

Research on Evaluation System and Policy Design of Hub City Ecological Niche Competitiveness Based on Logistics Network Integration

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Abstract: Hub cities are central cities that use transportation, logistics, information and other hub platforms as carriers to strengthen the aggregation, radiation, and diffusion functions of economic activities and information flow. From the perspective of niche theory, a theoretical framework for evaluating the competitiveness of logistics networks in hub cities is constructed. Based on national logistics hub city data, economic resources, logistics resources, innovation resources, and information resource ecological factors are selected, and an evaluation system is established through models such as niche width, niche overlap, niche suitability, and comprehensive niche value. Conduct multidimensional research on the ecological niche competitiveness of national comprehensive transportation hub cities. The results showed that: (1) From the perspective of comprehensive ecological niche evaluation values, Beijing, Shanghai, Guangzhou, Chongqing and Shenzhen have higher ecological niche values, indicating that these cities have relatively strong logistics competitiveness. (2) The ecological niche width of hub cities is showing an increasing trend, covering increasingly extensive resources, and the competitiveness of regional core cities is gradually increasing. (3) There is excessive competition among cities with the same level of ecological niche width, and homogenization competition increases under the same limited resource conditions, and there is no high degree of overlap in urban relationships among mega first tier cities. (4) From the perspective of niche suitability, there are 71 hub cities higher than the average, indicating that the logistics resource environment of most hub cities has a very high demand for the establishment of hub cities, especially in the northeast, northwest, north China, central Yangtze River region, and coastal areas of Guangxi. The average ecological niche suitability is ranked from high to low as Northwest, Northeast, Central China, South China, Southwest, North China, and East China. Based on the actual problems of logistics networks in our country, we propose characteristic expansion strategies, dislocation competition strategies, and collaborative cooperation strategies from three aspects: expansion, separation, and optimization of ecological niches.

Keywords: Hub cities; Logistics network; Ecological niche; Competitiveness evaluation; Ecological niche overlap.

1. Introduction

Based on the National Comprehensive and Vertical Transportation Network Planning Outline, it is clear to build a multi-level integrated national comprehensive transportation hub system, and to build around 20 international and 80 national comprehensive transportation hub cities, promoting the formation of a “hub network” regional development spatial organization model. The construction of hub cities has greatly reduced the logistics spatiotemporal costs in inland opening through the integration of logistics networks, improved the spatial allocation ability of global resource elements, improved logistics operation efficiency, achieved logistics cost reduction and efficiency increase, and promoted the construction of a new national dual circulation development pattern. However, hub cities have problems such as redundant construction, lack of functions, self-governance, disorderly competition, and high efficiency in transportation transfer costs. By building an efficient and integrated logistics network, hub cities can optimize their ecological niche in the entire urban system. Urban niche is an important concept of urban ecosystem, which describes the role and function of cities in the entire ecosystem. It is of great significance for understanding the structure and function of urban ecosystems and providing scientific basis for urban planning and management. Therefore, studying how hub cities can build a channel operation mechanism of “internal integration and external

collaboration”, further enhancing the integration effect of logistics networks, and revealing the ecological niche optimization mechanism of hub cities based on logistics network integration has important theoretical significance and application prospects.

2. Literature Review

As early as 1917, Grinnell defined the concept of niche and proposed the “ultimate distribution unit” that is exactly occupied by a species or subspecies. He used the concept of niche to analyze the position and role of biological units in an ecosystem. Scholars such as AVD Dobbelsteen, Yuliya Voytenko, and Samaniego H have introduced life sciences into urban science problems based on urban niche theory. Senger et al. explored urban transportation transformation from an ecological niche perspective, while Pallante et al. analyzed the impact of ecological niche changes on agriculture. Bernetti et al. [6] quantitatively described ecological niche using ecological niche space, viewing it as the sum of various ecological conditions and expanding the concept of ecological niche. On this basis, different scholars have explored and elaborated on theories such as niche situation, niche separation, niche movement, and niche construction, and established many quantitative models to explain the impact and changes of niches [7]. However, the concept of urban ecological niche varies among different scholars and is constantly expanding, gradually integrating with urban systems [8], tourism competitiveness [9], urban

