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Research on Quality Construction of National Logistics Hub in Yangtze River Delta Based on DPSIR Model

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Abstract: Under the background of double circulation, the national logistics hub will play an important role of node, hub and platform in the national logistics network. As a national strategy, the integration of Yangtze River Delta matters a lot to the national logistics network. This study constructs the evaluation index system of national logistics hubs and studies the construction of national logistics hubs in Yangtze River Delta and central China based on DPSIR theory. DPSIR model integrates the advantages of pressure-state-response (PSR) model and driving-state-response (DSR) model, and evaluates from driving force, pressure, state, influence and response. The results show that the construction of national logistics hubs in Shanghai, Nanjing, Suzhou, Ningbo-Zhoushan, Jinhua and other cities in the Yangtze River Delta is obviously better than that in the central part of China. In order to adapt to the integrated development of Yangtze River Delta and enhance the status of Anhui province in the national logistics hub network, logistics hub cities in Anhui Province should take effective measures from five aspects of the model. For example, concentrate on developing the economy; optimize the urban transportation system; build distinctive industrial clusters; develop multimodal transport facilities; innovate smart logistics models; treasure the construction of cold chain logistics; strengthen macro policy support; building a response mechanism for ecological green development.

Keywords: Yangtze River Delta, National Logistics Hub, High Quality Development, DPSIR Model

1. Introduction

The National Development and Reform Commission and the Ministry of Transport of the People's Republic of China jointly, in December 2018, issued the National Logistics Hub Layout and Construction Plan. In 2019, there were 23 national logistics hubs selected in the list, and another 22 cities were selected in 2020. These 45 national logistics hubs will play an important role as nodes, hubs, platforms in the national logistics network in the future. In December 2019, the Communist Party of China Central Committee and the State Council issued an outline of the integrated regional development of the Yangtze River Delta. The Yangtze River Delta integration was promoted to national strategy, with the Belt and Road, the Pearl River Delta integration, Yangtze River Economic Belt, commit to improve the spatial pattern of China's reform and opening up [1-2]. The purpose of the integrated development of regional economy in the Yangtze River Delta is to make the economy fully integrated, free flow of production factors to improve the efficiency of scale economy [3]. By comparing the construction of national logistics hubs in the Yangtze River Delta and central region, this paper try to find out the factors that promote and hinder the development of logistics, provide suggestions for the high-quality development of the logistics industry in Anhui province.

2. Literature Review

The research on Yangtze River Delta involves many fields and aspects. Shao Yaochun explored ways to promote the transformation and upgrading of traditional agriculture in the Yangtze River Delta [4]. Zhang Wei and Hu Yan studied the relationship between innovative human capital and green total factor productivity in the Yangtze River Delta by using

the spatial Dubin model from the perspectives of the whole region and sub-regions [5]. Wang Jingtian, Zhang Baoyi and Fu Xiaodong studied the impact of the collaborative agglomeration of producer services and manufacturing on urban total factor productivity in the Yangtze River Delta [6]. Zhao Haifeng and Zhang Ying analyzed the mechanism of specialization and differentiation division of labor in the Yangtze River Delta through multiple mediating effect test [7]. Liu Yongfeng and Geng Yanbin found that the transportation infrastructure network in the Yangtze River Delta has been basically formed, but there are still some problems, such as insufficient external radiation channels, poor connectivity of regional networks, incomplete functions of hubs, unbalanced development of transportation level, gap between service level and technological innovation ability, and the need to improve regional coordination mechanism [8]. Cao Bingru and Yin Di took the 16 cities in the Yangtze River Delta as the research object, constructed the index system and used the factor analysis method to construct the hierarchical system of the high-quality development of urban logistics industry, and determined the hub-spoke logistics network with Shanghai logistics circle, Nanjing logistics circle and Hangzhou logistics circle as the core [9]. The concept of national logistics hub was put forward at the end of 2018. Li Duwei, Yang Qian, Xu Xing et al. studied the concept, characteristics and status of production and service national logistics hub, and found that the interactive development mode of logistics industry and manufacturing industry with production and service national logistics hub as the carrier is necessary to shape the national supply chain [10]. Gan Weihua, Yao Wenpei and Liu Zhengli used grey relational analysis method to select 16 logistics factors affecting regional economic vitality from four dimensions: input level, output level, current level and potential level of regional economic vitality [11]. Cao Yunchun, Luo Yu used modified gravity model and social network analysis method, the 23 countries logistics hub city aviation logistics spatial correlation degree, correlation between network spatial structure and influence factors, the present "strong west east, missy thin, weak" pattern of spatial association, association network density is higher, "core - half edge, edge" structure is significant, a "multi-center drive" is gradually taking shape [12]. The "hub-spoke" hierarchical structure of the network is not obvious, and the role of the "bridge" city is insufficient. The network roughly forms four types of cohesive subgroups with different functions, and the degree of faction bristly among each subgroup is small, and the subgroup structure and gradient cooperation relationship are not reasonable. However, there are few studies on national logistics hubs in the Yangtze River Delta region.

Combined with previous research results, taking 16 key logistics cities in the Yangtze River Delta and the central region as examples, the DPSIR model is used to construct the evaluation index system of logistics development, to evaluate the construction of national logistics hub in the Yangtze River Delta, and to provide some suggestions for the construction of national logistics hub in Anhui.

3. Research Ideas and Data Sources

3.1. The Selection of Logistics Hub, Node City

Select 6 national hub cities in the Yangtze River Delta: Shanghai, Nanjing, Suzhou, Jinhua (Yiwu), Ningbo-Zhoushan, Wuhu and 5 national logistics hub cities in the central region: Taiyuan, Ganzhou, Zhengzhou, Yichang, Changsha and 5 logistics node cities in Anhui (Hefei, Fuyang, Bengbu, Anqing, Chuzhou) The relevant data of 16 cities in 2018 were compared and analyzed horizontally. This paper studies the development and construction of national logistics hub in Yangtze River Delta, and puts forward suggestions for the construction of national logistics hub in Anhui.

