Study on the Agglomeration and Diffusion Effect of Shipping Logistics Industry in Shanghai[*]

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Abstract:

To build Shanghai International shipping center refers to the typical shipping industry spatially agglomerated in Shanghai. By taking location quotient and gravitational force model, this paper calculated the agglomeration effect and diffusion effect of Shanghai shipping logistics industry. It is explored Shanghai's shipping location quotient appears inverse"U" shape; the agglomeration tendency is very stable. However, the diffusion effect is very limited spatially, 80% happened along Yangtze River, only 20% spread to other areas. Furthermore, the competition and cooperation strategy between core and core regions, the enhancing core diffusion and fostering hinterland between core and peripheral regions are given.

Key Words: Shanghai, Shipping Logistics Industry, Shipping Center, Agglomeration Effect.

I. INTRODUCTION

On the 25th March, 2009, the executive meetings of the State Council formally approved < Proposals on promoting Shanghai to accelerate the development of modern service industry and advanced manufacturing industry, constructing international financial and shipping center from State Council>, upgrading   the construction of Shanghai international shipping center to the national strategy. Taking international shipping industry as the core bond, shipping center is the international port metropolis that agglomerates elements and resources of shipping industry. From the perspective of industrial space, the construction of Shanghai shipping center is the efficient agglomeration of shipping logistics industry. This paper explores the way to construction of shipping center by the extent of specialized agglomeration in the industry and driven effect to other areas.

II. RESEARCH OF AGGLOMERATION EFFECT IN SHANGHAI SHIPPING LOGISTICS INDUSTRY

Shipping industry is the sub-industry of logistics industry. Because of traits like low cost and long-journey transport, shipping has become the main means of logistics at home and abroad. This essay measures the location quotient change of Shanghai shipping and logistics industry from 2001 to 2008, and further measures the agglomeration effect of shipping and logistics industry in the Yangtze River Delta and typical provinces along the coast and river to summarize the agglomeration effect of shipping and logistic industries in each area.

1. Location quotient of Shanghai shipping and logistics industry

Because of the statistical specifications problem, the development of Chinese logistics industry nowadays still remains at the level of cargo movement. Therefore, this essay uses the statistics in traffic, storage, and post industry instead of that in shipping and logistics industry. Moreover, the statistics are mainly from <China Statistical Yearbook>, calculate the number of staff in different industries according to index of number employed and location quotient of logistics industries in 10 cities and provinces along the Yangtze River and coast to get the location quotient in Shanghai logistics industry from 2000 to 2008. It is shown in Figure 1.
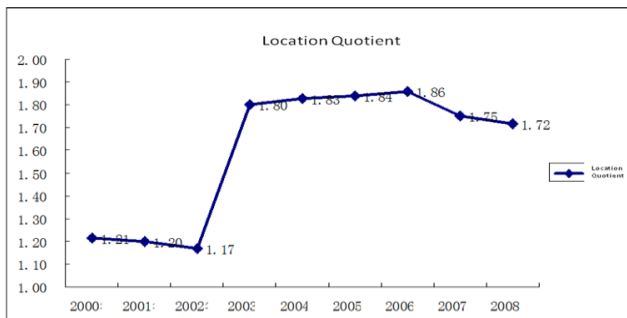

Figure 1 the location quotient change of Shanghai logistics industry from 2000 to 2008

As is shown in graph 1, from 2000 to 2008, Shanghai's shipping location quotient appears inverse 'U' shape. Furthermore, the location quotient from 2000 to 2002 is comparatively low. As the State Council issued the policy guidance to strengthen the development of logistics industry and the commitment to WTO in 2003, Shanghai logistic industry began to develop rapidly. However, this momentum met bottle neck in 2006 again, location quotient reduced slowly. It is clear that after 2007, the location quotient of Shanghai shipping and logistics tended to be steady, and change from polarization to diffusion.

2. The location quotient of shipping and logistics industry in several provinces

Figure 2 is the result of the location quotient of logistics industry in 10 cities and provinces from 2004 to 2008.
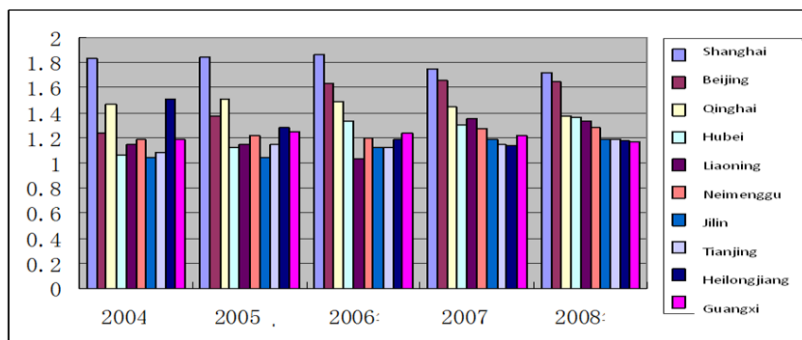