agglomeration competition [10] [11], cultural industries [12] and other fields. Among them, He Xiaorong [13] applied the theory of ecological niche to construct a four-dimensional indicator system of resources, market, economy, and environment, calculated the ecological niche values of 14 cities in Hunan Province, and finally divided prefecture level cities into three levels through cluster analysis. He analyzed the spatial pattern of tourism competition among various cities in Hunan Province and proposed targeted tourism development suggestions. Sun Yunfeng [14] takes the core cities of Xinjiang as the research object, adopts the niche width model, expands and compresses the model, explores the development status and interrelationships of core cities in Xinjiang, and proposes corresponding development strategies for different types of cities based on the results of cluster analysis. Liu Ting et al. [15] studied China's transportation industry based on the theory of ecological niche, and the results showed that the development of this industry plays a crucial role in the development of China's tertiary industry. They also proposed relevant suggestions to achieve coordinated development of the transportation industry. Chen Xiang and Jiang Pei [16] applied niche theory and constructed models of niche intensity, width, and overlap to measure the differences and industrial layout characteristics among manufacturing regions in the three provinces and one city of the Yangtze River Delta from 2015 to 2018. Based on the measurement results, they proposed strategies for the coordinated development of manufacturing in Anhui Province. Based on the concept of ecological niche, Liu Wenyi [17] described in detail the competitive level and development shortcomings of the tourism industry in various provinces of the Yellow River Basin, and proposed corresponding measures to form a harmonious collaborative development relationship.

The size and trend changes (overlap, separation, expansion) of urban ecological niches can reflect the general development laws and characteristics of cities, and are the basis for formulating urban development strategies [18] [19]. The ecological niches between cities should be different, because different cities have different geographical environments, resource endowments, regional cultures, technological advantages, and radiation areas. The driving force of urban development is reflected in the contradiction between new and old, high efficiency and low efficiency, which can be achieved through location competition through factors such as function, industry, and population. Ding Shengyan [23] believes that the theory of urban ecological niche is helpful for macro planning of urban functional modules, economic development, and environmental protection. Shi Jiangang [24] believes that the development of urban life forms is to find a suitable competitive niche and strategy for their own development in long-term competition, and to construct a competitive niche for cities in the Yangtze River Delta to propose corresponding strategies for the development of cities and enhance their competitiveness. Chen Shaoyuan et al. proposed the concept of "urban competitive niche", revealing that urban competition is due to the overlap of urban ecological niches in certain dimensions. They shifted the research on urban ecological niches to the functional relationships between cities, providing new ideas for cities to formulate development strategies. Luo Zhanfu [26] aimed to achieve high-quality development under the concept of ecological cities and quantitatively evaluated the urban development quality and regional ecological sensitivity

level of the Lanxi urban agglomeration, as well as the coupling and coordination relationship between the two. The above scholars have introduced and studied urban ecological niche from different perspectives, making important contributions to the formation and development of urban ecological niche theory. However, due to various reasons, the theoretical analysis has not yet formed a unified framework, and the depth of theoretical research is insufficient, resulting in a lack of theoretical foundation and poor practical guidance ability in empirical research.

The construction of a well-developed urban logistics network is a necessary condition for the expansion and efficient development of the urban economy. The establishment of various comprehensive transportation hubs enhances the functions of economic aggregation and channel radiation [27] [28]. Develop logistics plans within a certain regional scope based on different conditions, correctly understand and handle the interrelationships between the logistics industry and other industries, and promote the coordinated development of regional logistics subjects, objects, and carriers [29] [30]. Bai Yangmin and Li Yan [31] combined ecological theory and industrial cluster technology innovation theory to propose the concept of logistics industry cluster innovation ecosystem. They constructed a logistics industry cluster innovation ecosystem model and corresponding evaluation index system from different perspectives, and analyzed its evolutionary mechanism. Cao Bingru [32] pointed out that establishing an efficient and reasonable regional logistics network, breaking down administrative barriers between regional cities, and obtaining the optimal allocation of logistics resources in time and space are important means to promote the development of regional logistics industry and enhance the overall competitiveness of regional logistics. Qin Lu [33] constructed a Chinese urban logistics network based on the layout of 5A level logistics enterprises in various cities, and used four centrality indicators such as centrality to classify urban nodes. Based on this, he proposed a node city hierarchy analysis model to analyze the direction of logistics development in different cities. On the basis of evaluating the logistics development level of 13 cities in the Beijing Tianjin Hebei region, Li Mingfang [34] and Liang Chen [35] respectively used gravity model and genetic algorithm to calculate the logistics correlation between cities, and constructed the Beijing Tianjin Hebei axis spoke urban logistics network.

