advantage of the unique airport terminal. In the future, the airport will promote the speed of connection between maritime and air transport at the airport based on the airport terminal. To help improve the speed of sea transport from the terminal to the airport and to learn from the experience of Hong Kong airport, to improve the speed of information flow between customs, airport and airlines, to improve the level of information technology, so as to improve the speed of air-sea intermodal transport. Shenzhen Airport will take advantage of the "airport + terminal" air-sea intermodal transportation to better play the function of the airport as an important integrated transportation hub in the Greater Bay Area.

10.2 Integrated development of airports in the Bay Area

The national airport development strategy for the Guangdong-Hong Kong-Macao Bay Area is synergistic development, which requires mutual cooperation among airports to achieve. First of all, there is no good division of labor and cooperation among airports, and there is still a lot of overlap between airports and airports in terms of business; secondly, the area of the Bay Area is not large but there are five large airports built inside, which will cause airspace division due to the density of the five airports, and finally, the airspace is controlled by several airspace control areas with different height standards, and the airspace resources in the Greater Bay Area are tense for a long time. These are urgent problems to solve.

10.2.1 Accelerate the improvement of infrastructure

The coordinated development of the Guangdong-Hong Kong-Macao Greater Bay Area airport cluster, infrastructure interconnection is crucial, so an efficient and convenient transportation connection system needs to be established. By bridging intercity expressways and railroads and accelerating the creation of a one-hour transportation circle for the Guangdong-Hong Kong-Macao Greater Bay Area Airport Cluster, the time distance between the airports in the Bay Area can be shortened. At the same time, giving full play to the traffic potential of the Guangdong-Hong Kong-Macao Bridge can further shorten the time and space distance between Hong Kong airports and Zhuhai and Macau, realizing the "one-hour economic circle" of Hong Kong, Macau and Zhuhai. It can also open a direct bus service between the airports, reducing the time and effort of travelers to

various gateways, making it more convenient for travelers from both places and making their trip more comfortable.

10.2.2 Shenzhen and Hong Kong airports to strengthen deep-seated cooperation

At present, the cooperation between Shenzhen Airport and Hong Kong Airport only exists at a shallow level, and lacks in-depth cooperation. For deeper cooperation, mutual participation can be carried out. Learning from the experience of successful port industry cases in Hong Kong and the Pearl River Delta, the purpose of rational division of labor is achieved through Hong Kong capital investing in ports. However, it is difficult to achieve this by the government's administrative means alone, and in the end, it is necessary to take the road of mutual ownership of assets, so that resources can be jointly distributed, operations can be coordinated, and benefits can be shared. In addition to bringing funds to develop freight hardware facilities, it is more important to form a linkage between the two places, each focusing on its own market segment, and achieving a win-win situation. Shenzhen and Hong Kong airports can use their respective advantages to cooperate in land and air cargo intermodal transport, and the cargo is transported to Hong Kong airport by truck flights for direct loading, which not only increases the business volume of Shenzhen airport, but also promotes the sharing of cargo routes between the two airports and reduces the pressure of cargo operation at Hong Kong airport.

10.2.3 Establish a joint air traffic management center

With the intensification of competition in all aspects of the Guangdong-Hong Kong-Macao Bay Area airports, coupled with limited resources, the future of the Greater Bay Area wants to achieve the goals of national planning, then a department is needed to unify the management of the Bay Area's airport development, standing in a macro perspective to unify and coordinate the resource allocation of the airport cluster, helping each other and forming a unified synergy. At this time, it is necessary to solve the airspace management problems of the Bay Area airports and innovate the management mode of the Bay Area airport cluster. Assist and encourage Guangdong, Hong Kong and Macao to study the establishment of a joint air management center, the joint air management center can stand in a macro perspective to coordinate the coordinated development of the Bay Area airports, the rational allocation of resources, each airport to implement different strategic development priorities, the formation of complementary advantages within the airport, so that the overall role played by the Greater Bay Area airports is greater than the role played by each airport when operating alone, the formation of the Bay Area development synergy.

10.2.4 Build a data sharing platform in the Bay Area

The rapid flow of information plays a linking role for the integrated development of airport clusters. The synergistic development of airports in the Greater Bay Area should take the transportation data synergy as a hand, and relevant national departments as well as airports should work together to promote the construction of a unified transportation data sharing and interoperability platform in the Greater Bay Area, build a regional full time intelligent travel service system, and escort the synergistic development of airports in the Bay Area.