3.2. Introduction to the DPSIR Model

DPSIR model is a research model that integrates the advantages of pressure-state-response (PSR) model and driving-force state-response (DSR) model to solve environmental problems, including five factors: Driving force (D), pressure (P), state (S), influence (I), response (R). In recent years, DPSIR model, which is characterized by systematic, comprehensive and flexible, has been widely used in ecological security, sustainable utilization of resources, prediction of environmental risk change, sustainable utilization of water and soil resources, and sustainable agricultural development [13-17].

The layout and construction of logistics hubs follow certain internal mechanisms, which require comprehensive consideration of various micro and macro factors. The DPSIR model includes economic, social, resource, environmental and other factors, and can be applied to national logistics hubs to carry the power, pressure, state of urban construction, as well as economic and social influences and feedbacks. Driving force D refers to the impetus injected into the high-quality development of logistics industry by the development of society, economy and upstream industry; Pressure P refers to the constraints caused by the lack of urban transportation, infrastructure and information technology for the high-quality development of logistics industry [18]; State S refers to the state level of logistics industry under the coexistence of power and pressure; Impact I refers to the social, economic and environmental consequences caused by the high-quality development of logistics industry; Response R refers to the efforts made by the industry and government departments to enhance the driving force, relieve the pressure and improve the state of high-quality development of logistics industry. The evaluation model framework of national logistics hub high-quality construction based on DPSIR model is shown in Figure 1.

3.3. Logistics Development Evaluation Based on DPSIR Model

According to the relationship between the five systems in DPSIR model and the characteristics of logistics industry, the construction status of logistics hub is analyzed by selecting

indexes. High quality logistics industry driven by economic and social development, facing the urban transportation and infrastructure, information level, such as pressure, the driving force and pressure under the dual influence of logistics industry development in high quality can use economic support and industry support, industry influence in logistics freight traffic and transportation turnover, In order to enhance the driving force, relieve the pressure, and improve the state, the subject must adopt strategies to respond, leading to industry response and ecological response [19-20].

Table 1. *Evaluation index of high-quality development of logistics industry.*

System layer	Criterion layer	Index layer
Driving force system	Social development	Area (km^2)
		Permanent resident population (10000)
	economic development	GDP (100 million yuan)
		GDP per capita (10000 yuan)
		Total import and export (100 million yuan)
		Per capita disposable income of permanent urban residents (yuan)
		Per capita disposable income of permanent rural residents (yuan)
	Upstream industry development	Wholesale and retail value-added (100 million yuan)
		Total retail sales of consumer goods (100 million yuan)
		Gross merchandise sales (trillion yuan)
		Wholesale sales (trillion yuan)
Pressure system	urban traffic	Highway mileage (km)
		Expressway mileage (km)
		Railway mileage (km)
		Number of port berths
		Mileage of shipping channel (km)
	infrastructure	Real road area (10000km^2)
		Road area per capita (km^2)
		Number of trucks
		powerboat
		Cargo ship
State system	informatization	Landline subscriber (10000 users)
		Mobile phone users (10000 users)
		Internet user (10000 users)
	Economic support	Total social logistics (100 million yuan)
		Total revenue of logistics and related industries (100 million yuan)
		Added value of logistics industry (100 million yuan)
		Logistics industry added value accounted for the proportion of GDP (%)
		logistics industry added value accounted for the proportion of service industry added value (%)
Impact System	Industry support	Total postal service (100 million yuan)
		Income from express business (100 million yuan)
		Key logistics projects
	freight amount	Total amount of goods transported (10000 tons)
		Highway freight volume (10000 tons)
		Railway freight volume (10000 tons)
		Waterway freight volume (10000 tons)
		Air cargo volume (10000 tons)
	Freight turnover	Cargo transport turnover (100 million tons.km)
		Highway freight turnover (100 million tons.km)
		Rail freight turnover (100 million tons.km)
		Waterway freight turnover (100 million tons.km)
		Port cargo throughput (10000 tons)
		International standard container throughput (10000 TEU)
Response system	industry response	Provincial social logistics total cost (100 million yuan)
		Proportion of total logistics costs in GDP (%)
		Transportation costs (100 million yuan)
		The ratio of total transportation cost to total social logistics cost (%)
		Storage cost (100 million yuan)
		The ratio of total storage cost to total social logistics cost (%)
		Management fees (100 million yuan)
		The ratio of total management cost to total social logistics cost (%)
		Number of logistics enterprises with 3A and above
	Ecological response	Comprehensive utilization of industrial solid waste (10000 tons)
		Comprehensive utilization rate of industrial solid waste (%)
		Per capita park green area (km^2)

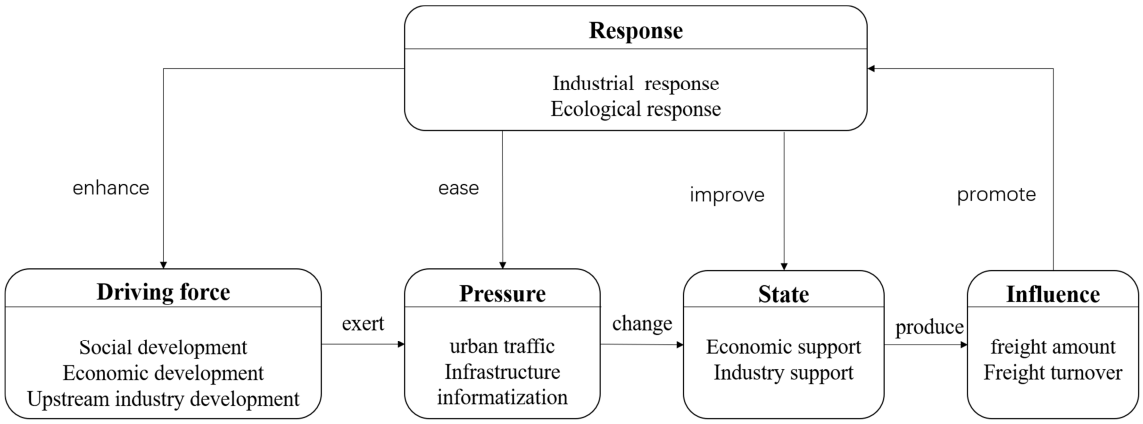

Figure 1. *Evaluation model framework of national logistics hub high quality construction based on DPSIR model.*

3.4. The Data Source

The data comes from 2019 China Statistical Yearbook of Logistics, 2019 Statistical Yearbook of cities, Statistical Bulletin of National Economic and Social Development, National Bureau of Statistics, China Federation of Logistics & Purchasing, Civil Aviation Administration of China, China Post Bureau and other official websites. Ningbo-Zhoushan will be counted as a city for some specific statistics.