With the consolidation of the theoretical foundation of evolutionary ecology in the fields of species, population, and industrial population, the quantification and measurability of ecological niches have begun to receive attention. Existing research on the ecological niche of hub cities mostly adopts research methods such as principal component analysis, cluster analysis, and factor analysis. This article will incorporate urban logistics networks into the evaluation of hub city ecological niches based on previous research, and evaluate and analyze the logistics ecosystem of national hub cities. With hub cities as the "poles" and channels as the "network", by integrating and coordinating multi-channel economic strategies, the optimization of resource allocation across the country can be achieved, promoting logistics cost reduction and efficiency increase, designing hub city ecological niche optimization policies, and at the same time, it can help enhance the integration effect of hub city logistics networks, promote the optimization of urban ecological niche development, and enhance competitiveness in the entire urban

system.

3. Research Area and Research Methods

3.1. Research area

The transportation industry is a pioneer in economic and social development, as well as an important indicator of the country's modernization level. From 2021 to 2035. The country will build a comprehensive three-dimensional transportation network, connecting all county-level and above administrative regions, border ports, national defense facilities, major scenic spots, etc. in the country. Guided by overall integration, we will focus on addressing weaknesses, reconnecting, optimizing networks, and improving efficiency. We will pay more attention to optimizing the utilization of existing resources and improving the quality of incremental supply. Improve the infrastructure network of railways, highways, water transportation, civil aviation, postal and express delivery, and build a national comprehensive three-dimensional transportation network with railways as the backbone and highways as the foundation, fully leveraging the comparative advantages of water transportation and civil aviation. By 2035, the total physical scale of the national comprehensive three-dimensional transportation network will be around 700000 kilometers(excluding the overseas sections of international land routes, air and sea routes, and postal routes). Among them, there are about 200000 kilometers of railways, about 460000 kilometers of highways, and about 25000 kilometers of high-grade waterways. There are 27

major coastal ports, 36 major inland ports, around 400 civil transportation airports, and around 80 postal and express delivery hubs.

This article selects about 20 international and 80 national comprehensive transportation hub cities, which are clearly defined in the Outline of the National Comprehensive Vertical Transportation Network Planning for the construction of multi-level integrated national comprehensive transportation hubs, as the research objects. The data mainly comes from statistical yearbooks of various cities, and the research period is from 2001 to 2021. Considering that some cities have not published statistical yearbooks, the research objects are selected as 99 prefecture level cities.

3.2. Indicator selection

3.2.1. Indicator system

As a composite system, the ecological niche of a city is influenced by various ecological factors. This study follows the principles of rationality, representativeness, typicality, and accessibility, and constructs a comprehensive evaluation index system consisting of four dimensions: urban economic niche(representing urban economic strength), urban logistics niche(representing the relationship between urban transportation industry population and logistics volume), social information niche(representing modern improvement technology and management level of urban logistics), and urban innovation niche(representing urban innovation ability). Among them, the time span of statistical years is long, and some cities have missing data in their statistical yearbooks. This article uses interpolation method to fill in the gaps.