10.3 Organic combination with industry

Based on the development strategy of this paper, the SO strategy is selected, so it will focus on the advantages that affect the development of Shenzhen Airport to the maximum, and in the SWOT analysis part of Shenzhen Airport, it is analyzed that Shenzhen's high-tech industry is developing strongly. Therefore, the organic combination of the development of Shenzhen Airport and the local industry is a major direction for the development of aviation logistics of Shenzhen Airport, and the following will put forward specific suggestions on how to organically combine Shenzhen Airport with the industry.

10.3.1 Cooperate with local high-tech companies

Bao'an District, where the airport is located, is the center of Shenzhen and is a large economic area of Shenzhen, with a strong industrial base, developed into an industrial structure with strategic emerging industries as the core of development, with the electronic information industry as the leading role. And the Shenzhen airport is located in the center of the Bay Area to develop the airside economy has obvious advantages of location. However, the overall layout and scale development of Shenzhen's airside economy does not fully match with the "global logistics hub city".

Shenzhen airport should make full use of the advantages of local high precision companies to promote the modernization process of the airport, such as cooperation with the airport to improve the speed of security checks, thereby reducing the waiting time of passengers; the introduction of more intelligent intelligent information screen and VR navigation service equipment, so that passengers can brush their faces to check flights without taking off their masks and other technologies. With the construction of a number of major transportation infrastructure around Shenzhen Airport, Shenzhen Airport and the surrounding areas will usher in new opportunities for development, the airside economic zone is increasingly taking shape, and it is the right time to comprehensively promote the import of high-value industries and high-quality planning and construction.

10.3.2 Pay attention to the construction of "aviation +" industry

The development of the airport needs the financial support of the industry, because the industry chain related to aviation logistics is long and needs to rely on a large amount of capital to support. By summarizing and analyzing the experience of domestic and foreign excellent airports in developing aviation logistics, we can know that the "aviation +" industry can effectively enhance the competitiveness of the relevant airport hubs, so Shenzhen airport aviation logistics should pay special attention to the "civil aviation +" industry if it wants to seek development.

Therefore, Shenzhen airport air logistics should pay special attention to the "civil aviation +" industry if it wants to seek development. Shenzhen airport can study in depth the national policy support for Shenzhen airport based on the continuous optimization of the environment, innovative forms of cooperation, and promote the rapid growth of the industry. Use airport resources to develop the airport economy of Shenzhen airport, build an economic center around the airport, and gather the aviation industry chain by establishing an aviation industrial park. It is also possible to establish cooperation with major international aviation-related enterprises to jointly invest in the field of "aviation +". Industry-driven development.

10.4 In-depth construction of intelligent airports

In the previous part of the SWOT analysis of Shenzhen Airport, it was mentioned that Shenzhen Airport has a strong high-tech industry foundation, but the degree of cooperation with the industry is not high; In the experience of Hong Kong Airport, we found the importance of informatization. Based on the choice of development strategy SO, this part will put forward specific suggestions on how to deepen the intelligent construction of Shenzhen Airport.

10.4.1 Improve the overall intelligent construction of the airport

In the past, Shenzhen Airport took the initiative to connect with the National Air Transport Bureau to use the integrated logistics and distribution information public service system in the airport, which is a firm first step to build a comprehensive information service platform for logistics in Shenzhen Airport.

In the future, Shenzhen airport should further play the airport's webpage and and WeChat mini-programs publicity as well as service level to comply with the development trend of networking and provide more convenient services for cargo owners, enterprises and other customers. For the airport to build up a mobile financial payment, consulting services, comprehensive search and other functions as one of the electronic construction platform. Facilitate customers while improving the efficiency of the airport, thus promoting the development of airport wisdom. Airports should

strengthen cooperation with local high-tech enterprises, deepen the participation of high-tech companies such as Huawei and Tencent in airport construction, and strengthen the analysis and use of high-tech technology in the analysis of data such as electronic product waybills at airports. Strive to realize the integrated operation of cargo stations in airports through technology completion.