4. An Empirical Analysis of High Quality Construction of National Logistics Hub in Yangtze River Delta

4.1. Driving Force System

The driving force mainly includes social development force, economic development force and upstream industry development status. The power of social development is reflected by the area, population and population density of a city. The area and population reflect the size and market demand of a city; GDP reflects the ability of a city to create economic value, per capita GDP reflects the ability of urban per capita to create value, and per capita disposable income in urban and rural areas reflects the consumption ability of market subjects; The development of upstream industries, such as the added value of wholesale and retail, wholesale sales, etc., jointly drive the upgrading and innovation of the logistics industry.

The area of the Yangtze River Delta only accounts for 2.2% of China's territorial area, among which only Ningbo Zhoushan has a larger geographical area of 32016km^2. The geographical area of Ganzhou is 39380km^2, about 6.2 times that of Shanghai, the geographical area of Yichang is 21000km^2. Ganzhou, Ningbo-Zhoushan and Yichang are far larger than other cities in terms of geographical area, with Bengbu, Wuhu and Shanghai coming in at the bottom.

Table 2. *Basic Urban Information.*

	Shanghai	Nanjing	Suzhou	Jinhua	Ningbo-Zhoushan	Taiyuan	Ganzhou	Zhengzhou
Area (km^2)	6341	6587	8488	10941	32016	6909	39380	7446
Population (10000 person)	2428	850	1063	562	972	446	871	1035
population density (10000 person/km^2)	0.383	0.129	0.125	0.051	0.030	0.065	0.022	0.139
GDP (100 million yuan)	38155.32	14030.15	18600.00	4559.91	13356.70	4028.51	3474.34	11589.70
GDP per capita (10 thousand yuan)	15.73	16.57	17.50	8.12	12.87	9.07	3.99	11.31

	Yichang	Changsha	Hefei	Wuhu	Fuyang	Bengbu	Anqing	Chuzhou
Area (km^2)	21000	11819	11445	6026	10118	5952	13590	13398
Population (10000 person)	414	839	819	378	826	341	472	415
population density (10000 person/km^2)	0.020	0.071	0.072	0.063	0.082	0.057	0.035	0.03
GDP (100 million yuan)	4460.82	11574.22	9409.40	3618.26	2705.00	2057.17	2380.50	2909.10
GDP per capita (10 thousand yuan)	10.78	13.79	11.49	8.39	3.28	6.03	5.04	7.04

Shanghai has the highest population density, which brings broad market demand and sufficient labor force for the high-quality development of logistics industry. As the capital city of Henan province with a large population, Zhengzhou ranks the second in population density and attracts a large number of provincial talents. The population density of Yichang and Ganzhou, located in the vast central region, is small, which poses a challenge to the development of the logistics industry. The large market demand for a variety of consumer goods and services and easy access to labor force are important driving forces for the high-quality development of the logistics industry.

It can be seen from Table 2 that the top three cities in terms of GDP are Shanghai, Suzhou and Nanjing, and Shanghai is in the absolute leading position, 8.4 times that of Jinhua and 3.3 times that of Zhengzhou. Economic prosperity will inevitably

drive the development of life, and development is the basis and key to solve problems. The top three cities in terms of per capita GDP are Suzhou, Nanjing and Shanghai. The per capita GDP of Suzhou and Nanjing is higher than that of Shanghai, because Shanghai has a larger population base. Changsha, a city in central China, tops the list in both gross domestic product and GDP per capita. One possible reason is the Beijing-Guangzhou railway. "The sound of the train, gold ten thousand liang", the cities along the Beijing-Guangzhou railway slowly phased out the cities along the Grand Canal, such as Zhengzhou, Shijiazhuang along the Beijing-Guangzhou more than Kaifeng and so on.

Table 3. *Fiscal revenue of various cities.*

	Shanghai	Nanjing	Jinhua	Ningbo-Zhoushan	Ganzhou	Zhengzhou	Yichang
Fiscal revenue (100 million yuan)	7165.10	1580.03	661.70	2784.90	485.52	1970.20	369.84

	Changsha	Hefei	Wuhu	Fuyang	Bengbu	Anqing	Chuzhou
Fiscal revenue (100 million yuan)	950.23	745.99	621.18	352.30	317.01	321.50	357.10

It can be seen from Table 3 that Shanghai, Ningbo, Zhoushan, Zhengzhou and Nanjing have higher fiscal revenue. Among the logistics node cities in Anhui Province, only the provincial capital Hefei has a high fiscal revenue, while the fiscal revenue of other regions is relatively low. The development of logistics industry in Anhui province depends on economic driving.

Table 4. *Total import and export volume by city.*

	Shanghai	Nanjing	Suzhou	Jinhua	Ningbo-Zhoushan	Taiyuan	Ganzhou	Zhengzhou
Total import and export (100 million yuan)	34046.82	4828.15	24079.75	3769.35	10541.40	1119.56	57.83	4129.90

	Yichang	Changsha	Hefei	Wuhu	Fuyang	Bengbu	Anqing	Chuzhou
Total import and export (100 million yuan)	220.60	2002.03	322.10	72.04	15.70	15.83	16.63	40.27

It can be seen from Table 4 that Shanghai ranked first in total import and export with RMB 3,404,682 million, followed by Suzhou, Ningbo-Zhoushan and Nanjing. Although the geographical area of Shanghai is small, due to its unique geographical position, Shanghai has won a place in the import and export trade and laid a solid foundation for the high-quality development of the logistics industry.

