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## The study on Shanghai international air transportation hub

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**SHANGHAI MARITIME UNIVERSITY**



**WORLD MARITIME UNIVERSITY**

Shanghai, China

**THE STUDY ON SHANGHAI  
INTERNATIONAL AIR TRANSPORTATION  
HUB**

By

**LI DIANDIAN**

**China**

A research paper submitted to the World Maritime University in partial  
fulfillment of the requirements for the award of the degree of

**MASTER OF SCIENCE**

**In**

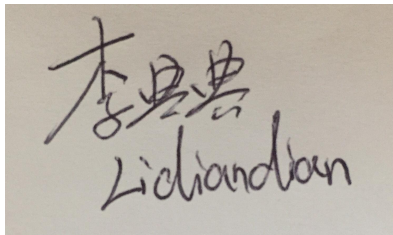
**INTERNATIOANL TRANSPORT AND LOGISTICS**

**2017**

## DECLARATION

I certify that all the material in this research paper that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this research paper reflect my own personal views, and are not necessarily endorsed by the University.



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**Supervised by**

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## **ABSTRACT**

Title of research paper: **The study on Shanghai International Air Transportation Hub**

Degree: **Master of Science in International Transport and Logistics**

With the progress of science and technology and economic globalization, the rapid development of air transport industry has become an important part of the economic system with significant impacts at global, national and regional level. The political and economic center of a country is often the hub of the country's aviation hub. In most cases, the development of aviation hub is an important indicator of urban competitiveness.

With the above understanding, This paper has studied the development of Shanghai International Air Transportation Hub, one of the inseparable part of Shanghai international shipping center. In the study, the paper firstly analyze the necessity of the Shanghai airport development into international aviation hub according to the requirements of "the Belt and Road" initiatives. The development of the aviation industry has also been explored in detail. After systematic environment scanning, the current situation of shanghai airport has been evaluated. With the methods of statistical analysis and comparative study, the comparative study between Shanghai and several typical International Air Transportation Hub. The advantages and disadvantages of Shanghai airport indicates that its development is full of opportunities and challenges as an international aviation hub. Finally, some recommendations have been put forward for driving shanghai into the international aviation hub port.

**KEYWORDS: Shanghai, Air transportation hub, the Belt and Road,  
International shipping center**

## TABLE OF CONTENTS

DECLARATION.....	ii
ACKNOWLEDGEMENT.....	iii
ABSTRACT.....	iv
TABLE OF CONTENTS.....	vi
LIST OF FIGURES.....	viii
LIST OF TABLES.....	ix
1. Introduction.....	1
1.1 Topic background and objectives of the study.....	1
1.2 Literature review.....	2
1.3 Outline of the paper.....	5
2. Environment scanning for Shanghai international air transportation hub.....	6
2.1 the impacts of policy and strategy.....	6
2.1.1 the impacts of “the Belt and Road” initiatives.....	6
2.1.2 the impacts of Shanghai international shipping center.....	8
2.2 Development of global civil aviation industry.....	9
2.2.1 General situation.....	9
2.2.2 Freight demand.....	10
2.2.3 Passenger demand.....	13
3. Situation Analysis of Shanghai international aviation hub.....	17
3.1 Facilities and throughputs.....	17
3.2 Factor analysis.....	19
3.2.1 Location conditions.....	20
3.2.2 Facility conditions.....	21
3.2.3 Collection and distribution system.....	22

3.2.4 Policy advantage.....	23
4. Comparative Study on Shanghai Airport hub.....	25
4.1 Methodology and indexes.....	25
4.1.1 Index system.....	25
4.1.2 Assessing methods.....	27
4.2 Sample air hubs.....	29
4.3 Empirical analysis.....	33
4.4 Findings.....	41
4.5 Suggestions.....	42
5. Conclusions.....	45
5.1 Main findings.....	45
5.2 Limitations of research.....	46



## LIST OF FIGURES

Figure 1 “The Belt and Road” road map.....	7
Figure 2 The proportion of flight density in Shanghai airport and "the Belt and Road" area in 2015.....	18
Figure 3 2013-2015 Shanghai airport and "the Belt and Road" area of the flight density and the proportion of international flights density.....	19
Figure 4 the Location of the Dubai Airport Figure 5 London Airport’s location.....	38

## **LIST OF TABLES**

Table1 the global freight market in March 2017.....	12
Table 2 the global passenger market in March 2017.....	15
Table 3 Comparison of infrastructure of Shanghai Pudong and Hongqiao airport.....	22
Table 4 Introduction to the sample hubs.....	30
Table 5 Passenger throughput from 2012 to 2016.....	33
Table 6 Cargo throughput from 2012 to 2016.....	34
Table 7 Aircraft takeoff and landing time from 2012 to 2016.....	35
Table 8 Geographical location.....	36
Table 9 Facilities location.....	38
Table 10 Policy support.....	39
Table 11 the ranking from comparison of three quantitative indicators.....	41

## **1. Introduction**

### 1.1 Topic background and objectives of the study

With the progress of science and technology and economic globalization, the rapid development of air transport industry has become an important part of the economy. It is also the same in the case of China. Especially under the background of “the Belt and Road” initiatives, China's aviation industry has developed rapidly.

Shanghai port has a superior geographic location and economic radiation ability, as the main carrier of the construction of international shipping center. The development of the aviation industry is one of the priorities of Shanghai during the 13th five-year plan period and the construction of Shanghai aviation hub, Shanghai airport strive to achieve the goal as leading passenger and cargo hub in the Asia-Pacific region, through the improvement of its own function and the cultivation of core competence, highlighting the aviation hub of the Shanghai International Metropolis in the international exchange, and thus further enhance the Shanghai International Shipping Center's function and status (Zheng-jia Li, 2014). As such, Shanghai Pudong international airport and Hongqiao airport will be further expanded to accommodate the growing international and domestic demand for passenger and freight transport.

In the twenty-first Century, the development trend of the world airport is the scale of the hub airport becoming bigger and bigger, meanwhile, the small and medium-sized

airports are facing severe challenges because of its limited range of radiation. Being the emerging international aviation hub, Shanghai airport also faces opportunities and challenges.

With the above background, this paper study the development of Shanghai International Air Transportation Hub, one of the inseparable part of Shanghai international shipping center. In the study, the paper firstly analyzes the necessity of the Shanghai airport developing into international aviation hub according to the requirements of "the Belt and Road" initiatives. The development of the aviation industry has also been explored in detail. After systematic environment scanning, the current situation of shanghai airport has been evaluated. By the methods of statistical analysis and comparative study, the comparative study has been made between Shanghai and several typical International Air Transportation Hub. Some recommendations have been put forward to make shanghai the international aviation hub port.

## 1.2 Literature review

The previous section introduces the background and the significance of research. The following is a brief review of current domestic and foreign research results in this field.

To date, the importance of building air transport hubs, the basic conditions of international aviation hubs and how to maintain their competitiveness have been widely studied.

Firstly, about the issue of hubs choosing, Shahrzad khosravi and Mohammad Reza Akbari Jokar (2016) studied a model for “Domestic Facility and Hub Location” in transportation network. In the sequential approach, domestic facilities were allocated and hubs were selected afterwards; Gito Sugiyanto, Purwanto Bektu Santosa, Aris Wibowo and Mina Yumei Santi (2015) pointed out the growth of hub-and-spoke airport networks has allowed medium and large-size airports that limited in passenger demand in the catchment area to become the primary hubs in their respective regions. Wei Zhao (2015) analyzed the traffic characteristics surrounding the main Asia Pacific international aviation hub, especially international passenger throughput and cargo throughput, to summarize the successful experience of global aviation key international hub.

Next, as the air fuel cost is the main part in the transportation costs, Morton E. O'Kelly (2014) examined particular aspects of the air freight system that are especially vulnerable to a spike in the costs of aviation fuel. About air freight, Susan M. Walcott, Zhang Fan (2017) looked into the air freight connections within China, focusing on rapidly developing trade center, aiming to accelerate growth in the lagging inland region.