Table 1. Indicator System

system level	ecological niche	index	weight		
Ecological niche competitiveness of hub cities	Urban economic ecological niche	Value Added of Primary Industry	0.02093	X1	
		Value Added of Secondary Industry	0.03308	X2	
		Value Added of Tertiary Industry	0.05240	X3	
		Total Retail Sales of Consumer Goods	0.03935	X4	
		Number of Employees in Transport, Storage, and Postal Services	0.06080	X5	
	Urban logistics ecological niche	Output Value of Transport, Storage, and Postal Services		0.04325	X6
			Number of Post Offices at Year-End	0.02612	X7
		Postal Service Revenue	0.10142	X8	
		Total Passenger Traffic	0.05185	X9	
		Total Freight Traffic	0.02322	X10	
	Urban innovation ecological niche	Total Length of Highways within the Region	Scientific Research Personnel	0.09047	X12
			Expenditure on Science and Technology	0.11473	X13
		Expenditure on Education	0.06853	X14	
		Number of Full-Time Teachers in Regular Higher Education Institutions	0.05028	X15	
		Number of Students Enrolled in Regular Higher Education Institutions	0.04618	X16	
	Urban information ecological niche	Number of Mobile Phone Subscribers at Year-End		0.02882	X17
			Total Telecommunication Business Volume	0.04859	X18
		Number of Local Telephone Subscribers at Year-End	0.03875	X19	
		Number of Internet Users	0.03437	X20	

3.2.2. Study Methods

3.2.2.1 The TOP entropy weight method

Before the analysis, in order to avoid the influence of different dimensions and units, this paper adopts the entropy value method to determine the weight of each index, and the

calculation formula is as follows:

$$T_j = -\frac{1}{\ln(sn)} \sum_{i=1}^s \sum_{i=1}^n p_{ij} \ln p_{ij}$$

The difference coefficient of each index is:

$$F_j = 1 - T_j$$

Thus, the weight of each indicator is obtained:

$$W_i = \frac{F_i}{\sum_{j=1}^m F_j}$$

Where, p_{ij} It represents the specific gravity probability of each index after the mean method eliminates the influence of the amount. t represents the year and i represents the city, from which the entropy value of the index j is obtained. W_i For the weight of each indicator.

3.2.2.2 Comprehensive ecological niche model

The urban ecological niche evaluation index system is divided into four dimensions, and the calculation formula of the comprehensive evaluation value is:

$$LS = \sum_{i=1}^n \left(\sum_{j=1}^m x_{ij} W_{ij} \right) W_i$$

LS represents the urban comprehensive ecological niche, n is the number of urban ecological niche evaluation index dimensions, m represents the number of indicators of the i th index dimension, x_{ij} For data normalized for niche factors in each city, W_{ij} Represents the weight of each ecological niche factor, and W_i represents the weight of each indicator dimension.

3.2.2.3 Urban ecological niche width model

Niche width A range of a species able to exploit resources, climatic and environmental factors in its living environment to perform physiological functions. The urban ecological niche is the comprehensive accounting of urban resources through the obtained natural resources, social resources and economic resources. The width of the urban niche depends on the state of the resources (the total amount of natural resources, human resources, etc.); the width of the urban niche depends on the potential of the resources (the rate of change of various resource stocks) and the passage of time. The organic combination of state and potential fully reflects the size of the urban ecological niche, that is, the width of the urban ecological niche.

In this paper, the improved Simpson index of Levins and Hurlber was used to construct the urban ecological factor matrix by assigning m cities as rows and n ecological factors as columns. The Levins measure B of the urban i niche width was calculated based on the ecological factor matrix:

$$B_i = \frac{1}{\sum_{j=1}^n p_{ij}^2} = \frac{Y_i^2}{\sum_{j=1}^n x'_{ij}{}^2}$$

p_{ij} It is the proportion of resource j in all available resources of the industrial cluster i , namely x'_{ij} take part in Y_i The ratio of p_{ij} satisfied $\sum_{j=1}^n p_{ij} = 1$. Y_i Is the standardized total amount of all resources available to the city i . x'_{ij} It is the ecological factor, j ($j = 1, 2, \dots, n$). The standardized data is obtained by using the minimum—method of maximum standardization, and the conversion formula between $[0, 1]$ is as follows:

$$x'_{ij} = \frac{x_{ij} - \text{Min}_i}{\text{Max}_i - \text{Min}_i}$$

Finally, use B according to the following formula Standardize to obtain standardized values for the niche width: \hat{B}_i

$$\hat{B}_i = \frac{B_i - 1}{n - 1}$$

\hat{B}_i The values range between 0 and 1, which indicates the largest niche width of the city at $=1$ and at $=0$. When the ecological niche width of the city is large, it can indicate that the urban resources are more comprehensive competitive.