Table 5. *Per capita disposable income of urban and rural residents.*

	Shanghai	Nanjing	Suzhou	Jinhua	Ningbo-Zhoushan	Taiyuan	Ganzhou	Zhengzhou
Per capita disposable income of urban residents (yuan)	73615	64372	54341	54883	63183	36362	34826	42087
Per capita disposable income of rural residents (yuan)	33195	27636	27691	26218	36708	18377	11941	23536

	Yichang	Changsha	Hefei	Wuhu	Fuyang	Bengbu	Anqing	Chuzhou
Per capita disposable income of urban residents (yuan)	38463	55211	45404	42064	32844	37028	34041	34091
Per capita disposable income of rural residents (yuan)	18134	32329	22462	22745	13079	16666	14347	14487

It can be seen from Table 5 that Shanghai has the highest per capita disposable income of urban residents, followed by Nanjing, Ningbo and Zhoushan. Rural residents have the highest per capita disposable income in Ningbo-Zhoushan, followed by Shanghai and Changsha. The gap of disposable income between urban and rural residents is the largest in Shanghai (40,420 yuan), followed by Nanjing (36,736 yuan) and Jinhua (28,665 yuan).

Table 6. *Total retail sales of consumer goods by city.*

	Shanghai	Nanjing	Suzhou	Jinhua	Ningbo-Zhoushan	Taiyuan	Ganzhou	Zhengzhou
Total retail sales of consumer goods (100 million yuan)	13497.21	6135.74	5746.90	2253.00	5054.30	1952.81	1005.87	5324.40

	Yichang	Changsha	Hefei	Wuhu	Fuyang	Bengbu	Anqing	Chuzhou
Total retail sales of consumer goods (100 million yuan)	1665.00	5247.03	3234.51	1149.61	1082.00	908.35	900.10	720.10

It can be seen from Table 6 that in 2018, the total retail sales of consumer goods in Shanghai, Nanjing, Suzhou, Zhengzhou and Changsha were RMB 1,347.921 billion, 618.574 billion, 574.690 billion, 532.44 billion and 524.703 billion respectively. The total amount of social consumer goods in Shanghai is the highest, followed by Zhengzhou and Changsha, whose total retail amount of social consumer goods is much higher than other central cities. The total retail amount of social consumer goods in logistics node cities in Anhui province is very low, which reflects that improving residents' consumption level and regional economic ability is the top priority to promote the high-quality development of logistics industry.

Table 7. *Wholesale and retail value added by city.*

	Shanghai	Nanjing	Ganzhou	Hefei	Wuhu
Wholesale and retail value-added (100 million yuan)	5023.23	5533.59	262.68	969.70	1020.35

It can be seen from Table 7 that the wholesale and retail trade in Shanghai and Nanjing are in the leading position in the whole country. Although the wholesale and retail trade in Wuhu lags behind a lot, it is in the stage of rapid growth. In 2020, Wuhu was included in the list of national logistics hub construction, which indicates to some extent that Wuhu has great potential for economic development.

4.2. Pressure System

The pressure mainly includes urban traffic pressure and infrastructure pressure. Urban traffic pressure involves the total length of highways, railway operating length, port berths, etc. Infrastructure pressure refers to the level of basic logistics facilities and reflects the comprehensive logistics capability. The more complete the logistics infrastructure is, the higher the logistics carrying capacity and social recognition degree will be. At the same time, the intelligent logistics relying on information technology has been paid much attention by people, and the level of information technology has also become a problem that the development of logistics industry must face.

Table 8. *Total mileage of highways and expressways in each city.*

	Shanghai	Nanjing	Suzhou	Jinhua	Ningbo-Zhoushan	Taiyuan	Ganzhou
Highway mileage (km)	13106	10636	12173	14491	13217	7621	31055
Expressway mileage (km)	836	614	598	452	609	287	1490

	Zhengzhou	Hefei	Wuhu	Fuyang	Bengbu	Anqing	Chuzhou
Highway mileage (km)	13861	19026	10984	17911	9451	19613	28651
Expressway mileage (km)	631	481	276	256	185	374	553

As can be seen from Table 8, the total length of highways in Ganzhou is the longest, reaching 31,055 kilometers, followed by Chuzhou and Hefei. Ganzhou, located in the southern part of the central province of Jiangxi and more than six times the size of Shanghai, has more roads connecting urban and rural areas than any other city, and ranks first in the number of expressways. Ganzhou railway mileage is 555 km, Shanghai 466 km and Fuyang 317 km. The total highway mileage of the six cities in Anhui province is not much different from other cities, but the level of expressway mileage and railway mileage is lower than that of the Yangtze River Delta and the national logistics hub cities in the central region.

The Yangtze River Delta has a trunk railway network with "four vertical and five horizontal" as the backbone. In 2017, the length of railways in the Yangtze River Delta reached 10097.9 km, and the railway density was 2.9km/km^2, more than twice the national average. Secondly, the Yangtze River Delta has a road network with "four vertical, four horizontal and one ring" as the main channels. In 2017, the length of highways in the Yangtze River Delta reached 495,000 km, and the network density was 14,000 km/km^2, 2.8 times the national average. Thirdly, the Yangtze River Delta has developed waterway network, the Yangtze River, Huaihe River, Grand Canal, Qiantang River and other interwoven inland waterway network forming, inland waterway navigable mileage of 41998km, accounting for 33.1% of the total mileage of the country, among which the mileage of grade channel reaches 20000 km. Shanghai shipping channel mileage is 1973 kilometers, Jinhua shipping channel mileage is 9766 kilometers, Shanghai shipping channel is far smaller than Jinhua city, but the passenger turnover and freight turnover of Shanghai port is far more than Jinhua city, ranking the forefront of the country. Shanghai has 1,978 port berths, while Zhoushan has 309 port berths. Shanghai has an obvious advantage in making use of sea transportation to make up for the lack of land space.