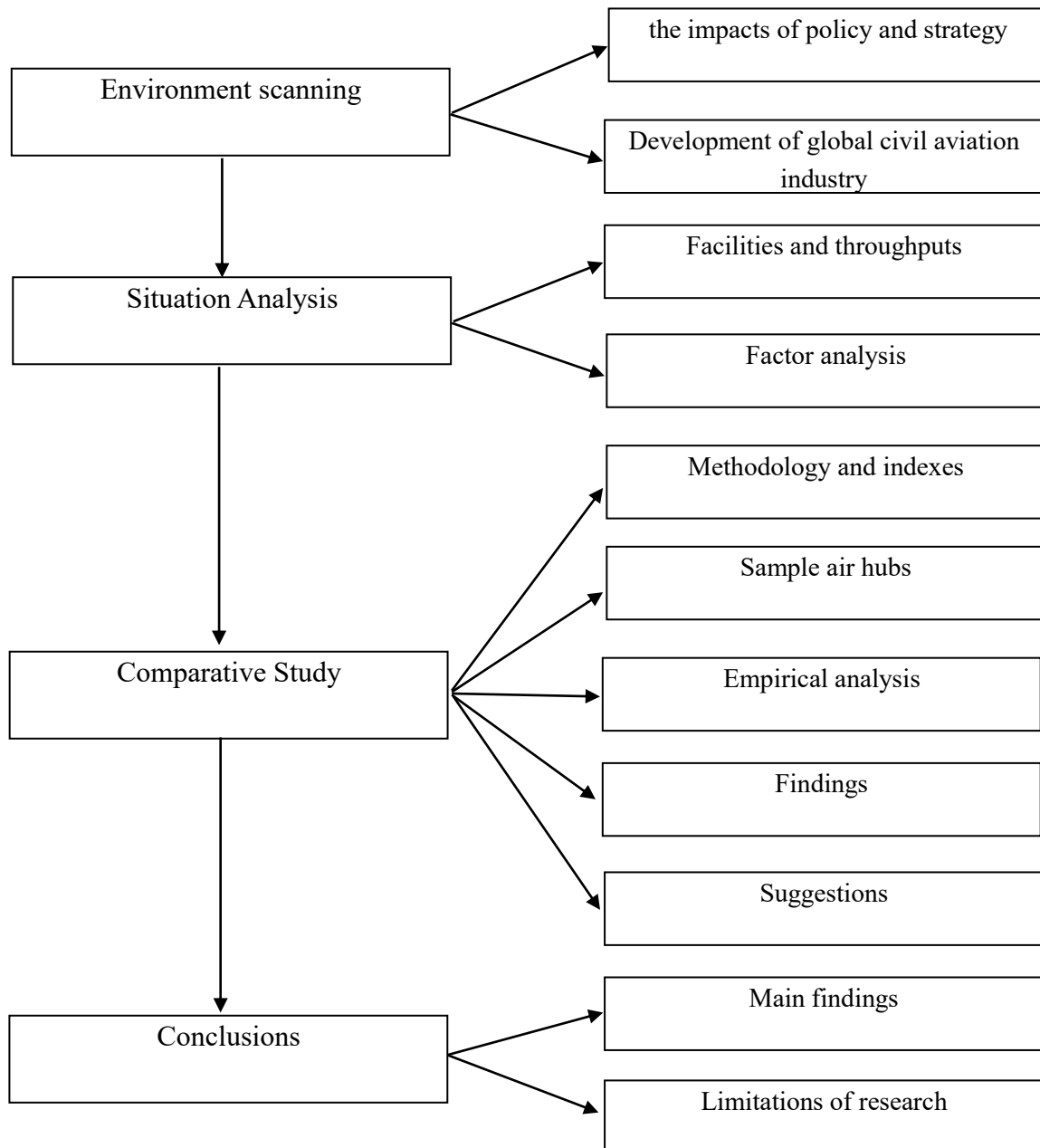
Not surprisingly, the issues on the competitive position of major airports in international air transportation have drawn considerable attention. First of all, Burghouwt and Veldhuis (2006) analyzed the competitive position of hub airports in the transatlantic market. Additionally, Malighetti et al (2008) examined the connectivity of the European air transport network and confirmed that the four main hubs in Europe namely, Frankfurt, Paris CDG, London Heathrow and Amsterdam Schiphol were ranked as the world's leading hubs in terms of connectivity; Martin

H.Thelle and Mie la CourSonne analyzed (2017) the development in competitive constraints faced by European airports resulting from the wide-ranging changes to the European aviation market over the last twenty years. The result is that airports now largely have to compete with one another to retain and attract traffic. As Qiang Cui, Hai-bo Kuang, Chun-you Wu and Ye Li (2013) proposed in the paper, index system of airport competitiveness is built from four aspects: Regional Development, Production Factors, Demand Conditions and Support Industry; Kung-Jeng Wang and Wan-Chung Hong (2011) also proposed a novel approach to strategy formulation, which utilizes the theory of competitive advantage of nations (a revised diamond model), SWOT analysis and strategy matching using the TOWS matrix and competitive benchmarking; Yan-wei Li and Xue-bing Yang (2017) pointed out that the upgrading of the international competitiveness of the aviation hub is a necessary requirement for the construction of a world-class airport complex in Beijing, Tianjin and Hebei, and they also have found out the improvement of the international competitiveness benefits from the efficiency of ground operation, the interconnection between different transport modes, and the improvement of the policy environment.

Finally, it comes to the "The Belt and Road" policy for creating the benefits of China's aviation hub. Qian Zhang (2015) found that in the context of "One Belt And One Road", civil aviation transport has already been on the front end. Good government policy guidance and support can effectively promote the development of civil aviation transportation industry. Ya Wang (2016) comprehensively and systematically studied its development advantages, disadvantages and opportunities and challenges by using the SWOT method. In the background of "The Belt and Road" strategy, civil aviation and government in West China should seize the opportunity to speed up the airport and supporting infrastructure construction, to

form an effective air transport network, play a greater role in the exchange of regional interconnection and economic integration process.

### 1.3 Outline of the paper



## **2. Environment scanning for Shanghai international air transportation hub**

### 2.1 the impacts of policy and strategy

#### 2.1.1 the impacts of “the Belt and Road” initiatives

From 2016 to 2020, the 13th five years planning for China, Chinese civil aviation industry has achieved steady growth and the travel rate per person per year will reach 0.5 in 2020(State Council, 2012). The goal is to serve the national strategy and meet the need of social development, to achieve internationalization and popularization of civil aviation power strategic objectives. Among the above goals, serving the "The Belt and Road" initiatives is the top priority task for the development of China civil aviation industry, focusing on building a win-win development environment and improve the international voice of Chinese civil aviation.

President Xi has proposed the "the Belt and Road" strategic concept. The goal of this strategy is to achieve common prosperity and development of the port in a peaceful and win-win manner. And it can also promote the cultural exchange between countries along the belt and road. Among them, the " Belt" is spread across southeast Asia and northeast Asia and ends with Europe. The "Road" is to connect Asia, Europe and Africa from the sea by a new situation so that Asia, Europe and Africa will be more closed.

“The Belt and Road” strategy strengthens the regional cooperation and promotes the economic development of countries. The strategy is committed to building the infrastructure near the Asia-Europe-Africa continent and ocean, laying for ASEAN



maritime silk road and the traffic along the connectivity to strengthen hinterland of the contacts and joint development among countries' trade protection. The promotion of "the Belt and Road" is a new situation for China's development and has showed an urgent need for China's opening up to the outside world, which is of strategic significance in the context of the new era.

**Silk Road Economic Belt and Maritime Silk Road in the making**



Figure 1 “The Belt and Road” road map

Source: Xinhuanct.com, Barclays Research

China’s civil aviation focuses on enhancing the cooperation with the aviation of countries along the Belt and Road, truly realizing all-round interconnection. For example, we have built the platform for cooperation with ASEAN and started the construction of the platform for cooperation with Central Asian nations. Besides, the route development of airlines, the cultivation of various talents and academic exchanges and cooperation all play a significant leading role in the airport traffic and throughput on the nodes along the route. According to the statistics, China has

achieved direct flights with 43 countries along the route, and there are about 4,200 flights every week. The airlines in China have set up overseas departments of business in 24 countries along the Belt and Road. In the summer-autumn season of 2016, there were 4,232 regular flights between China and countries along the Belt and Road every week. Since the summer and autumn in 2017, Chinese airlines will produce seventy new international routes along the Belt and Road (Zhao-gang Sun, 2016).