10.4.2 Promote the construction of intelligent logistics platform

If Shenzhen Airport wants to build an intelligent logistics platform, it must further attract more airlines to settle in on the existing basis, and even strive to make more airlines willing to use Shenzhen Airport as their base airline, cooperate with high-tech on the basis of bringing together a large number of airlines, and use the intelligent platform to unite the company into an organic whole.

In attracting more airlines to settle in. For the airport, the airport infrastructure should be strengthened, the internal management system should be improved, and aviation talents should be introduced into the airport to further optimize the management level of the airport, so as to improve the overall management and service level of the airport. And to attract airlines in the Shenzhen airport by the airport group itself is far from enough, the local government in Shenzhen should play a leading role in this. For example, the introduction of relevant policies to attract airlines preferential, such as tax exemptions, the provision of quality air rights time, provide relevant financial support and cooperation with the airport to introduce relevant preferential policies to attract airlines to move in. You can also promote the relevant investment body in Shenzhen and the main domestic and foreign cargo airlines to form a joint venture cargo airlines, such as DHL, China Southern Airlines, etc..

10.4.3 Intelligent and convenient service

Comprehensively improve the self-service level of airport service process, simplify passenger check-in procedures, enhance the sense of sincere service acquisition, optimize the diversification of airport services, and provide passengers with diversified and personalized services. In terms of seamless air-ground support of airlines, improve the intelligent level of air-ground communication and improve the speed of communication. Improve the level of intelligence, increase the telescopic speed of the aircraft and the ground connection, and shorten the distance between the airport and the ground connection section. In terms of logistics visualization integration services, we will deepen the cooperation between airports and technology companies, build an integrated system for logistics information visualization, and realize the high-speed transmission of logistics information and the intelligence of retrieval. At the same time, the leap of airport staff management

and business operation management to digitalization, informatization and intelligence has improved the overall intelligence level of the airport.

Use its own advantages to expand the scope of logistics services

10.5 Completing the shortcomings of international passenger transport business

In the SWOT analysis of Shenzhen Airport above, it was mentioned that the air passenger transport of Shenzhen Airport has a large scale, and the passenger transport business has developed well; In the section on the development status of air logistics at Shenzhen Airport, it is mentioned that Shenzhen Airport's passenger throughput and passenger routes have great advantages; When analyzing the development experience of Guangzhou Baiyun Airport, it is mentioned that Guangzhou Baiyun Airport is relatively complete because its international routes are relatively complete; In the analysis of the external industry competition situation of Shenzhen Airport, it is mentioned that the development of international routes of Shenzhen Airport needs to be improved. Based on the selection strategy SO of this article, this part will put forward relevant suggestions on how to supplement the international passenger transport business.

10.5.1 Take advantage of the city's GDP

As one of the top cities in the country in terms of GDP, Shenzhen has certain advantages in terms of current economic development and growth, with a higher economic growth rate than other cities and a leading total economic volume. According to the relationship between GDP and civil aviation output of 1:1.8, Shenzhen airport has a high elasticity in terms of passenger throughput and transit capacity. This makes Shenzhen airport have a solid and stable passenger market in terms of developing air passengers.

And with the development and gathering of high-tech industries in Shenzhen, a world-renowned high-precision industrial park has been formed, and with the internationalization of the city, the airport's international passenger business has also ushered in its own development opportunities.

10.5.2 Based on the bridgehead of the Maritime Silk Road, expand international routes

The staff of the civil aviation market development department of Shenzhen Airport said that in the next period of time, Shenzhen Airport will invest more resources in international routes and encourage other airlines to open more international routes at Shenzhen Airport, so as to improve the efficiency and quality of Shenzhen Airport on international routes. In terms of infrastructure construction, Shenzhen Airport is promoting the expansion of satellite halls, third runways and

other projects, and in terms of customs, it is actively promoting the implementation of the 144-hour transit visa-free policy, and constantly laying a solid foundation for it to build an international hub.

At the same time, it actively moves closer to the strategic development direction of the national aviation hub. In the development of international routes, we will actively obtain more air traffic rights and advantageous resources for North American and European routes, especially relying on Shenzhen's location at the starting point of the Belt and Road, taking countries along the "Belt and Road" as the main layout objects of the aviation network, and helping Shenzhen Airport build a bridgehead construction of the 21st Century Maritime Silk Road by building a "4-hour aviation circle" on the Maritime Silk Road and a "12-hour aviation circle" connecting major cities around the world (Li Yuan. 2019).