Table 9. *Each city has actual road area, per capita road area.*

	Shanghai	Nanjing	Suzhou	Ningbo-Zhoushan	Yichang	Hefei	Fuyang	Bengbu	Anqing	Chuzhou
Real road area (10000 km^2)	30281	15904	15891	8451	4129	8069	5262	3225	1393	2161
Road area per capita (km^2)	12.5	24.2	14.95	14.3	22.2	14.8	26.0	20.46	22.1	42.5

As can be seen from Table 9, the actual road area is 302.81 million square meters in Shanghai, followed by Nanjing and Suzhou. Chuzhou has the largest road area per capita with 42.5 square meters, followed by Fuyang and Nanjing. The per capita road area of Shanghai is less than that of cities in Anhui Province, less than half of that of Fuyang, which makes Shanghai face heavy traffic pressure. Hefei, capital of Anhui Province, has the smallest road area per capita, about one third of that of Chuzhou. The actual road area in Anqing and Chuzhou is smaller than that in other cities.

Table 10. *Number of trucks by city.*

	Shanghai	Nanjing	Jinhua	Ningbo-Zhoushan	Taiyuan	Ganzhou	Zhengzhou	Yichang
Truck	335200	131289	217399	86341	1435651	145604	205688	84159

	Changsha	Hefei	Wuhu	Fuyang	Bengbu	Anqing	Chuhzou
Truck	122812	144865	47085	202323	78694	53704	65163

It can be seen from Table 10 that the largest number of trucks is 1,435,651 in Taiyuan, followed by Shanghai and Zhengzhou. Mineral is the pillar industry of Taiyuan. The mining, processing and sales of various advantageous minerals cannot be separated from transportation. The number of trucks in Taiyuan is much higher than that in other cities. Nanjing has the largest number of trailers with 13,187, followed by Fuyang and Hefei. In general, except Fuyang, the number of transportation vehicles in other cities in Anhui province is lower than that in Jiangsu, Zhejiang and Shanghai and the logistics hub cities in central China.

Table 11. *Number of fixed telephone, mobile phone and Internet broadband users in each city.*

	Shanghai	Nanjing	Suzhou	Jinhua	Ningbo-Zhoushan	Taiyuan	Ganzhou	Zhengzhou
Landline subscriber (10000 users)	663	201	249	90	230	79	102	164
Mobile phone users (10000 users)	3722	1284	1856	1719	1430	737	823	1592
Internet user (10000 users)	773	1750	623	382	475	222	213	430

	Changsha	Hefei	Wuhu	Fuyang	Bengbu	Anqing	Chuzhou
Landline subscriber (10000 users)	153	118	39	39	29	41	33
Mobile phone users (10000 users)	1203	1007	362	652	297	375	349
Internet user (10000 users)	279	315	124	171	84	113	106

It can be seen from Table 11 that Shanghai, Suzhou and Nanjing are at the leading level of informatization in China, and Hefei ranks first in Anhui Province. The number of fixed telephone, mobile phone and Internet broadband users are respectively 1.18 million, 10.07 million and 3.15 million. The high-quality development of logistics industry cannot be separated from intelligence, informatization and networking. To accelerate the improvement of the level of information technology, we need to make full efforts to move forward and work for a long time.

Table 12. *Number of motor ships and cargo ships in each city.*

	Nanjing	Suzhou	Ningbo-Zhoushan	Ganzhou	Hefei	Wuhu	Fuyang	Bengbu	Anqing	Chuzhou
powerboat	1443	328	2237	222	2066	3903	2865	3543	669	1222
Cargo ship	1371	151	2145	161	2055	3893	2539	3481	662	1213

It can be seen from Table 12 that the number of ships in Anhui province is higher than that in Nanjing, Ningbo, Zhoushan and other places, which indicates that the waterway transportation in Anhui Province has development potential. Although Anhui is not as convenient as Jiangsu, Zhejiang and Shanghai with ocean waterway transportation, but the Yangtze River and Huaihe River provide convenience for Anhui water transportation, Anhui should in-depth planning of water transportation routes in the future, improve the river level, build multimodal transportation facilities, improve the strategic cooperation level with Shanghai port and Ningbo - Zhoushan port, and play the water transportation potential.

4.3. State System

The development of logistics is reflected by economic support and industry support. Economic support includes the total amount of social logistics, the total revenue of logistics and related industries, the added value of logistics and its proportion in GDP and added value of service industry, etc. Industry support force involves the total postal business, Courier business income and other indicators.

Table 13. *The total amount of social logistics in each city.*

	Jiangsu	Zhejiang	Henan	Hubei	Hunan	Anhui
Total social logistics (100 million yuan)	302132	169300	1308823	8482	108576	65738

It can be seen from Table 13 that the total amount of social logistics is 30,213.2 billion yuan in Jiangsu, followed by Zhejiang, Henan and Anhui. The highest total revenue of logistics and related industries was 10.3805 billion yuan in Shanghai, followed by Zhengzhou, Yichang and Changsha. Anhui logistics related industry revenue is only 411.55 billion yuan, about two-fifths of Shanghai, Anhui and Shanghai there is a huge gap; However, social logistics in Anhui province is developing rapidly, and the business volume of express delivery will exceed 2 billion pieces in 2020.

Table 14. *Total postal business and express business income of each city.*

	Shanghai	Nanjing	Suzhou	Jinhua	Ningbo-Zhoushan	Taiyuan	Ganzhou	Zhengzhou
Total postal service (100 million yuan)	1365.90	203.45	181.57	259.90	123.70	42.50	29.29	159.89
Income from express business (100 million yuan)	1288.80	101.30	156.21	224.50	102.82	20.86	9.96	74.90

	Yichang	Changsha	Hefei	Wuhu	Fuyang	Bengbu	Anqing	Chuzhou
Total postal service (100 million yuan)	20.02	155.21	149.80	46.37	15.31	22.40	33.07	10.84
Income from express business (100 million yuan)	6.95	58.42	59.70	13.20	5.86	6.24	6.45	6.10

It can be seen from Table 14 that the total postal business volume is Shanghai, Jinhua, Nanjing and Hefei in order, and the express business income is Shanghai, Jinhua, Nanjing and Hefei in order. The total volume of postal business and express business income can reflect the high-quality development level of a city logistics industry. Shanghai postal and express business income is among the top in China, and its express business income is more than 20 times that of Hefei. In Anhui province, only Hefei city has a small gap between Courier business income and central cities of Zhengzhou and Changsha, but a large gap between the development level of logistics industry and Jiangsu, Zhejiang and Shanghai.