With the support of various policies, there has been a rapid growth in the passenger traffic for the countries along the Belt and Road, occupying an increasing proportion of international airline traffic. The civil aviation in China on the Belt and Road should focus on the overall situation, serve national strategies, create maximum social value as much as possible and drive more positive effects under the leadership of the Party and the State Council.

#### 2.1.2 the impacts of Shanghai international shipping center

In April 2009, the State Council formally adopted the opinions on promoting the development of modern service industry and advanced manufacturing industry in Shanghai, building international financial centers and international shipping centers. (State Council, 2012)

"Opinions" pointed out that "by 2020, the following goals will be basically completed: shipping resources' highly centralization, the functions of shipping services, the excellent shipping market environment, the modern logistics service efficiency, and international shipping center with global shipping resource allocation

ability; and Shanghai will be basically formed as the center, the Jiangsu and Zhejiang provinces as the two wings, in the Yangtze river basin as the hinterland, rational division of labor, work closely with other domestic ports of international hub port".

The aviation field has been part of the construction of shipping centers because the aviation industry is playing an increasingly important role in the today's economy and social development. Air transportation has become an important part of modern transportation, just at this point, aviation is needed to support the development of shipping (Qin-na Fu, 2016). According to the experience of some big cities in the world, all the cities are constructed around the aviation hub. Therefore, the construction of Shanghai international shipping center is as important as the two water transport and air transport, which are indispensable. The development of the aviation industry is the key of the development of Shanghai in the "13th Five-Year" period. Shanghai should strengthen the intensive construction of the airport infrastructure, increase the capacity of airport facilities, and meet the needs of the growth of air traffic volume and the upgrading of functional quality.

## 2.2 Development of global civil aviation industry

### 2.2.1 General situation

In 2016, though the global economy was slowly recovering in uncertainty, the global aviation industry continued to share the dividend on low oil prices, creating the most profitable historical record in the industry.

According to the latest estimate by IATA at the end of the year, the global volume of passenger traffic will increase by 5.7%, reaching 3.773 billion passengers in 2016.

The global volume of freight transport will increase by 3.3%, reaching 53.90 million tons. It is predicted that the global volume of passenger traffic will increase by 5%, reaching 4 billion passengers in 2017. And the global volume of freight transport will increase by about 3.3%, reaching 55.7 million tons. From 2015 to 2017, it is the best record in history for the overall profits of global airlines. In 2015, the operation revenue of global airlines was 718 billion dollars, and the net margin was 35.3 billion dollars with a net profit rate of 4.9%. In 2016, it is estimated that the operation revenue of global airlines will be 701 billion dollars, and the net margin will be 35.6 billion dollars with a net profit rate of 5.1%. In 2017, it is predicted that the operation revenue of global airlines will be 736 billion dollars with an increase of 5%, and the net margin will be nearly 30 billion dollars with a net profit rate of 4.1%. In 2015, the ROIC (Return on Invested Capital) of global airlines was 9.3%. It has reached 9.4% by 2016. It is predicted to be as high as 7.9% in 2017. The ROIC of global airlines is higher than global capital cost ratio for three years in a row, which is the best operation record in the aviation industry in twenty years.

According to the latest estimate of IATA at the end of 2016, it is predicted that the passenger revenue of global aviation industry will reach 530 billion dollars in 2017, and the freight revenue will reach 49.4 billion dollars. The passenger volume will increase by about 5% and reach 4 billion passengers. The transport volume of freight and mail will increase by 3.3% and reach 55.7 million tons. The global economy will increase by about 2.5%, the global passenger person-kilometers will increase by 5.1%, and the turnover of global freight and mail will increase by 3.5%.

### 2.2.2 Freight demand

In October, 2016, the freight demand of global airlines grew by 8.4%, reaching the highest record in twenty months. IATA noted that the growth in demand for air freight usually benefited from the introduction of high-value electronic products and the increase in new export orders. Besides, Hanjin Shipping announced bankruptcy protection at the end of August in 2016, leading to some growth in air freight demand.

According to the latest regular data of global airfreight launched by IATA, there was a year-on-year growth of 14% in global airfreight demand in March, 2017(calculated according to freight ton-kilometers, which is the fastest increase since October, 2010. In March, 2017, there was a year-on-year growth of 4.2% in the freight capacity (calculated according to available freight ton-kilometers). The performance in March promotes the strong growth in the freight volume of the first quarter. After the adjustment of the influence by the leap year of 2016, there is an increase of nearly 11% in freight demand in the first quarter of 2017, and a year-on-year increase of 3.7% in the freight capacity. As the growth in demand is higher than that in freight capacity, the income also rose. In March, there is the continued growth in world trade. And new export orders set a record high in six years. There is a strong growth in airfreight demand (Wei-wei Zhu, 2009). The growth in airfreight volume of semiconductor materials which used to make high-value electronic consumption products, played a certain role in promoting the strong performance of airfreight.

In view of airline area, there was a year-on-year growth of 13.6% in the freight volume, and a growth of 4.8% in freight capacity of airlines in the Asia-Pacific region in March, 2017. There was a growth of 9.5% in the freight volume, and a growth of 2.8% in freight capacity of airlines in North America in March, 2017.

There was a growth of 18.2% in the freight volume, and a growth of 6.7% in freight capacity of airlines in Europe in March, 2017. There was a year-on-year growth of 16.3% in the freight volume, and a growth of 2.7% in freight capacity of airlines in the Middle East in March, 2017. There was a decline of 4.2% in freight demand of airlines in Latin America in March, 2017, compared to that in the same period of 2016. There was a largest year-on-year increase in freight demand of airlines in Africa in March, 2017, and the freight volume grew by 33.5% while the freight capacity grew by 6.3% year on year. Except Latin America, the airlines in all the regions had a year-on-year growth in freight demand in March, 2017. The airlines in Europe and the Asia-Pacific region had the strongest growth, accounting for two thirds of total growth in industrial demand. It also maintained certain growth in freight demand of airlines in North America, Middle East and Africa.

Table1 the global freight market in March 2017

	Global market share	March 2017 (% Year-on-year)			
		Freight ton kilometers	Available freight ton kilometers	Year-on-year change in load factor	Load factor level
Total Market	100.0%	14.0%	4.2%	4.1%	47.4%
Africa	1.6%	33.5%	6.3%	5.9%	28.9%
Asia Pacific	37.5%	13.6%	4.8%	4.4%	57.0%
Europe	23.5%	18.2%	6.7%	4.9%	50.8%
Latin America	2.8%	-4.2%	-1.9%	-0.8%	31.9%
Middle East	13.9%	16.3%	2.7%	5.6%	47.6%
North America	20.7%	9.5%	2.8%	2.3%	36.9%

Source: sky.news.sina.com.cn

In the situation that there is local fluctuation but the overall trend is improving in global economy, the global airfreight market also shows a weak recovery pattern. Compared to global airfreight market, there is stronger recovery momentum in Chinese airfreight market. After the constant decline in 2011 and 2012 in traffic volume of freight and mail, the demand picks up gradually. The year-on-year growth in the traffic volume of freight and mail in China is respectively 3%, 5.9%, 5.8% and 5.5% in 2013, 2014, 2015 and 2016. Although China's economic growth has slowed down, it is still among the leading economies in the world. As the country continues to promote the industrial transformation and upgrading, China will continue to maintain as the "world factory" and the status of the world's largest goods trading country for a long time to come. At present, the country is strengthening the opening to the outside world, speeding up global integration, and implementing the development strategy of the Belt and Road Initiative. Meanwhile, it actively promotes the construction of free trade areas, and encourages the development of cross-border e-commerce and other new foreign trade modes. In the future, China's foreign trade is more frequent, and China has enormous potential in the international airfreight market (Jian-wei Huang, 2017).