10.5.3 Improving the quality of airport services

For the nature of the airport industry, service levels are important. The main target of airport international passenger services, foreign passengers are more concerned about the service level and differentiation level of the airport. Therefore, the service differentiation of airports should focus on the different needs of service recipients, and strive to provide unique service products. This can benchmark against world-class airports, learn from the development experience of Hong Kong Airport, and improve the airport service quality evaluation system. Promote the construction of service culture and build a high-quality service brand of the airport. It is achieved by optimizing the guidance signage of the airport, enhancing the experience of the architectural space in the airport, and improving the service facilities of the airport. Make the airport a place where passengers want to stay for a long time, and develop the airport's international passenger business.

10.6 Make up for the airport's cargo shortfall

In the previous article, not only mentioned in the SWOT analysis that the cargo development of Shenzhen Airport is its development shortcoming, but also for the development status of Shenzhen Airport air logistics, the development experience summary of Hong Kong Airport, the analysis of competitors in the same industry in the analysis of the external environment of the industry environment, these parts all mention that Shenzhen Airport's air cargo still has a lot of room for development, so this part will put forward relevant suggestions for the future cargo development of Shenzhen Airport.

10.6.1 Transform to informatization, automation and intelligent cargo terminal

As the advantages of fast air cargo continue to shrink, and because the timeliness of air cargo is the key to maintaining its high added value. However, recent statistics show that in the process of

air cargo transportation, the handling of ground cargo, such as the receipt processing of the airport cargo station and the pre-loading treatment of the cargo station, accounts for 90% of the cargo transportation time, which greatly reduces the efficiency of air cargo, so the air cargo part should take relevant measures to improve efficiency.

1.Development of customer-oriented network information systems

Focusing on improving the sense of user experience, we will develop a customer-oriented network information system so that airport customers, such as passengers and cargo owners, can query the content they want to query with a simple click on their mobile phones and computers. Realize "customer" as the center, build an information system to connect air cargo terminals, airlines, third-party agents and other topics. Strengthen information sharing and integrate advantageous resources. The key to the implementation of the integrated integration strategy of air logistics enterprises is information sharing.

2.Strengthen information sharing and integrate superior resources

As the main body connecting all parties, the airport cargo terminal should assume the responsibility of communicating with all parties. Shenzhen Airport strengthens cooperation with high-tech companies and makes full use of information technology to integrate information in all aspects of the terminal, such as transportation, loading and unloading and other ground operations; Manage and control relevant information such as logistics operations; Nationwide networking of business systems. At the same time, a comprehensive information platform is built to link all parties in logistics for effective linking and resource sharing, and integrating all aviation resources, so as to revitalize the entire logistics supply chain.

10.6.2 Firmly grasp the policy advantages

Taking the pilot reform of refined airspace management in the Pearl River Delta region as an opportunity, we will promote the reform of airport airspace structure and optimize the airspace time management of airports. And vigorously promote the application of new navigation technology in the airport, transform the existing infrastructure while building new infrastructure to ensure the operation of the airport, increase the peak hour flight capacity of the airport under the drive of policy advantages, and create conditions for Shenzhen Airport to open more international routes.

10.6.3 Expand the functions of regional air cargo portals

Since there is still a gap between the airport and other airports in the region in terms of air cargo, Shenzhen airport should focus on expanding its air cargo gateway function in the region and

improving its service level in the local market. The proposed positioning is inseparable from Shenzhen's geographical, economic and industrial advantages. Shenzhen Airport has a huge hinterland market because it is located in the core of the Pearl River Delta inside the Guangdong-Hong Kong-Macao Bay Area, and the city's GDP ranks among the top in the country, and the city has a good foundation for the development of high-precision industries. Such strategic positioning is in line with the direction of Shenzhen's urban development, and under such development positioning, Shenzhen airport's air cargo should focus on expanding international routes that match the industrial structure of the hinterland, and improve the layout of cargo routes with key domestic markets.