Figure 2. The location quotient ranking of logistics industry in main cities and provinces from 2004 to 2008

From figure 2, it is clear that the location quotient of logistics industry in 10 provinces appears to be echelon shape; the development of logistics industry in each area is hierarchical. Compared with other provinces and shipping cities, the agglomeration degree of Shanghai's freight capacity in article circulation area remains the top one, and the quotient is above 1.72. Additionally, the logistics industry in other areas raises steadily, the location quotient in Beijing ranks the second after 2006, and the quotient is about 1.6. The gap among other provinces is not big, they belong to the third echelon, and the quotient is about 1.2.

According to figure 2, after 2006, the gap of location quotient between Shanghai logistics and other cities and provinces narrows down, this means the agglomeration degree of this industry continuously rises, and the agglomeration difference among areas reduces. The agglomeration and diffusion coexist in the whole industry, and this means core and fringe areas present good converging development.

3. The competition among domestic shipping cities

From 2004 to 2008, the shipping industry boom year by year, this is shown in table 1.

Table 1 2004-2008 development of domestic shipping transportation industry

Index	2004	2005	2006	2007	2008
Length of transport routes(10 thousand km)	419.03	562.74	586.44	623.65	651.31
Inland waterway mileage	12.33	12.33	12.34	12.35	12.28
Civil Aviation Routes	204.94	199.85	211.35	234.3	246.18
Total freight volume (10 thousand tons)	1706412	1862066	2037059.7	2275821.6	2587412.6
Railway	249017	269296	288224	314237	330354.14
Highway	1244990	1341778	1466347	1639432	1916759
Waterway	187394	219648	248703	281199	294510
Civil Aviation	276.7	306.7	349.43	401.85	407.64
Pipeline	24734	31037	33436.27	40551.76	45381.82
Cargo throughput at ports above coastal scale(10 thousand tons)	246074	292777	342191	388200	429599

Nowadays, the actual development and growth pattern in every province also have problems. Shipping center can stimulate the agglomeration of elements within the area and promote regional economic development, so each local government takes the development of shipping center as the goal, and this makes every government compete viciously and imitate each other when they develop and construct ports. In 2007, <Revitalization plan in Northeast> suggest taking the advantage of northeast to make Dalian the international shipping center in Northeast Asia. Moreover, in 2009, <The suggestion about accelerating the construction of North international shipping center in Tianjin Binhai New Area > released by Tianjin indicated that Tianjin Binhai New Area will spend 5 to 6years to establish North international shipping center initially that serves North of China, Northeast Asia and Central and West Asia. Furthermore, Shandong province expressed clearly that it totally support Qingdao to compete for North international shipping center.

Nowadays, the tendency of ports' planning and development within one cluster are the same, and the homogenization of port business is serious. This will cause repeat investment for construction and vicious competition within one port group, reducing efficiency. Today, the throughput of ports in our country has exceeded 25% of actual need, and in terms of ports' utilization, Dalian is 78%, Qingdao is 68% and Tianjin is 55%, if it adds ports under construction and to be built, supply and demand will further imbalance.

III. THE RESEARCH OF DIFFUSION EFFECT IN SHANGHAI SHIPPING AND LOGISTICS INDUSTRY

While Shanghai shipping and logistics industry is obviously agglomerated, it also has diffusion effect. This essay will establish logistics and economic contact intensity model based on gravitational model, and determine Shanghai main diffusion direction and influence intensity by calculating this economic influence degree.

The fundamental thought of gravitational model is oriented from Newton's law of universal gravitation; mainly reflect the ability to attract between two objects. Therefore, the logistics and economic contact intensity model based on this reflects the tightness of logistics contact among all regional units, and it determines Shanghai's spatial diffusion direction throughout the region by intensity division of Shanghai and other regions.

The formula of logistics and economic contact intensity among Shanghai and other areas is :

$$F_{sj} = \left(\sqrt{P_s G_s} * \sqrt{P_j G_j} \right) \Big/ D_{sj}^2 \quad \text{.................(1)}$$

Take logarithm for both sides, and make formula 1 dimensionless:

$$\ln F_{sj} = \frac{1}{2} \ln P_s + \frac{1}{2} \ln G_s + \frac{1}{2} \ln P_j + \frac{1}{2} \ln G_j - 2 \ln D_{sj} \quad \text{.................(2)}$$

s means Shanghai, j means another area, F_{sj} is the logistics and economic contact intensity, P_s and P_j are the total freight volume between two areas, G_s and G_j are the total income of logistics between two areas, D_{sj} is the shortest road distance between the central cities in two areas.