4.4. Impact System

The development of logistics industry affects the cargo transportation volume and cargo transportation turnover, and the transportation network and industry development can reach the transportation level when facing the coexisting driving force and pressure [18]. Cargo transport volume and turnover include highway, waterway, railway, air and other means of freight transport volume and turnover.

Table 15. *The total freight volume of each city and the freight volume of highway, railway and waterway.*

	Shanghai	Nanjing	Suzhou	Jinhua	Ningbo-Zhoushan	Ganzhou
volume of freight traffic (10000 tons)	107387	38564	16335	13624.45	99584	15378
highway (10000 tons)	39595	15751	14787	13201	32424	11935
railway (10000 tons)	468	1480	175.9	393.9	13063	529
waterway (10000 tons)	66906	15955	1372	25.51	54081	2913

	Zhengzhou	Changsha	Hefei	Wuhu	Bengbu
volume of freight traffic (10000 tons)	27631	41739	39545.9	29253.3	38578
highway (10000 tons)	25679	38808	34143	7998	23826
railway (10000 tons)	1920	114	137.9	246.3	213
waterway (10000 tons)	0	2603	5258	21009	14539

It can be seen from Table 15 that Shanghai has the highest freight volume, followed by Ningbo-Zhoushan. Anhui city freight volume and the central city difference is not big, but with Shanghai and Ningbo - Zhoushan gap is larger. Cargo transport overall presents to road transport, but Shanghai and Ningbo-Zhoushan and other parts of the city water transport freight volume far exceeds the road freight volume, lies in the natural geographical advantages of Shanghai port and Ningbo-Zhoushan port, most of the other central and western regions are limited by geographical location and choose road and railway transport. Most cities in Anhui mainly choose road or railway transportation, the railway freight volume is small because the final destination often needs to be used with road transportation.

Table 16. *The turnover of goods in cities and the turnover of goods in waterways and highways.*

	Shanghai	Nanjing	Suzhou	Jinhua	Ningbo-Zhoushan	Ganzhou
turnover volume of freight traffic (Million ton-km)	23258	3123.57	279.00	11537.91	7101.44	281.06
waterway (Million ton-km)	22887	2755.34	59.01	4814.00	3458.19	10.69
highway (Million ton-km)	299	253.26	208.81	93.32	648.14	270.36

	Zhengzhou	Changsha	Wuhu	Bengbu	Anqing	Chuzhou
turnover volume of freight traffic (Million ton-km)	864.36	487.42	1155.71	1263.08	451.55	449.81
waterway (Million ton-km)	0	17.10	1058.41	543.43	235.71	57.59
highway (Million ton-km)	621.42	423.38	97.23	719.66	215.81	392.21

As can be seen from Table 16, the turnover of cargo transportation in Shanghai is 2,3258 billion ton-kilometers, much higher than that of other cities. Jinhua, Ningbo-Zhoushan and Nanjing followed. Yiwu express delivery volume ranks first in the world, and Jinhua cargo turnover also ranks among the top in the country.

Table 17. *Transportation turnover of railway and air goods in various cities.*

	Shanghai	Nanjing	Zhengzhou	Changsha
Railway freight turnover (Million ton-km)	10	73.43	213.82	40.69
Air cargo turnover (Million ton-km)	62	1.06	29.12	1.24

It can be seen from Table 17 that Zhengzhou has the largest railway transportation turnover of 21.382 billion ton-kilometers, followed by Nanjing, Changsha and Shanghai. Wuhu is only 0.08 million ton-km. The railway transportation turnover of Zhengzhou is about 21 times that of Shanghai and 2.9 times that of Nanjing. From the perspective of air transport, Shanghai air cargo turnover is 6.2 billion tons kilometers, which is in the absolute leading position, while Zhengzhou air cargo turnover is 2.912 billion tons kilometers, which is a large scale of air transport. Multimodal logistics can effectively improve the quality of logistics and transportation, such as "water-iron-public" or "air-iron-public" combination can effectively reduce logistics costs and improve logistics efficiency, but this depends on the completeness of logistics infrastructure.

Table 18. *Port cargo throughput and container throughput of each city.*

	Shanghai	Nanjing	Suzhou	Ningbo-Zhoushan	Wuhu	Anqing
Port cargo throughput (10000 tons)	73048	25447	53227	108439	12016	2983
Container throughput (10000 TEU)	41126	321	635.51	2635.57	80.31	12.09

As can be seen from Table 18, Shanghai had the highest cargo throughput of 730.48 million tons, followed by Ningbo-Zhoushan, Suzhou and Nanjing. Shanghai has the highest container throughput of 411.26 million TEU, ranking first in the world for 10 consecutive years, followed by Ningbo - Zhoushan, Suzhou and Nanjing. The cargo throughput of Wuhu port is 11.16 million tons, which is only 1/6 of that of Shanghai, and the container throughput is 803,100 TEU, which is only 1/4 of that of Nanjing, although it is large in Anhui Province. The implementation of the integration strategy of the Yangtze River Delta provides Anhui with a rare opportunity. Whether it can grasp the opportunity is the key to promote the economic promotion of Anhui.

4.5. Response System

The response includes two aspects: industry response and ecological response. The industry response is the industry's attempt to cope with the dilemma in the spirit of strengthening the driving force, alleviating the pressure and improving the state. It is reflected by the total social logistics cost and its proportion in GDP, transportation cost, storage cost and other indicators. Ecological response is to take measures to protect the environment in order to reduce the damage of logistics development to the environment [21], which is reflected by indicators such as the utilization rate of industrial solid waste, utilization rate and park green space area per capita.