11 Summary of the whole text, logical organization of the whole text and the specific use of diagrams

11.1 Summary of the full article

This paper first briefly introduces the research background, purpose and significance of the development of air logistics at Shenzhen Airport, as well as the research methods and article framework, analyzes the current situation of air logistics development at Shenzhen Airport, and conducts research from the aspects of freight, passenger transport, infrastructure and industrial environment, and concludes that the airport still lacks in the international business of air cargo and passenger transport.

Next, the other two airports in the Guangdong-Hong Kong-Macao Greater Bay Area will be analyzed, and their development experience will be summarized to prepare for the development strategy of Shenzhen Airport.

Secondly, using the theory of enterprise strategic management, through the analysis of the internal and external environment of Shenzhen Airport, the use of PEST, Porter Five Forces Model, SWOT analysis and other theories, the macro environment, industry competition environment and internal environment of the development of air logistics of Shenzhen Airport were analyzed in depth, and the opportunities, challenges, advantages and disadvantages of the development of passenger transport business of Shenzhen Airport were summarized.

Thirdly, AHP analysis is carried out on the basis of SWOT analysis, and a systematic strategic analysis of the development of aviation logistics at Shenzhen Airport is carried out, and the analysis results point out that Shenzhen Airport should develop its existing advantages to the maximum on the existing basis and grasp the airport development opportunities, so as to make up for the disadvantages and threats of airport development aviation logistics.

Finally, it is proposed that in order for the air logistics of Shenzhen Airport to achieve high-quality development in line with the new era, it is necessary to focus on deepening the advantages of multimodal transport, the integration of bay area airports, organic integration with industries, in-depth intelligent construction, and using its own advantages to expand the scope of logistics services, making up for the shortcomings of international passenger transport business and the short board of cargo at the airport.Shenzhen airport in the next five years want to win their own competitive development advantage in the Guangdong-Hong Kong-Macao Bay Area opportunities and advantages or great, as long as the Shenzhen airport to seize their existing advantages and opportunities to make up for the shortcomings of the airport development, the future of Shenzhen

airport will win their own place in the Guangdong-Hong Kong-Macao Bay Area, will become a transportation hub to match the development of Shenzhen city, will live up to the expectations of the country.

11.2 Full Text Logical Compendium

You can clear the logic of the development strategy in this document through the Shenzhen Airport Development Strategy overlay matrix (Appendix 3).

11.3 Specific use of charts

11.3.1 This article table data sources and use table

You can clearly understand the source of the tabular data in this article, how it is used, and what it does through the table (Appendix 4).

11.3.2 The data source and use table of this paper figure

You can clearly understand the data sources, how to use the figures in this article, and what they do in the table (Appendix 5).

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Appendices

Appendix 1. Judgment matrix of one to nine. (Table 6)

Importance scaling	Meaning
1	Indicates that two elements are of equal importance compared to each other
3	Indicates that the former is slightly more important than the latter compared to the two elements
5	Indicates that the former is significantly more important than the latter compared to the two elements
7	Indicates that the former is more important than the latter compared to the two elements
9	Indicates that the former is more important than the latter compared to the two elements
2,4,6,8	Represents the compromise between the above two adjacent judgments
Reciprocal	If the ratio of the importance of element i to element j is aij, then the ratio of the importance of element j to element i is aji=1/aij

Appendix 2 Random consistency index RI table.(Table 8)

Stochastic consistency index RI											
n	1	2	3	4	5	6	7	8	9	10	11
RI	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.51

Appendix 3: The Overlay Matrix of Shenzhen Airport Development Strategy.

Specific aspects of the development strategy of Shenzhen Airport selection (9 chapters)	Advantageous conditions for implementing these strategies(section)	Conditions of opportunity to implement these strategies(section/Chapter)	Other reasons for choosing these strategies (weaknesses, threats and problems in airport development)(section)	Specific strategic implementation plan(section)
Multimodal Transport	5.2.4 5.2.5 6.1.1 6.3.1 6.4.3	3.1.1 6.3.1	6.4.3	10.1.1 10.1.2
Bay Area Integrated Development	3.3.3		6.4.1 6.4.2	10.2.1 10.2.2 10.2.3 10.2.4
Integration with urban industries	5.1.2 6.1.3 8.4.3		5.1.2 6.1.3	10.3.1 10.3.2
Intelligent level	6.1.3	4.1.1 4.1.2	4.1.1 4.1.2	10.4.1 10.4.2 10.4.3