Total freight volume includes railway, highway, waterway, civil aviation and pipeline. Total income of logistics uses transportation, storage and postal industry, and the shortest road distance is that between Shanghai and each provincial capital. Furthermore, all the data is from <China Statistical Yearbook> and China Traffic Map, and it measures the gravity between Shanghai and other 30 provinces, the gravity of Shanghai to Yangtze River Delta and each province use percentage, which is shown in table 2.

Table 2 Logistics and economic contact between Shanghai and each province

Province	Gravity（%）	Province	Gravity（%）	Province	Gravity（%）
Zhejiang	**53.22**	Guangdong	0.91	Heilongjiang	0.18
Jiangsu	**21.98**	Shanxi	0.66	Jilin	0.16
Anhui	**6.49**	Liaoning	0.46	Guizhou	0.11
Shandong	4.55	Shanxi	0.43	Gansu	0.08
Henan	1.97	Tianjin	0.41	Yunnan	0.08
Fujian	1.53	Neimenggu	0.41	Ningxia	0.05
Jiangxi	1.48	Beijing	0.32	Hainan	0.04
Hebei	1.41	Sichuan	0.28	Xinjiang	0.03
Hubei	1.29	Guangxi	0.23	Qinghai	0.02
Hunan	1.02	Chongqing	0.18	Xizang	0.00

Table 2 shows that the influence of Shanghai to other provinces mainly concentrates on Yangtze River Delta, and the radiation effects of Shanghai to Zhejiang, Jiangsu and Anhui occupies 81.69% of Shanghai's total radiation, especially to Zhejiang and Jiangsu, totally 75.2%.

Therefore, Shanghai's radiation capacity concentrates on downstream of Yangtze River, especially Yangtze River Delta Region. Additionally, the logistics and economic contact with Zhejiang and Jiangsu is quite close, but it has less contact with other cities, 80% of external links focus on downstream of Yangtze River, and the contact with other regions only accounts for 20%.

IV.   THE STRATEGIES TO SHANGHAI SHIPPING CENTER UPGRADING

According to the analysis above, Shanghai logistics and shipping industry has good agglomeration effect, and have advantages to compete with coastal cities. Moreover, in aspects of diffusion, Shanghai's influence is comparatively small, focusing on downstream of Yangtze River and Yangtze River Delta. Therefore, we should use policy to provide Shanghai core area with growth environment to complement with each other, promoting the development of new secondary core area to reach the structure mode 'space integration' instead of 'core-fringe'.

1.   Regional competition and cooperation among core cities

Shanghai should cooperate with surrounding ports, it is necessary for surrounding ports to compete and cooperate with Shanghai port in order to optimize interests. Moreover, national whole industry development needs integration of every shipping city. Realizing complementary competition and cooperation and reducing fix cost and sunk cost are good for reducing staff fix cost; attraction and cultivation of the talented people and sharing of human resource are good for eliminating cost.

Competition and cooperation exist economies of scale, and it can save investment of shipping city in terms of resources, reduce sunk cost and make full use of heterogeneity resource from other shipping cities to expand resource boundary of shipping cities. Meanwhile, it can also increase resource utilization and have coordination effect by complement of mutual resources and ability. Furthermore, good competition is good for stimulating shipping city more efficiently, and cooperation combines every link, like shipping equipment R&D, distribution of goods and service to get the optimal combination, and specification and work division degree improve, finally making the whole competitiveness of Chinese shipping city improve. See Figure 3.
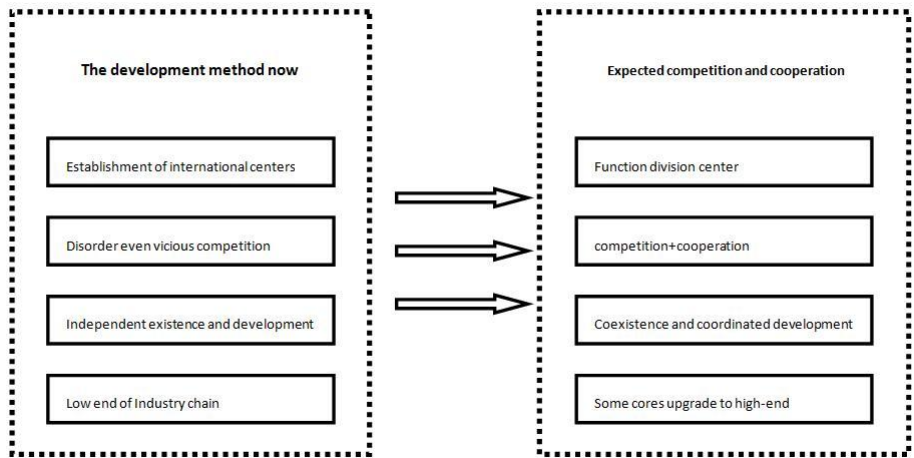