Table 19. *The total cost and proportion of social logistics in each province.*

	Jiangsu	Zhejiang	Henan	Hunan	Anhui
Total social logistics costs (100 million yuan)	12863.20	8127.00	7373.10	5551.80	4711.00
The proportion in GDP (%)	13.90%	14.50%	15.30%	15.20%	15.70%
The ratio of transportation cost to total social logistics cost (%)	50.70%	34%	61.90%	48.20%	74.70%
The ratio of storage cost to total social logistics cost (%)	38.88%	45%	27.20%	35.10%	18.30%
The ratio of management cost to total social logistics cost (%)	10.42%	21%	10.90%	16.70%	7.00%

As can be seen from Table 19, the total cost of social logistics in Jiangsu province is the highest, which is 128.632 billion yuan, but its proportion in GDP is the lowest, which is only 13.9%. The cost of social logistics in Anhui province was 471.1 billion yuan, accounting for 15.7% of GDP. Anhui should take active measures to reduce cost and increase efficiency, reduce the total cost of social logistics GDP ratio. The specific composition of logistics costs around the situation is not the same: Jiangsu, Henan, Hunan and Anhui' transportation costs accounted for the highest proportion, Zhejiang' storage costs accounted for the highest proportion.

Table 20. *Number of logistics enterprises with 3A status and above in each city.*

Logistics enterprises	Shanghai	Nanjing	Suzhou	Jinhua	Ningbo-Zhoushan	Taiyuan	Ganzhou	Zhengzhou
5A	26	6	6	2	3	3	0	9
4A	137	17	45	30	36	30	6	40
3A	66	17	90	50	93	11	31	38
total	229	40	141	82	132	44	37	87

Logistics enterprises	Yichang	Changsha	Hefei	Wuhu	Fuyang	Bengbu	Anqing	Chuzhou
5A	2	8	0	1	0	0	0	0
4A	14	51	40	16	2	0	2	2
3A	37	26	7	11	15	2	3	0
total	53	85	47	28	17	2	5	2

Table 20 shows that by March 2020, there are 229 logistics enterprises with 3A or above in Shanghai, 141 in Suzhou, 132 in Ningbo-Zhoushan, 85 in Changsha and 40 in Hefei. Among the 5A-level logistics enterprises, there are 26 in Shanghai, 8 in Changsha, 6 in Suzhou, 3 in Ningbo -- Zhoushan and 0 in Hefei. The development gap of logistics enterprises in Anhui province is obvious.

Table 21. *Exhaust emissions and sulfur dioxide emissions by city.*

	Shanghai	Nanjing	Suzhou	Jinhua	Ningbo-Zhoushan	Zhengzhou
Exhaust emissions (Million m^3)	13780	8884	21844	1434	7685	2998
Sulfur dioxide emissions (10000 tons)	0.99	1.24	6.17	1.47	1.50	1.10

	Yichang	Changsha	Wuhu	Bengbu	Anqing	Chuzhou
Exhaust emissions (Million m^3)	3013	636	2576	660	1115	1093
Sulfur dioxide emissions (10000 tons)	2.14	0.13	0.58	0.16	0.21	0.13

It can be seen from Table 21 that Suzhou has the highest total exhaust emission of 2,184.4 billion square meters, followed by Shanghai, Nanjing, Ningbo-Zhoushan. From the perspective of sulfur dioxide emissions in cities, Suzhou has the highest sulfur dioxide emissions, reaching 61,700 tons; The sulfur dioxide emission in Yichang is much higher than that of other cities, more than twice that of Shanghai, which reflects the lack of environmental protection awareness in some areas. With the coming of carbon peak and carbon neutral period, it is urgent to take effective measures to alleviate it.

Table 22. *Comprehensive utilization of industrial solid waste in various cities.*

	Shanghai	Nanjing	Suzhou	Jinhua	Zhengzhou	Yichang
Comprehensive utilization of industrial solid waste (10000 tons)	1553	1750	2621	273	899	652

	Hefei	Wuhu	Bengbu	Anqing	Chuzhou
Comprehensive utilization of industrial solid waste (10000 tons)	818	315	168	286	269

Table 22 shows that Suzhou, Nanjing and Shanghai have the highest utilization of solid waste. Zhengzhou, Yichang and Hefei had higher utilization; The utilization in Wuhu, Bengbu, Anqing and Chuzhou was relatively low. The discharge of industrial solid waste is closely related to economic prosperity and the development performance of the logistics industry. For example, Shanghai and Nanjing have high utilization of industrial solid waste.

Table 23. *Per capita park green space and comprehensive utilization rate of industrial solid waste in each city.*

	Shanghai	Nanjing	Suzhou	Jinhua	Ningbo-Zhoushan	Zhengzhou	Yichang
Per capita park green area (m^2)	8.20	15.47	13.72	12.76	11.43	14.30	12.60
Comprehensive utilization rate of industrial solid waste (%)	93.05	88.41	94.28	98.02	96.81	70.10	49.96

	Changsha	Hefei	Wuhu	Fuyang	Bengbu	Anqing	Chuzhou
Per capita park green area (m^2)	14.98	14.54	12.92	13.07	13.07	16.30	15.20
Comprehensive utilization rate of industrial solid waste (%)	82.49	72.36	80.04	94.33	95.72	90.22	92.42

As can be seen from Table 23, Anqing has the highest per capita park green area (16.3m^2), followed by Nanjing, Chuzhou and Shanghai. The per capita green space of other cities in Anhui is not much different from Jinhua, Yichang and other places. The comprehensive utilization rate of industrial solid waste in the Yangtze River Delta is relatively high, while that in the central cities is relatively low. For example, the comprehensive utilization rate of industrial solid waste in Yichang is only 49.96%, far lower than that in other cities.

5. Research Conclusions and Suggestions

5.1. Research Conclusion

From the perspective of driving force system, Shanghai, Nanjing, Suzhou, Ningbo-Zhoushan, Zhengzhou, Changsha and other national logistics hub cities have strong driving forces for the high-quality development of logistics industry. The high-density population of national logistics hub cities such as Shanghai, Zhengzhou and Nanjing strengthen the social development power for the high-quality development of logistics industry; the national logistics hubs such as Shanghai, Nanjing, Ningbo-Zhoushan and Zhengzhou, which carry the economic prosperity of the cities, are also important driving forces for the high-quality development of the logistics industry. Anhui Fuyang, Anqing, Chuzhou and other cities' logistics driving force are weak.