### 2.2.3 Passenger demand

The global civil aviation industry with rapid growth gets a shot in the arm again. IATA predicts that the global airline passenger volume will reach 7.2 billion passengers in 2035, nearly twice as much as that in 2016 (3.8 billion passengers).

According to the latest data of regular transportation in global airlines launched by IATA, there was a growth of 6.8% in global airline passenger demand (calculated

according to revenue passenger-kilometers) comparing to that in the same period of 2016 in March, 2017. And the transport capacity grew by 6.1%, and the load factor declined to 80.4% with a decline of 0.5%, setting a record for the month. Compared to February, the demand growth slowed slightly in March.

As far as the international passenger transport market is concerned, there was a year-on-year growth of 6.4% in international passenger transport demand in March, with a slight decline compared to that in February, which is due to data distortion after the adjustment of the leap year. There was some growth in the airlines of all the regions, and the total transport capacity grew by 6.1%. The load factor increased by 0.2% and reached 78.8%. The traffic volume of passengers in European airlines increased by 5.7% in March compared to that in March, 2016. The strong upward trend is partly due to economic growth in the region. The passenger traffic volume grew by 9.1% year on year in Asia-Pacific airlines in March. And the transport capacity grew by 7.4%. The load factor increased by 1.2% and reached 78.7%. The growth rate was smaller in the passenger traffic volume for Middle East airlines in March compared to that in the same period of the last year, which reached 4.9%. And there was a sharp slowdown compared to the growth rate in January and February. The passenger traffic volume grew by 2.7% in March in North American airlines year on year. The transport capacity grew by 3.7%, and the load factor declined by 0.7% and reached 79.8%. Since July, 2016, the passenger volume has been on the decline after seasonal adjustment and the transport capacity has been decreasing. The passenger volume grew by 9.7% in March in Latin American airlines, which is the strongest among all the regions. This is the second time that Latin American airlines rank first among all the regions in 63 months, mainly due to the support of strong international passenger demand of South American market. The passenger demand of



African airlines continues to maintain sound momentum. Compared to that in March, 2016, the passenger volume grew by 6.0% and the transport capacity grew by 2.4%. The load factor increased by 2.3% and reached 68.2%.

Table 2 the global passenger market in March 2017

	Global market share	March 2017 (% Year-on-year)			
		Revenue Passenger Kilometers	Available Seat Kilometers	Year-on-year change in load factor	Load factor level
Total Market	100.0%	6.8%	6.1%	0.5%	80.4%
Africa	2.2%	4.9%	1.9%	2.0%	69.4%
Asia Pacific	32.9%	10.7%	8.0%	1.9%	80.7%
Europe	26.4%	6.0%	5.3%	0.5%	81.4%
Latin America	5.2%	7.8%	5.3%	1.9%	80.2%
Middle East	9.6%	4.7%	9.3%	-3.2%	73.2%
North America	23.7%	3.2%	3.3%	- 0.1%	83.6%

Source: sky.news.sina.com.cn

According to the expectation report of airline passenger traffic launched by IATA, the Asian-Pacific region is the biggest drive to promote the growth of aviation demand. In the future twenty years, more than half of new visitors will come from the region. Around 2029, China will replace the United States as the world's largest airline market. At the same time, the developing market will become the main driving force for growth. In the past ten years, the proportion of developing countries

in total global passenger traffic has soared from 24% to nearly 40%, and this trend will continue.

### **3. Situation Analysis of Shanghai international aviation hub**

#### **3.1 Facilities and throughputs**

Shanghai currently has two major airports in Pudong and Hongqiao. Among them: the Pudong airport has two terminals with a construction area of 832,000 square meters, 560 check-in counter, 70 boarding bridge and 162 gate position, which can accommodate 80 million passengers. It has 3 freight areas, covering 3.36 square kilometers, and 56 cargo plane seats, which can accommodate 5 million tons of cargo. Pudong airport has 4 runways, and the operation mode of double rise and fall and double track independent parallel approach is realized, which can reach 74 sorties per hour.

Hongqiao airport has two runways and two terminals with 445,000 square meters of construction surface, 206 check-in counter, 67 boarding bridge and 161 gate position, which can accommodate 40 million passengers and one million tons of cargo.

Shanghai has a total of 255 navigation points, of which domestic navigation points (including Hong Kong, Macao and Taiwan) are 143, international navigation points are 112, respectively, accounting for 69.08% of the country's 207 domestic navigation points and 81.75% of the country's 137 international navigation points. There are 35 navigation points related with counties along the belt and road, ranking second nationwide. In 2015, 35 domestic airlines (including Hong Kong, Macao and Taiwan) and 61 international airlines opened flights to Shanghai, and there were a total of 705,800 flights in two major airports, that is, Shanghai Pudong, Hongqiao

airports, accounting for 8.24% of the country, which were respectively, 11.56 million and 29.61 million more than Beijing Capital Airport and Guangzhou Baiyun Airport. Especially, the flight density of Shanghai Airport to the countries along "the belt and road" was 999 vehicles/week, accounting for 30.45% of Shanghai international flights. In terms of sub-region, the highest density of flights in the ASEAN region, was 712 vehicles/week, accounting for 71.26% of the flights of the country, followed by 133 vehicles/week, accounting for 13.34% in the West Asia region; central and Eastern Europe accounts for the lowest proportion of flights, only a total of the whole year, accounting for 0.002%; followed by Central Asia, for 2 times/week, accounting for 0.195%.

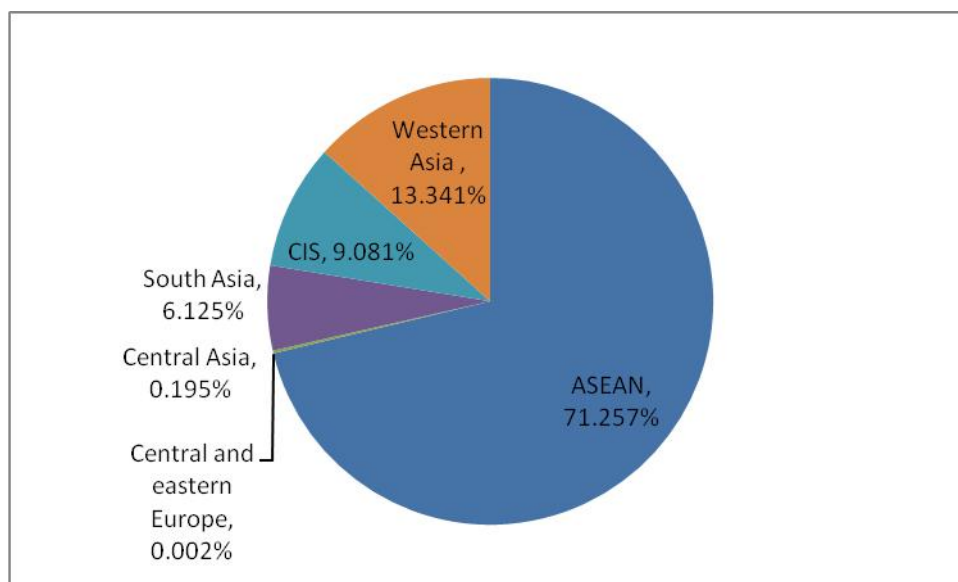


Figure 2 The proportion of flight density in Shanghai airport and "the Belt and Road" area in 2015

Source: CARNOC.com

The flight destiny of Shanghai Airport to the countries along the "the belt and road" added 381 vehicles/week, an average annual increase is 190/week, the average annual growth rate is 10.30%. At the same time, the flight destiny of Shanghai airport to the countries along "the belt and road" shows the characteristics of annual

increase, and its proportion of international flight density is characterized with a "U" type.