Passenger Business	3.3.1 3.3.3 5.2.1 5.2.3 6.1.4 6.2.2 6.3.3 6.1.5	5.2.4 3.3.2 6.3.3	4.2.1 6.2.1 6.2.2	10.5.1 10.5.2 10.5.3
Freight business	5.2.1 5.2.3 6.1.2 6.2.3 6.3.2 6.1.5	3.1.2 3.2.1 5.1 5.2.4 6.3.3 6.3.4 6.4.4	3.2.2 4.1.2 4.2.2 6.2.1 6.2.3 6.3.2	6.3.2 10.6.1 10.6.2 10.6.3

Appendix 4:This article table data sources and use table

Name of the form	Source	How it is used	conclusion
Table 1:The cargo and mail throughput of Shenzhen Airport during the 13th Five-Year Plan period.	szairport.com	On the official website of Shenzhen Airport, specific data on total cargo and mail throughput and growth rates for 2018, 2019 and 2020 are collected in the form of tables comparing total cargo and mail throughput with domestic cargo and mail throughput and growth.	Conclude the fact that the domestic and foreign cargo and mail throughput of Shenzhen Airport is unbalanced, ...

Table 2: The five speed increases of Chinese railroads	Civil Airports Production Statistics Bulletin. 2019. https://www.mot.gov.cn.	In the civil airport production statistics bulletin, five processes of China's railroad speed increase were extracted, including the time, content and scope of speed increase, and they were shown into the table.	In the end, the development of railways is very fast, and in some ways has robbed the business of air logistics.
Table 3：Guangdong, Hong Kong and Macau Airport Access Statistics.	China Civil Airports Association. 2019. http://www.chinaairports.org.cn/.	The number of domestic routes, the number of international routes, the total number and the number of direct flights to airports in Guangdong, Hong Kong and Macau in 2019 were collected on the website of the Civil Airports Association of China (CAAC) by their statistics.	In contrast, it is more intuitive to see the gap between Shenzhen Airport's international business and other airports.
Table 4: Shenzhen GDP statistics for the past 8 years	Shenzhen Statistics. 2022. http://tjj.sz.gov.cn.	On the website of Shenzhen Bureau of Statistics, specific data on Shenzhen's GDP and GDP per capita for the past 8 years are collected.	On the website of Shenzhen Statistics, the GDP and per capita GDP of Shenzhen Airport in the past eight years are collected. So as to have a more intuitive understanding of the economic development of Shenzhen.
Table 5: Data-level evaluation structure model of air logistics development in Shenzhen airport.	The influencing factors in the table come from SWOT analysis, because the method used in this paper is AHP analysis on SWOT analysis.		
Table 6: Judgment matrix of one to nine.	The content in the table is the meaning of the various scales proposed by the Sati 1~9 scale method.		

Table 7: Judgment matrix for the criteria layer	The scoring criteria of 1~9 scale method were used to score the previous table Shenzhen airport air logistics influence factors sequentially and construct a judgment matrix.
Table 8: Random consistency index RI table	The consistency criterion RI for testing the pairwise comparison matrix is found from relevant sources: the RI is called the average random consistency index. This is an industry standard
Table 9: The weights of each index at the criterion layer and the consistency test results	This is a unified collation of the above two tables so that the results of the weights and consistency tests of each indicator at the criterion level can be more intuitively seen.
Table 10: Statistics of the weight of each part of AHP analysis	Using the results of the single ranking of all indicators in the previous level, the weights of the importance of all factors on the next level are calculated, and the weights of all criterion levels are derived and aggregated.
Table 11: SWOT strategy analysis table.	The SWOT strategies for the development of air logistics in Shenzhen airport are specifically sorted out and the general scheme of each strategy is derived to provide a platform for subsequent strategic choices.