Figure 3 the whole development method of shipping city

We should avoid the competitive domestication of international shipping, emphasize the development of the competition and accompany between each shipping cities, detail the division of work, cooperate to win together. On the other hand, Shanghai harbor shipping industry is mainly in the low part of industrial chain. In order to emphasize the international influence of harbors, Shanghai harbors must expand actively the upper sections such as shipping service and shipping finance. This also needs the coordination and support from surrounding harbors. All of these can promote development of co-competition models, promote the overall regional cooperation between Bohai Gulf, Yangtze River Delta and Pearl River Delta and form the coastal shipping city chain.

2. Enhance the radiation function of core cities and cultivate hinterland

The diffuse influence of Shanghai transportation is mainly concentrating in Yangtze River Delta region. In the future, on the basis of continuing to increase the interaction between Shanghai and Yangtze River Delta region, Shanghai should promote actively integrated development with upper-middle regions of Yangtze River Delta in order to establish the

modern integrated and distributed system, which is going to scale, intensity, efficiency and optimum structure. This system set Shanghai as the core, Jiangsu and Zhejiang Provinces as two wings and Yangtze River Delta as hinterlands. Through this system, it can enhance the driving influence from Shanghai to Yangtze River region and extend its radiation regions. See Figure 4.

To the plan of Yangtze River valley and Delta, it should establish the network system, break barrier between different departments for each provinces and local protect and influence market barriers. Meanwhile, it should also complete a set of devices and facilities and perfect the system of relating services. Due to the support of government policies, the accumulated effects from economic development and other factors, Shanghai will be at the core position in a relative long period.

If it only wants to depend on the surrounding-area radiation effect from Eastern central areas to Midwestern areas in order to drive development naturally, the phenomenon of polarization in the development of Chinese shipping industry will continue to a long time. Therefore, to pace up the overall growth and convergence of Chinese shipping industry, government can do two things simultaneously. That is government can not only through the radiation drive from Eastern areas, but also through training the growth pole in the upper-middle parts of Yangtze River, such as upper reaches- Chongqing, middle reaches- Wuhan, lower reaches- Shanghai (figure 4). It can establish a regional structure of " core- edge", which is clear off marginal areas through the inside development, drive coastal economic development and pace up the faster and better overall development in Chinese Shipping Industry.
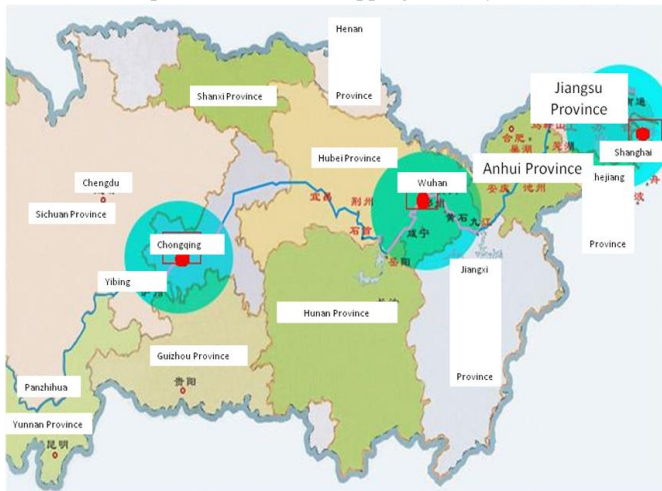

Figure 4 planning and advice of Yangtze River

V.   CONCLUSIONS

Chinese State Council published the proposals to construct Shanghai to be international financial and shipping center in 2020. Taking international shipping industry as the core bond, shipping center is the international port metropolis that agglomerates elements and resources of shipping industry. From the perspective of industrial space, this paper explores the way to construction of shipping center by the extent of specialized agglomeration in the industry and driven effect to other areas. By taking location quotient and gravitational force model, this paper calculated the agglomeration effect and diffusion effect of Shanghai shipping logistics industry. It is explored Shanghai's shipping location quotient appears inverse"U" shape; the agglomeration tendency is very stable. However, the diffusion effect is very limited spatially, 80% happened along Yangtze River, only 20% spread to other areas. Finally the competition and cooperation strategy between core and core regions, the enhancing core diffusion and fostering hinterland between core and peripheral regions are given.

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