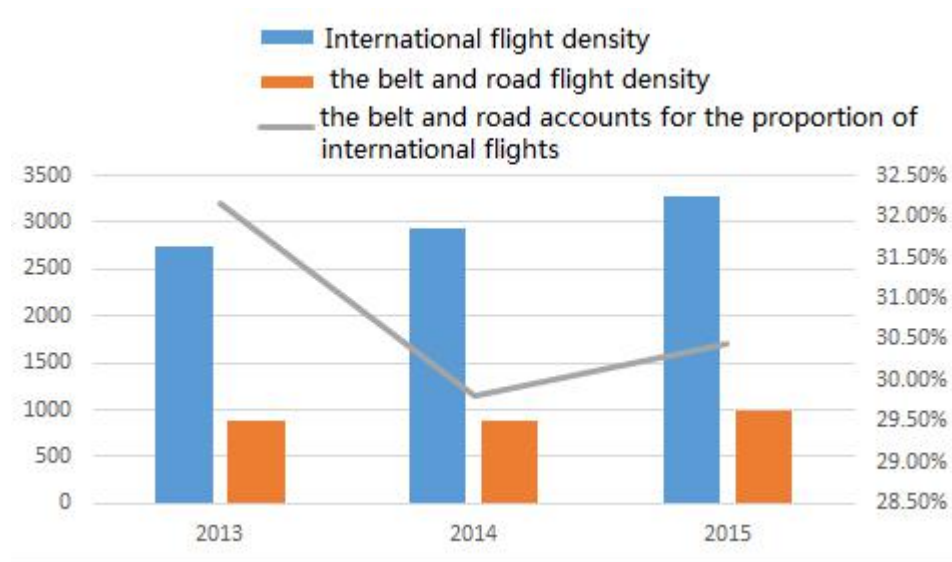


Figure 3 2013-2015 Shanghai airport and "the Belt and Road" area of the flight density and the proportion of international flights density

Source: CARNOC.com

### 3.2 Factor analysis

In recent years, Shanghai has completed the construction of infrastructure and the integrated transport system on the ground in Shanghai Pudong International Airport and Shanghai Hongqiao International Airport, around the construction goal of the Shanghai international air transport hub. The framework of strategic transformation for Shanghai hub route network and base airlines has been basically constructed. There is a rapid growth in the safeguard of aviation supporting service, especially in freight logistics service. It effectively meets the demand of the economic development in Shanghai and the Yangtze River Delta for air transport, and achieves the rapid promotion of core competitiveness in Shanghai airports.

As the economic, cultural and trade center in China and the world-class national gateway, Shanghai is the only city with two civil airports in China. Pudong and Hongqiao airports are just located in the eastern and western sides of the development axis for modern service industry in Shanghai, effectively boosting the transformation and sustainable development of Shanghai.

### 3.2.1 Location conditions

Shanghai air hub has superior regional advantages, as it is located in the center of the economic circle in the Yangtze River Delta. In geography, it is also the most important economic center in China. And it is also the intersection of China's eastern coastal economic belt and the Yangtze River Basin. It is located on the West Bank of the Pacific Ocean, and on the triangular routes of Asia, Europe and America. And the flat terrain in Shanghai is conducive to runway construction and the take-off and landing of aircrafts.

At present, the freight and passenger throughput of the two airports in Shanghai both rank first in China, firmly in the top of the Asian-Pacific region. Shanghai is a leading city in the Yangtze River Delta. Its rapid development also drives the development of the surrounding major cities with strong economic radiation capability. The direct service zone of Shanghai airports is the Yangtze River Delta. In this region, it is dense in the population, developed in economy, high in the disposable income per capita and the educational level. And it is numerous in the amount of foreign trade and introducing foreign investment. The tertiary industry has constantly optimized the structure. There is rapid development in tourism and exhibition industry. These factors, closely related to air transport, lay a foundation of

abundant market resources for the development of air transport in Shanghai. The indirect service zone of Shanghai airports is the overlay area of two-hour flight circle. In this region, it is rich in resources. It not only covers 80% of the top 100 cities, and 54% of the territory area. But there is also 90% of the population of China in this region. Meanwhile, it is the source of 93% of the GDP in China. And it also covers a majority of the interior areas of the developed economies in the Asia-Pacific region.

The overall goal of the construction in Shanghai international air hub is to construct perfect domestic and international route networks, become an air gateway between China and the rest of the world as the core hub in the Asian-Pacific region. Finally, it becomes an important node of the world aviation network.

### 3.2.2 Facility conditions

In 2016, the passenger throughput of the two airports in Shanghai has reached more than 100 million passengers, exceeding that of the Capital Airport in Beijing. The throughput of freight and mail has far exceeded that of other domestic airports. The three runways of Pudong Airport and two runways of Hongqiao Airport have been all put into operation. The long-term plan of Pudong Airport is to build 4 runways and 4 terminals. The T1 terminal of Hongqiao Airport after transformation will achieve the docking with the viaduct. It will be smoother to enter and go out of the terminal. The further integration with subway, bus, taxi and other transportation hubs will be convenient for tourists to independently choose the mode of ground transportation.

The following table lists the infrastructure conditions of the two airports and compares them:

Table 3 Comparison of infrastructure of Shanghai Pudong and Hongqiao airport

	Track number	Apron area (million square meters)	gate position	boarding bridge
Shanghai Pudong airport	5	149	218	70
Shanghai Hongqiao airport	2	51	66	13

Source: CARNOC.com

### 3.2.3 Collection and distribution system

In mainland China, Shanghai is the only city with two international airports. And it is internationally recognized as “a city with two airports”. Shanghai has positioned airports as international hubs rather than regional hubs, from the very beginning. As early as the 90s of last century, Shanghai introduced the Strategic Plan of Shanghai Air Hub, and established the policy of "simultaneous construction of two airports". There is no doubt that Shanghai is the most successful domestic city in operating “a city with two airports”, the most mature domestic city in “a city with two airports”, and the pioneer of “a city with two airports” in planning, construction, operation and management.

According to the statistics, the annual passenger throughput of the two airports in Shanghai will reach 120 million passengers by 2020. By 2020, Shanghai will basically build an international shipping center with the allocation capacity of global shipping resources and rank among the world-class shipping centers. On the sea and



air hub, it will continue to consolidate the status of the international sea and air hub in Northeast Asia. The container throughput will continue to maintain a leading position in the world, reaching 40-42 million TEUs. The airport passenger throughput will reach 120 million passengers and the throughput of freight and mail will reach 4.4 million tons. Passenger transfer rate will increase to 13%-14% in Pudong Airport. In the collection and distribution system, it will basically build a collection and distribution system in modernized port. The ratio of water-to-water transfer of containers will be above 50%. There will be a significant increase in the proportion of railway collection and distribution. Therefore, transportation between Pudong Airport and Hongqiao Airport will reduce to forty-five minutes.

#### 3.2.4 Policy advantage

At present, the civil aviation adopts its own advantages to achieve a leading breakthrough in the interconnection and interworking of infrastructure within the strategy of “the Belt and Road”. And it has signed bilateral air transport agreements with more than sixty countries along the Belt and Road, and realized direct flights with more than 40 countries (Qian Zhang, 2015). It is planned to reach over 4,420 flights every week. At present, China is actively having talks about the negotiation of air transport agreement and expansion of aviation rights arrangements, and continues expanding the relations in civil aviation with the countries along the Belt and Road.

On the target of "13th Five-Year", Shanghai has basically confirmed ten primary missions. And Shanghai airports will usher in a new round of development opportunities. For the national strategies including “the Belt and Road”, Yangtze

River economic belt and the Yangtze River Delta Regional Planning, it is urgent to promote regional transportation and expand regional cooperation (Jiao-e Wang, 2015). Pudong Airport will also usher in the fifth runway, and the new achievements of airport economy about domestic feeder liners and large aircraft project will become the best link for Shanghai to strengthen regional cooperation with relevant cities. The construction of Shanghai Technological Entrepreneurship Center, international city and global city is to bring steady growth of business travelers. The consumption upgrade of the public in China is driving the sustainable development of tourism. In particular, Disneyland Shanghai theme park opened in 2016, bringing a large number of tourists to Shanghai airports. In aviation logistics, e-commerce springs up rapidly and enters into the period of explosive growth, which has driven the rapid growth of air express industry. Shanghai Free Trade Zone is expected to first establish the port customs environment acting on international convention, to further promote the surge in throughput of international airfreight and mail. National strategies, regional development and market vitality are bringing new opportunities for Shanghai. And airports, just like "pioneers", have taken the lead in showing broad prospects in front of the opportunities.