Appendix 5:The data source and use table of this paper figure

The name of the figure	Source	How it is used	conclusion
Figure 1: Change in air cargo volume of Shenzhen airport in the past ten years.	Shenzhen Transportation Administration. 2022. (sz.gov.cn).	Data on the cargo volume of Shenzhen airports over the past ten years was collected on the website of the Shenzhen Transportation Bureau and presented in the form of a bar chart showing the cargo development of Shenzhen airports.	Shenzhen Airport's cargo volume has been growing over the past decade.
Figure 2: Changes in passenger throughput of Shenzhen Airport in the past ten years	Shenzhen Transportation Administration. 2022. (sz.gov.cn).Accessed on:April 3, 2023.	Specific data on passenger throughput at Shenzhen Airport over the past ten years was collected on the website of the Shenzhen Municipal Bureau of Transportation and shows the evolution of passenger throughput at Shenzhen Airport in the form of a bar chart.	Shenzhen Airport's passenger business has been hit hard by the 2019 epidemic.
Figure 3：Shenzhen Airport Passenger Source Map	CCA. 2019. www.caac.gov.cn.	Specific data on the origin of passengers at Shenzhen Airport is collected on the website of the Civil Aviation Administration of China and is presented in the form of a pie chart.	Shenzhen airport is still more of a source of passengers from this city, but it has great potential to attract passengers from other cities.

Figure 4: Airport Cargo Share in Guangdong, Hong Kong and Macau	Civil Airports Production Statistics Bulletin. 2022. https://www.mot.gov.cn.	TData on the cargo share of each airport in the Hong Kong-Zhuhai-Macao Greater Bay Area is collected in the Civil Airport Production Statistics Bulletin and presented in the form of a pie chart.	The cargo share of Shenzhen Airport in the Greater Bay Area is lower than that of Hong Kong Airport and Guangzhou Airport in the whole country.
Figure 5: Cargo Throughput Statistics of Hong Kong Airport, Guangzhou Airport and Shenzhen Airport in the Past 20 Years.	Civil Aviation Administration's "Civil Aviation Airport Production Statistics Bulletin" and official snapshots of each airport)	The cargo throughputs of Hong Kong, Guangzhou and Shenzhen airports in the past 2005, 2010, 2019 and 2022 were collected from the Civil Aviation Airport Production Statistics Bulletin, and the annual cargo throughputs of these three airports were compared by year to provide rough statistics on the cargo development of the three airports.	The comparison of the cargo volume of each airport in each year is obtained, as well as the change in cargo volume of each airport.
Figure 6:Change in passenger throughput of airports in the Greater Bay Area	China Airports Network. 2020. https://www.ceicdata.com.	Specific data on the passenger throughput of major airports in the Greater Bay Area for 2015 as well as 2019 were collected and compared on an airport-by-airport basis at China Airports Network.	To see the development of passenger business of each airport in these four years and the development of passenger traffic of Shenzhen airports in the Greater Bay Area.

Figure 7:Change in passenger traffic at Shenzhen Airport during 2015-2020.	Civil Airports Production Statistics Bulletin. 2019. https://www.mot.gov.cn.	Specific data on passenger traffic at Shenzhen airports from 2015-2020 are collected in the Civil Airport Production Statistics Bulletin, and the data for these years are compared in the form of bar charts.	It is seen that the passenger traffic of Shenzhen airport is seriously affected by the epidemic.ed by the epidemic.
Figure 8: Market share of Shenzhen Airport by airline (passenger throughput in 2018)	OAG database. 2018.https://oag.cn.	Find out which airlines Shenzhen Airport had in 2018 from the OAG database and collect specific data on their market share in passenger throughput.	It is concluded that there are many airlines in Shenzhen airport, but none of them has a large market share.
Figure 9: Shenzhen, Guangzhou and Hong Kong airports' passenger transit volumes and transit rates, 2018 .	OAG database.2018. https://oag.cn.	Specific passenger transit volume and transit rate data for Shenzhen, Guangzhou and Hong Kong airports in 2018 collected from the OAG database	It is concluded that the international passenger transit rate of Shenzhen airport is low and the international business needs to be improved.
Figure 10: SWOT analysis of air logistics development in Shenzhen Airport	The SWOT quadrilateral of the development strategy of Shenzhen airport is constructed by weighting the strengths S, weaknesses W, opportunities O and threats T. It is more intuitive to see how the development strategy of Shenzhen airport should be chosen.		

Figure 11: Shenzhen Airport Strategic Choice Map	On the basis of the SWOT quadrilateral, we construct the axes of strategic choices for the development of Shenzhen airport, find the strategic development points, and use them as the basis for proposing relevant strategies for development.