3.2.2.4 The urban ecological niche overlap index model

Niche overlap is used to describe the degree of association between two species, which can partly indicate the degree of similarity between two species. The introduction of niche overlap into the competition relationship between the hub cities and the development pattern of the hub cities is reflected, the higher the overlap, the more intense the competition between the two cities. The Pianka niche overlap index is used to calculate the niche overlap as follows:

$$D_{ig} = \frac{\sum_{j=1}^n p_{ij} p_{gj}}{\sqrt{\sum_{j=1}^n p_{ij}^2 \sum_{j=1}^n p_{gj}^2}}$$

p_{ij} And p_{gj} It is the proportion of resource j in all available resources of industrial clusters i and g . D_{ig} The values range from 0 to 1, and 0 means non-overlap, and there is no competitive relationship between the two cities. 1 indicates the complete overlap of the ecological niches between the two cities.

(5) Urban ecological niche suitability model

Ecological niche suitability represents the species within a certain range of adaptation to the environment resources, for urban system, can use the niche suitability model comparison hub urban system of the ecological factor in the actual value and optimal deviation degree, to measure the hub city development needs the optimal ecological environment and now have the fit between the space resources. Calculate the i -niche suitability F of the hub city; The real ecological niche is x'_{ij} , With the optimal ecological niche x_{aj} Close to the use of Wu Cui and Tan Qingmei The mathematical expression is:

$$K_i = \sum_{j=1}^n \omega_j \frac{\min\{|x'_{ij} - x_{aj}|\} + \beta \max\{|x'_{ij} - x_{aj}|\}}{|x'_{ij} - x_{aj}| + \beta \max\{|x'_{ij} - x_{aj}|\}}$$

x_{aj} Is the optimal value of the ecological factors. Since it is difficult to do large-scale experiments in urban systems, this paper will use the maximum value in the evaluation index to determine the optimal demand. The evaluation indexes of urban ecological niche are all positive factors, and the optimal ecological value of ecological factor j meets the following formula:

$$x_{aj} = \max(x'_{aj})$$

ω_j It is the weight of the j th ecological factor calculated by the entropy weight method; it is the model parameter and can be calculated with $\beta = 0.5 K_i$

$$\beta = \frac{\frac{1}{nm} \sum_{i=1}^m \sum_{j=1}^n (|x'_{ij} - x_{aj}|) - 2 \min\{|x'_{ij} - x_{aj}|\}}{\max\{|x'_{ij} - x_{aj}|\}}$$

β For the parameters, Li Zizhen et al. considered about 0.35 as appropriate to measure the ecological niche suitability of crops.

To further evaluate the evolutionary space of the niche, the evolutionary momentum E of the niche suitability of urban i :

$$E_i = \sqrt{\frac{\sum_{j=1}^n |x'_{ij} - x_{aj}|}{n}}$$

4. Measurement Results and Analysis of Urban Ecological Niche Competitiveness

4.1. Evaluation results of ecological niche value

The top 30 cities in the comprehensive ecological niche are selected in the following table:

Table 1. Values of Niche Dimensions

city	Economic niche	Logistics niche	Innovation niche	Information niche	Comprehensive niche	ranking
Beijing	2.373	1.281	3.237	1.175	2.242	1
Shanghai	2.794	1.148	2.438	1.209	2.085	2
Guangzhou	1.475	1.136	1.763	0.829	1.402	3
Chongqing	1.625	1.032	1.146	0.778	1.217	4
Shenzhen	1.646	0.759	1.203	0.787	1.182	5
Tianjin	1.332	0.487	1.217	0.501	0.988	6
Chengdu	1.017	0.727	1.189	0.639	0.955	7
Wuhan	0.991	0.408	1.500	0.401	0.943	8
Nanjing	0.906	0.364	1.303	0.337	0.834	9
Hangzhou	0.990	0.492	1.020	0.445	0.812	10
Suzhou	1.283	0.384	0.499	0.468	0.710	11
Zhengzhou	0.714	0.325	1.064	0.390	0.695	12
Xi'an	0.580	0.396	1.106	0.409	0.687	13
Changsha	0.747	0.261	0.839	0.284	0.603	14
Qingdao	0.863	0.327	0.588	0.319	0.577	15
Jinan	0.630	0.238	0.848	0.262	0.562	16
Shenyang	0.649	0.329	0.643	0.314	0.528	17
Harbin	0.557	0.274	0.749	0.312	0.522	18
Ningbo	0.842	0.300	0.381	0.358	0.502	19
Hefei	0.537	0.258	0.725	0.199	0.489	20
Dalian	0.693	0.268	0.493	0.271	0.473	21
Shijiazhuang	0.519	0.269	0.591	0.277	0.452	22
Changchun	0.522	0.181	0.623	0.231	0.438	23
Fuzhou	0.69	0.192	0.460	0.272	0.419	24
Wuxi	0.798	0.186	0.285	0.265	0.418	25
Nanchang	0.391	0.162	0.722	0.176	0.417	26
Kunming	0.427	0.285	0.560	0.234	0.412	27
Yantai	0.610	0.185	0.278	0.201	0.349	28
Taiyuan	0.294	0.211	0.538	0.176	0.338	29
Guiyang	0.277	0.381	0.445	0.152	0.338	30

As can be seen from the table, the ecological niche subdivision value and comprehensive ecological niche of Beijing and Shanghai are higher than those of other cities, The comprehensive ecological niche value of Beijing reaches 2.242, and the comprehensive ecological niche value of Shanghai reaches 2.085, indicating that Beijing and Shanghai have high resource utilization efficiency. In addition, the ecological niche of Guangzhou, Chongqing and Shenzhen

follows closely and all are more than 1. Moreover, the logistics ecological niche of these five cities is also at the leading level, and the development environment of urban logistics industry is obviously better than that of other cities. From the perspective of the segmentation value of urban ecological niche, Beijing is in the leading position in the economic ecological niche, logistics niche, innovation ecological niche and information niche. Shanghai,

Guangzhou, Chongqing and Shenzhen have slightly higher segmentation value ratio, which proves that the hub city has high competitiveness and has strong competitiveness in each field.

4.2. Ecological niche width analysis

. 8352. 3810. 5829. 3810 The niche width value of each hub

city is calculated from formula. In this paper, the niche width value of 99 hub cities in 2020 is divided into high ecological width(0.5829~0), medium ecological niche width(00~0)and low niche width(0. 0441~0). As the evaluation value of other years, it can compare the change of ecological niche width in the time dimension. And plot the spatial distribution on Arcgis.