## **4. Comparative Study on Shanghai Airport hub**

### 4.1 Methodology and indexes

In order to estimate the competitiveness of Shanghai Airport hub, the evaluating index system will be produced. According to the above qualitative and quantitative indicators, statistical analysis and comparative study will be taken between Shanghai and several typical hub.

#### 4.1.1 Index system

These six indicators are passenger throughput, cargo throughput, aircraft takeoff and landing times, geographical location, policy support and facilities condition. The relationship of some indicators with the development of the international Airport hub are discussed in the following.

##### (1) Superior geographical location

Whether it is a domestic hub, an international hub or a composite hub, most of them have superior geographical positions in aviation. As they are located in the center of the route structure in this region with good natural airworthiness conditions, they become important nodes in global route network. The superior geographical positions and low deviation coefficient of hub airports can help passengers transfer quickly and reduce the waiting time (Juan Dong, 2008). For shipping agents and

shippers, it is easier to integrate the goods and reduce the waiting time of the goods to be processed. For airlines, it is easy to form scale effect. For the hub airport itself, it can bring considerable and stable income to the airport, improve the utilization rate of facilities, and enhance the development potential of the airport, thereby enhancing the brand and status of the airport.

### (2) A complete system of collection and transportation

Successful air hubs should have sound infrastructure that enables the busy passenger and freight flows to get in and out of the airport conveniently, safely and quickly. Moreover, it should have a perfect collecting and distributing system to connect the downtown area and surrounding cities through fast and economical ground transportation. It is an important support for the efficient transportation of passengers and freight in air hubs, as well as an indispensable content in the construction of air hubs (Ting-ting Jia, 2012). Air hubs must have the subway to connect the downtown area and the public transportation system to connect surrounding cities. Meanwhile, it should have rail transit, public bus and other relatively comfortable, fast and smooth modes of transportation. There should be many passenger distribution centers and frequent ground transportation services.

### (3) strong government policy support

The construction of the air hub is complex system engineering. In addition to a favorable geographical location, sound infrastructure, a vast economic hinterland and powerful aviation market, it also requires the country, local governments and

industrial management departments to introduce supporting policies and loosen the corresponding control.

Firstly, the construction of the air hub needs the government to create a loose business environment, so that the airlines can have proper decision-making authorities on routes, fares, models and flight times as well as the airlines can smoothly construct and operate the central route network. Secondly, the customs, frontier inspection department and other departments should take effective measures to design, implement and simplify the efficient joint inspection procedures. Thirdly, in terms of traffic rights, the transition from the city to the central radiation route network will inevitably be accompanied by the opening of the traffic rights.

#### 4.1.2 Assessing methods

##### (1) Statistical analysis

Statistical analysis refers to the research activities which adopt statistical methods and knowledge related to the object of analysis in combination with quantitative and qualitative analysis. It is an important work after statistical design, statistical investigation and statistical arrangement. And it is the analysis on the basis of the previous work, in order to achieve a deeper understanding of the object of study. Meanwhile, it is also the research activities in certain topics integrating the design of the analysis scheme and the collection and arrangement of the data. Systematic and perfect data is a prerequisite for statistical analysis.

Application of statistical methods and the combination of quantitative and qualitative

methods are important features of statistical analysis (Wikipedia, 2017). With the popularity of statistical methods, not only statisticians can do statistical analysis, but workers from all walks of life can also adopt statistical methods for statistical analysis. It is strictly incorrect to say that the analysis activities that statisticians participate in are called statistical analysis. It is the product of statistical analysis to provide accurate and timely statistical data with high quality and the high-level statistical analysis report in certain depth and extent. In a sense, the provision of high-level statistical analysis report is the final product of statistical data through further processing.

## (2) Comparative study

Comparative study is the study and judgment of the similarities or differences between things and between people. The method of comparative study can be understood as the study of two or more connected things according to certain standards, to seek for the similarities and differences between them, and the universal laws and the special laws.

Everything is the unity of quality and quantity, so in the process of scientific research, we should not only grasp the quality of things, but also grasp the quantity of things. The qualitative comparison mentioned here is to determine the nature of things by comparing the essential attributes of things. Quantitative comparison is the quantitative analysis of the attributes of things in order to accurately formulate changes in things. Qualitative analysis and quantitative analysis have their own advantages. In educational science research, we should pursue the unity of the two, but not blindly pursue quantization. Education is, after all, an activity different from

workers' manufacturing, and many things are not quantifiable. But we must have certain quantity concept and have a clear idea about the “quantity”, and let the figures speak.

#### 4.2 Sample air hubs

In this paper, the choice of the hub is divided into international and domestic hubs. For the international hub, choose Dubai air hub, Atlanta air hub and London air hub. For domestic hubs, choose Beijing air hub, Guangzhou air hub and Chengdu air hub as sample hubs for statistical analysis and comparative research with Shanghai air hub respectively. The reasons for choosing the seven hubs are as follows:

Firstly, these air hubs are major airports in large scale in the world. They have great market demand. And they all have extensive economic hinterland, excellent geographical location and good hardware facilities;

Secondly, the three international hubs ranked the world's top ten hubs in throughput of passengers and freight and take-off and landing sorties in 2016. Similarly, the air hubs in Beijing, Guangzhou and Chengdu are all comparable to Shanghai air hub in the scale of throughput;

Thirdly, the seven air hubs all have obvious policy advantages. National and local governments have introduced supporting policies to support their development and strengthen interconnection and trade contact with other hubs.

In a word, this paper chooses the six air hubs in Dubai, Atlanta, London, Beijing,

Guangzhou and Chengdu respectively as the object for comparative analysis and study with Shanghai air hub. The following table is the general introduction to the hubs:

Table 4 Introduction to the sample hubs

Sample hubs	Introduction to the hub
London	<p>London is the political, economic, cultural and financial center of Britain, as well as the global financial center. The air transport is exceptionally developed in London, and nine airports adopt the name of “London Airport”. However, the passenger throughput in London is centered on six airports. London Heathrow Airport, one of the busiest international airports in the world, remained the world's largest hub for international passenger transport in 2013. It ranked the second to Dubai International Airport in 2014. London Gatwick Airport, London Stansted Airport, Luton Airport and Southend Airport are mainly responsible for low-priced routes in short distance. London City Airport is the smallest and closest to the downtown. It mainly serves business travelers and some short-distance flights.</p> <p>London is also the only city in the world with four airports, which have the passenger throughput above ten million.</p>
Dubai	<p>Dubai International Airport is the most populous city in the United Arab Emirates, the wealthiest city in the Middle East, the economic and financial center of the Middle East, and the capital of trade in Arabia.</p> <p>Dubai International Airport, located 4.6 kilometers east of Dubai, is owned by the Dubai municipal government. It is operated and managed</p>



	<p>by Dubai Airport company, and provides aviation services for Dubai. In terms of passenger volume, it is the fifth busiest airport in the world, and it is also the sixth busiest cargo airport in the world in terms of freight volume. Over the next 20 years, Dubai airport high-speed growth trend is obvious, is expected to achieve 98.5 million of passenger throughout and 4.1 million tons of cargo throughput in 2020.</p>
Atlanta	<p>Atlanta is the strategic point of land and air transportation as well as the financial center in Southeast America. Although there is only one airport in Atlanta, Atlanta has become the world air hub center with its huge transport volume as the busiest airport in the world.</p> <p>Atlanta Airport is the largest and busiest airport in the world for passenger transfers. Passenger throughput has ranked first in the world for a long time. In 2016, the passenger throughput reached 104.3 million passengers, and then it was the only one airport in the world with the passenger throughput above 100 million passengers.</p>
Chengdu	<p>In the 13th Five-Year Plan, CAAC Southwest Regional Administration will declare Chengdu as an international air hub in China. After the successful declaration, Chengdu will become the fourth international air hub city after Beijing, Shanghai and Guangzhou. Chengdu Shuangliu International Airport has become one of the busiest airports in the world. During the Spring Festival of 2015, there were over 140 thousand passengers entering and leaving the airport every day. There were about 880 flights entering and leaving the airport every day. That is to say, there was a plane taking off or landing at Chengdu Shuangliu International Airport almost every minute.</p> <p>In 2016, the passenger throughput of Chengdu Shuangliu International</p>