From the perspective of pressure system, Shanghai, Taiyuan, Wuhu, Bengbu, Fuyang and Anqing are faced with a relatively large urban traffic pressure. Yichang, Ningbo -- Zhoushan, Wuhu and Bengbu face great pressure on logistics infrastructure; Wuhu, Bengbu, Anqing, Chuzhou and other cities are under great informational pressure.

From the state system, the development level of logistics

industry in Shanghai is in the absolute leading position; Shanghai, Suzhou, Nanjing, Ningbo-Zhoushan and other regions have strong economic support; In the Yangtze River Delta, Jinhua, Ningbo - Zhoushan, Nanjing and the central region of Zhengzhou, Changsha, Hefei industry support strength is strong.

From the perspective of impact system, Shanghai, Ningbo - Zhoushan, Jinhua logistics industry high-quality development level is the best; The overall development level of logistics industry in Nanjing, Zhengzhou, Changsha and Hefei is good, among which the development momentum of aviation logistics in Zhengzhou is good, obviously better than most other cities; The high-quality development of logistics industry in Bengbu and Wuhu has great room for improvement.

From the perspective of response system, Shanghai, Nanjing, Suzhou, Jinhua, Ningbo-Zhoushan and other national logistics hub cities in the Yangtze River Delta, as well as Zhengzhou, Hefei and other cities, have good industrial and ecological response. Yichang, Bengbu, Fuyang and other cities did not respond enough.

5.2. Suggestions

As an important pole of the Yangtze River Delta integration strategy, Anhui province has a big gap in the quality development level of its logistics industry compared with Jiangsu, Zhejiang and Shanghai. How to improve the construction level of national logistics hub in Anhui Province? Based on the above research conclusions, some suggestions are put forward to promote the high-quality development of logistics industry in Wuhu, a national logistics hub in Anhui Province, and logistics node cities:

(1) Focus on economic development and enhance the driving force of logistics hub.

The sustainable development of city economy will inevitably promote the prosperity of logistics industry. Anhui province is a densely populated province, the supply of logistics industry is still difficult to meet the market demand, restricting the high-quality development of logistics industry is a main reason for the overall economic level is not high, per capita consumption capacity is not strong. Therefore, Anhui province to improve the overall level of logistics industry, must seize the opportunity of the Yangtze River Delta integration development, establish close ties with Jiangsu, Zhejiang and Shanghai, improve the level of opening up, optimize the environment.

(2) Optimize the urban traffic system and ease the pressure on logistics hubs.

Urban transportation network is a direct factor that affects the high-quality development of logistics industry. The increase of logistics demand has higher and higher requirements on the transportation network [22]. First of all, on the basis of the original transportation network, strengthen the expansion and transformation of railway, effectively improve the railway transportation capacity and efficiency, make the transportation more convenient and rapid, more efficient and diversified services. Secondly, accelerate the implementation of expressway expansion, national and provincial trunk roads upgrade, rural road expansion and extension, improve the highway transport network with expressway as the framework, national and provincial trunk roads and rural roads as the support. Third, implement the construction of comprehensive transportation channels across the Yangtze River and Huaihe River, enhance the connectivity capacity, strengthen the construction of port infrastructure in the Yangtze River and Huaihe River basins, and realize the coordinated development of ports and inland waterways in the region.

(3) Create characteristic industrial cluster, save logistics transaction cost.

Industrial cluster development can quickly collect all kinds of information, promote the formation of professional market, reduce transaction costs, and give play to the advantages of scale. In order to save the cost of storage, transportation and management, the logistics enterprises should actively participate in the construction of characteristic industrial cluster and accelerate the formation of professional market [23].

(4) Multimodal transport facilities will be built to upgrade logistics hubs.

Multimodal transport can effectively bring together and play to the advantages of multiple modes of transport. Anhui province integrates the advantages of waterway, highway, railway and air transportation, and has the conditions of multimodal transportation. It should speed up the construction of multimodal transportation infrastructure such as "water-iron-public" or "air-iron-public", and strengthen the "one-stop" comprehensive information service for enterprises. The construction of Wuhu port type national logistics hub should take advantage of the advantages of low water transportation cost and large freight volume, improve the multi-modal transportation infrastructure such as hot metal transfer site, and promote the high-quality development of combined transportation [24].

(5) Improve the scientific and technological level of the industry and innovate the smart logistics mode.

The future competition is the competition around the core technology, who master the core technology, who can win in the fierce market competition. The new generation of information technology innovation applications, such as the Internet of Things, cloud computing, big data and mobile Internet, have increasingly highlighted the position of smart logistics. Hefei should encourage logistics enterprises, scientific research teams of universities and industry associations to deepen cooperation, build a high-level logistics information service platform around the key links of logistics, intelligently collect and process information of all links of logistics and supply chain management throughout the whole chain, and improve efficiency.

(6) Attach importance to the construction of cold chain logistics and improve the logistics hub system.

The consumption level will increase and the market demand will expand, and the development of cold chain logistics will be accelerated. Anhui's economic development momentum is good, Anhui should seize the key opportunity to rise, relying

on the production area, speed up the construction of cold chain logistics infrastructure, improve the "cold storage, transportation, processing, sales" integration of cold chain logistics system. Anhui province is actively building provincial demonstration logistics parks with cold chain logistics as the mainstay, and promoting the improvement of interconnected logistics hub system with the construction of major cold chain logistics projects.

(7) Strengthen policy response, enhance logistics hub competitiveness.

National and local governments will increase policy supply and vigorously support the construction of logistics hubs, logistics parks, fast distribution nodes and smart logistics service platforms. Anhui should grasp the demand, improve the system of "channel, hub and network "with logistics hub as the core, give play to the radiation and convergence function of logistics hub, and enhance the competitiveness.

(8) Strengthen ecological green response, pay attention to the development of green logistics.

Extensive economic development will cause damage to the environment, and development cannot be achieved without the cultivation of environmental awareness and the practice of energy conservation and emission reduction. Logistics industry development must be of high quality in environmental protection and resource conservation as the goal, Anhui should strongly encourage enterprises to adopt green transportation, green storage, green machining and other measures to reduce the damage to environment and resources waste, such as the last one kilometer for distribution, using green energy vehicles using recycled filling material product packaging, etc., support green logistics development.

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