	<p>Airport reached 46 million passengers, ranking the fourth among domestic airports and the world's top 30 airports in passenger throughput. The international and regional passenger throughput exceeded 4 million passengers, also ranking fourth in the national cities.</p>
Guangzhou	<p>Guangzhou Baiyun International Airport is one of the three international hub airports in China. In 2016, the passenger throughput was 59.73 million passengers, and the throughput of freight and mail was 1.65 million tons. There were 149 international routes, with an access to more than 200 countries and regions in Asia, Africa, Europe, North America and Oceania. The Second Terminal will be put into operation before the Spring Festival of 2018, which will satisfy the demand for 80 million passengers in passenger throughput, 2.5 million tons in the throughput of freight and mail, and 620 thousand sorties for take-off and landing. T3 Terminal will be completed in 2022. And the fourth and fifth runways have been in the planning and construction.</p> <p>After the completion of the third phase of expansion project in Guangzhou Baiyun International Airport, it is expected to reach 105 million passengers per year in passenger throughput and 5 million tons per year in the throughput of freight and mail.</p>
Beijing	<p>Beijing--the political and economic center of China, is the busiest air hub in China. It is the second busiest hub in the Asian-Pacific region after Tokyo. Beijing has two airports. Beijing-Capital International Airport occupies a dominant position. In 2015, the annual passenger throughput was more than 94.39 million passengers, ranking first in Asia and second in the world.</p>

Source: CARNOC.com; gbiac.net; bcia.com.cn; dubaiairports.ae; cdairport.com

### 4.3 Empirical analysis

The seven ports are analyzed and compared through six indexes in the following.

#### (1) Passenger throughput

The following table presents detailed data on passenger throughput from 2012 to 2016:

Table 5 Passenger throughput from 2012 to 2016

Airport name	Passenger throughput (person)				
	2016	2015	2014	2013	2012
Beijing	94,393,454	89,939,049	86,128,313	83,712,355	81,929,352
Shanghai	106,462,549	99,188,938	89,659,029	82,789,492	78,708,890
Guangzhou	59,732,147	55,201,915	54,780,346	52,450,262	48,309,410
Chengdu	46,039,037	42,239,468	37,675,232	33,444,618	31,595,130
Dubai	836,500	780,100	714,300	664,300	576,800
Atlanta	1,042,500	1,014,900	961,800	944,300	954,600
London Heathrow	757,100	749,900	733,700	723,700	700,400

Source: CARNOC.com; ACI; askci; ccaonline; UFSOO.com; Shanghai statistics bureau

From 2012 to 2016 the seven large hub ports basically present a trend of increase in passenger throughput, it is worth mentioning that in 2016 Shanghai's two major airports surpassed Atlanta airport, which ranked first in the world. The passenger throughput of the Beijing hub is basically flat with that of Shanghai's two airports,

and Beijing's capital airport ranked No. 1 in terms of passenger throughput. For Shanghai Airport, it has an advantage in passenger transport. Based on the index of passenger throughput from 2012 to 2016, the ranking of Shanghai Airport is No.1, and Beijing Airport is No.2.

(2) Cargo throughout

The following table presents detailed data on cargo throughput from 2012 to 2016:

Table 6 Cargo throughput from 2012 to 2016

Airport name	Cargo throughput (ton)				
	2016	2015	2014	2013	2012
Beijing	1,943,159	1,889,439	1,848,251	1,843,681	1,799,863
Shanghai	3,869,187	3,708,831	3,613,830	3,363,643	3,367,971
Guangzhou	1,652,214	1,537,758	1,454,044	1,309,745	1,248,763
Chengdu	611,590	556,552	545,011	501,391	508,031
Dubai	2,592,454	2,510,841	2,367,574	2,396,249	2,291,474
Atlanta	4,322,071	4,258,275	4,197,365	4,122,891	3,968,217
London Heathrow	1,483,677	1,491,183	1,499,258	1,507,456	1,653,792

Source: CARNOC.com; ACI; askci; ccaonline; UFSOO.com; Shanghai statistics bureau

From the above table, Atlanta Airport has an advantage in cargo transport. Based on the index of cargo throughput from 2012 to 2016, the ranking of Atlanta Airport is No.1, and Shanghai Airport is No.2. The Chengdu Airport is the last one. Shanghai Pudong airport has been ranked first in the country, while Shanghai's two major airports have combined cargo throughput far more than other domestic hubs. The freight throughput of these seven hubs is also basically increasing each year, but it is

not volatile. In addition, the hubs in London fell slightly, and it can be found that freight throughput is about 4% of passenger throughput.

### (3) Aircraft takeoff and landing time

The following table presents detailed data on aircraft takeoff and landing time from 2012 to 2016:

Table 7 Aircraft takeoff and landing time from 2012 to 2016

Airport name	Take-off and landing sorties (Time)				
	2016	2015	2014	2013	2012
Beijing	606,081	590,199	581,952	567,757	557,159
Shanghai	741,883	705,774	655,430	615,106	596,662
Guangzhou	435,231	409,679	412,210	394,403	373,314
Chengdu	319,382	293,643	270,054	250,532	242,658
Dubai	498,220	403,517	353,507	369,953	344,245
Atlanta	882,497	914,778	911,124	913,161	894,156
London Heathrow	481,825	472,817	471,046	472,059	471,341

Source: CARNOC.com; ACI; askci; ccaonline; xinhuanet.com; Shanghai statistics bureau

From the above table, Atlanta Airport has an advantage in aircraft takeoff and landing time. Based on the index of aircraft takeoff and landing time from 2012 to 2016, the ranking of Atlanta Airport is No.1, and Shanghai Airport is No.2. The Chengdu Airport is the last one.

### (4) Geographical location

The following table presents detailed situation of geographical location:

Table 8 Geographical location

Airport name	Geographical location
Beijing	Beijing Capital International Airport is the largest international air hub in China with the most important geographical position, the most complete equipment and the busiest transportation and production.
Shanghai	Shanghai air hub has superior regional advantages, as it is located in the center of the economic circle in the Yangtze River Delta. In geography, it is also the most important economic center in China. And it is also the intersection of China's eastern coastal economic belt and the Yangtze River Basin. It is located on the West Bank of the Pacific Ocean, and on the triangular routes of Asia, Europe and America.
Guangzhou	Guangzhou Baiyun International Airport has occupied natural geographical advantages in the routes of Oceania, Africa and Southeast Asia, South Asia and the Middle East, becoming the first domestic gateway airport in an access to Oceania, Africa and Southeast Asia, South Asia and Middle East.
Chengdu	Chengdu Shuangliu International Airport, located in the southwestern suburb of Chengdu City, is 16 kilometers away from downtown. It has the expressway and many bus lines in direct access to the urban area. And there is a long-distance bus station, taxi service station and high-speed rail and other convenient traffic networks to connect the air and ground transportation.  Chengdu Tianfu International Airport, 51 kilometers from downtown

	Chengdu, is the largest project of civil transport hub airport in the national planning and construction of "13th Five-Year Plan".
Dubai	Dubai International Airport is located in the center of Europe, Asia and Africa with superior geographical position while there is no domestic market. Therefore, it is very suitable for the development of international transfer.
Atlanta	Through the route network layout in ATL, passengers can fly to the regions covering 80% of the total population of the United States within 2 hours.
London Heathrow	London Heathrow International Airport, 24 kilometers away from the downtown area, was put into use in the 1940s. It covers an area of about 12 square kilometers, with 2 runways and 5 terminals. Heathrow International Airport is the most important international hub airport in Britain, the center of air traffic in Europe and one of the busiest airports in the world.

Source: CARNOC.com; gbiac.net; bcia.com.cn; dubaiairports.ae; cdairport.com; Wikipedia

Figure 4 the Location of the Dubai Airport

Figure 5 London Airport' s location



Source: tianxun.com; Wikipedia

From the above table, the seven airports are all located in excellent geographical location.

(5) Facilities condition

The following table presents detailed situation of facilities location.

Table 9 Facilities location

Airport name	Facilities location
Beijing	Beijing Capital International Airport has three terminals and two 4E runways
Shanghai	Pudong airport operates two passenger terminal buildings, covering an area of 822,000 square meters, and auxiliary facilities, including 560 check-in counters, 70 boarding bridges and 162 parking apron. Hongqiao



	airport operates two passenger terminal buildings and two runways, covering an area of 445000 square meters, and auxiliary facilities, including 206 check-in counters, 67 boarding bridges and 161 parking apron.
Guangzhou	The airport now has 3 runways and 1 terminal, and the long-term plan includes 5 runways and 3 terminals.
Chengdu	The airport has two parallel runways and two terminals with an area of 500 thousand square meters.
Dubai	Dubai International Airport has three terminals and five waiting halls.
Atlanta	The infrastructure is also ample with 3 terminal buildings, 6 terminal corridors and 207 boarding gates. At present, ATL is connected to 4 expressways.
London Heathrow	London Heathrow International Airport has 2 runways and 5 terminals. The third runway at Heathrow Airport is planned to expand.

Source: CARNOC.com; Wikipedia

From the above table, the hardware facilities of these airports are also good with 2-5 terminal buildings and high-level runways.

#### (6) Policy support

The following table presents detailed situation of policy support.

Table 10 Policy support

Airport name	Policy support
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Beijing	In terms of policy conditions, the operation pattern of the two airports should be divided according to the aviation alliance, so that it can avoid repeated investment on the basis of maintaining moderate competition, and enhance the operation quality of the route network based on this airport
Shanghai	Strategy of "The Belt and Road "
Guangzhou	It has initially formed an "Air Silk Road" which starts from Guangzhou, covers Southeast Asia and connects Europe, America and Australia with an access to major cities in mainland China.
Chengdu	Strategy of "The Belt and Road "
Dubai	The government has implemented a series of investment and tax exemption policies to attract air travelers worldwide
Atlanta	In terms of policy, ATL has early enjoyed the great changes due to aviation deregulation policies, which caused a series of important changes in air transport system.
London Heathrow	The British government hopes to stimulate the economy by increasing investment of capital construction to protect against external economic risks.

Source: Chinadaily; GOV.cn; xinhuanet.com; Ministry of Commerce of the People's Republic of China; CARNOC.com

Except of ATL airport, the expansion and investment projects of other abroad airports are approved by the local government. But ATL has early enjoyed the great changes due to aviation deregulation policies, which contributed to the astonishing growth in air traffic volume. Shanghai airport, Chengdu airport, and Guangzhou airport are all benefit from the Strategy of "the Belt and Road ".

#### 4.4 Findings

From the above tables 5, 6 and 7, we can get the following findings:

Table 11 the ranking from comparison of three quantitative indicators

Airport name	Passenger throughput	Cargo throughput	Take-off and landing sorties	Integrated ranking
Beijing	2	4	3	<b>3</b>
Shanghai	1	2	2	<b>1</b>
Guangzhou	3	5	6	<b>5</b>
Chengdu	4	7	7	<b>6</b>
Dubai	6	3	4	<b>4</b>
Atlanta	5	1	1	<b>2</b>
London Heathrow	7	6	5	<b>6</b>

Source: own calculation

From the above table, Shanghai Airport has an advantage in passenger transport, Cargo transport, and take-off and landing sorties. Based on comparison of the three quantitative indicators, the integrated ranking of shanghai Airport is No.1, and

Atlanta Airport is No.2.

From the qualitative indicators, the seven airports are all located in excellent geographical location. The hardware facilities of these airports are also good with 2-5 terminal buildings. Except of ATL airport, the expansion projects of other six airports are approved by the local government. But ATL has early enjoyed the great changes due to aviation deregulation policies, which contributed to the astonishing growth in air traffic volume.

After statistical analysis and comparative study, it is found that these seven hubs have their own characteristics and advantages, and they have certain influence and competitiveness in China and even the whole world. The six indexes selected in this article can well explain their basic conditions and prospects for the development of an international air hub. From the three qualitative indicators, we can see that Shanghai's two airports about the passenger or freight ranked first in China for the last few years, and has always maintained a position of ten of the world's top. In the quantitative indicators, Shanghai Airlines hub also shows its strong competitiveness, whether it is geographical location, infrastructure or policy support.

#### 4.5 Suggestions

Through the above research and analysis of the results of a large number of documents, we can recommend the following countermeasures and suggestions:

- (1) The construction of Shanghai international aviation hub should pay attention to give full play to regional advantages, combining the efficiency of route layout,

development potential and the long-term development strategy. Such as Atlanta airport, Heathrow airport and Dubai airport as transit hubs, superior geographical location is an important condition. Not all airports can become an international hub airport, and we must be take the airport's own geographical position into consideration to define the function orientation of the airport.

- (2) Shanghai international aviation hub construction should pay attention to the role of government. Beijing, Chengdu and Dubai airport can rapidly grow into an international hub airport. The important reason is the promotion of national strategy. In the process of building an international hub airport, we should focus on three aspects. First, we should formulate corresponding national strategies to speed up the construction and development of airports. The second is to create a loose policy and legal environment to provide the airlines with moderate decision-making power. Third, making appropriate airport development plans to promote the sustainable development strategy of the airport.
  
- (3) The construction of Shanghai international aviation hub should focus on software and hardware construction, and hardware is the foundation. In combination with the actual situation, the construction of a multi-mode transportation hub is an important measure to expand the service radius of the airport and expand the market of airport hinterland. According to the regional development needs, we will constantly strengthen the construction of airport facilities, enhance the capacity of airport services, and promote the construction of international hub airports. Passenger transit is the most important function of international hub airport, therefore in the process of strengthening the construction of airport facilities, we should pay attention to build complete transit facilities, including a

number of the airfield runway and reasonable process of transit facilities, advanced flight information system and related supporting services. On the other hand, we should pay attention to the construction of "people-oriented" service system. Perfect service system is one of the basic requirements of international hub airport. Thus, both hardware and software services are guaranteed.

- (4) The construction of Shanghai international aviation hub should pay attention to the joint development with airlines. Airlines is the most important partner, the airport is able to get in touch with aviation market and aviation resources agglomeration through collaboration with airlines. Judging from the factors of international hub airports, it is one of the essential conditions for the international hub airports to have a strong base air. Therefore, the construction of international hub airports should pay attention to the adoption of policies, services and other important airlines to enter the airport.

## **5. Conclusions**

### 5.1 Main findings

This paper study the development of Shanghai International Air Transportation Hub, one of the inseparable part of Shanghai international shipping center. From the study, the following conclusions have been drawn:

- (1) Under “the Belt and Road” and other national strategies including the construction of Shanghai international shipping center, the opportunity and challenge of Shanghai construction international air hub coexist.
- (2) Shanghai Airport has an advantage in passenger transport, Cargo transport, and take-off and landing sorties. However, there exists some disadvantages in the soft environment.
- (3) The construction of Shanghai international aviation hub is one of the general objectives of the construction of Shanghai international shipping center. In order to accelerate the construction of international aviation hub, we need to improve the infrastructure protection ability, to break the bottleneck of the development of air transport, and focus on long-term development, to strengthen the system of strategic planning, to accelerate the construction of a world-class aviation hub and to play its due role in order to better serve the Yangtze River Delta and the country.

## 5.2 Limitations of research

The drawback of the paper is that the article only aims at selecting six major indexes and six representative international and domestic hub airports, and finally draws a conclusion by means of statistical analysis and comparative study.

First of all, the selected indicators has certain characteristics, but not enough to Overgeneralization, only one-sided assessment of Shanghai proved to own basic conditions of international transportation hub. Second, the data sources are accurate, but only cargo throughput, passenger handling capacity and the number of landings and landings are analyzed from 2012 to 2016. The amount of data is very limited, leading to limitations of the analysis results. Third, the three qualitative indicators can be much smaller than that for the construction of Shanghai international hub can experience, different policies can also contributed to the development of the aviation hub in some way in the future.



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