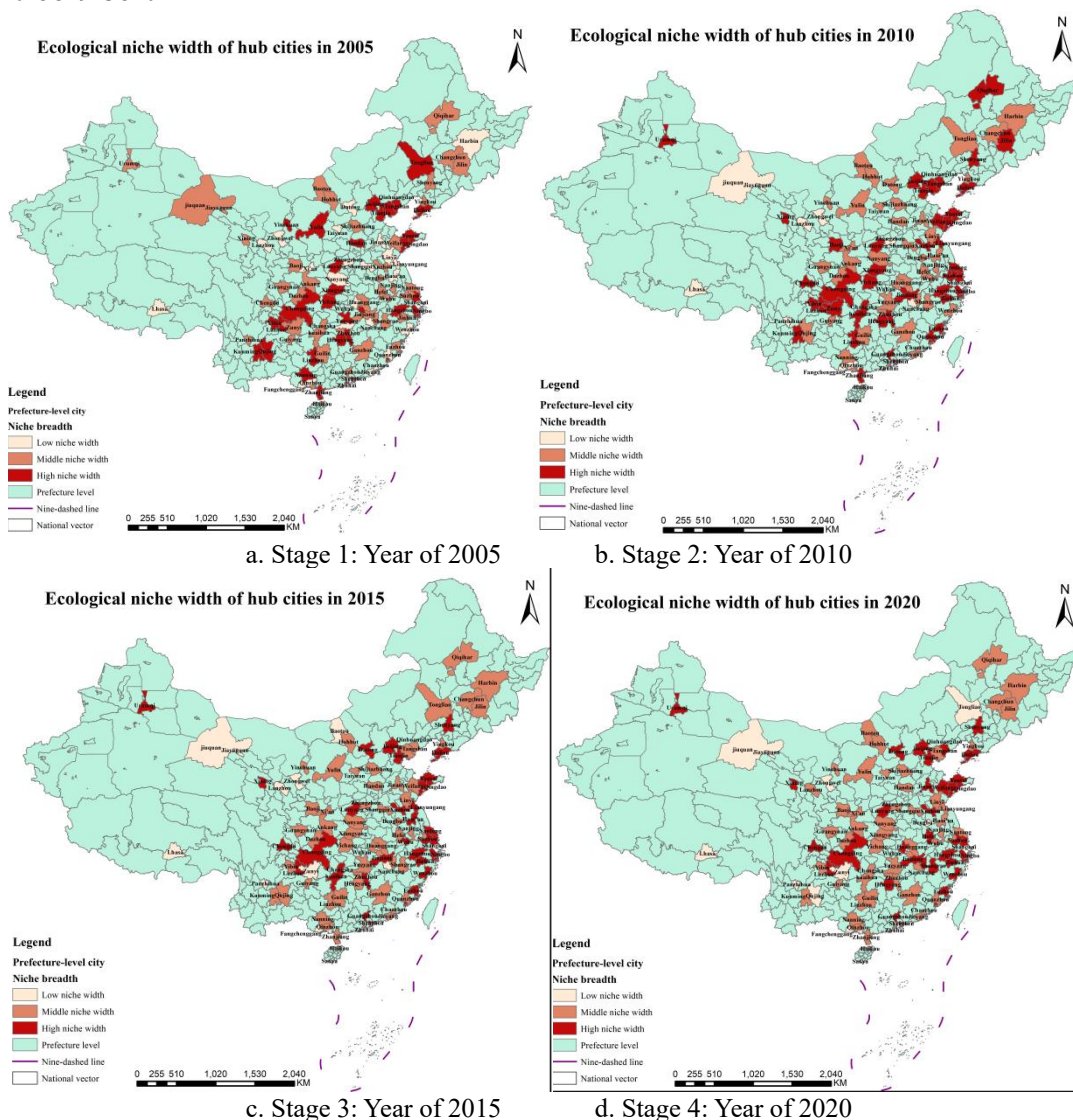


Figure 1. Distribution of Niche Breadth in Hub Cities

From the time dimension, the average niche width of 99 hub cities in 2005, 2010, 2015 and 2020 is 0. 4016, 0. 5081, 0. 5406 and 0. 5255 respectively. The width of the niche is on the rise, and the coverage of spatial resources of hub cities is increasingly extensive, and the development of hub cities has abundant resources, but there is a downward trend in 2020. In order to further analyze the data changes in detail, the average niche of the hub cities in 2019 is 0. 5475, and the decline is determined to start from 2020.

In 2005, the ecological niche width of the hub cities did not reach the high width in the same scale, and at this time, the hub cities used less resources. In 2010, Tianjin, Shanghai and Beijing had the largest ecological niche breadth. Cities with high niche width are mainly distributed in the Yangtze River Delta, Bohai Rim and southwest China. By 2015, Shenzhen, Suzhou, Chengdu, Wenzhou, Wuhu, Nantong, Lianyungang, Zhuzhou and Jinhua by the ecological niche city into high niche city, the Yangtze river hub city resource utilization

ability gradually improve, southwest formed in Chengdu-Chongqing as "dual-core" city economic circle, drive the surrounding hub city quickly attract all kinds of resources, the formation of factors of production. From the spatial point of view, the ecological niche width of the hub cities in the coastal areas of the Yangtze River Delta has increased significantly, indicating that the coastal areas can obtain more abundant resources, thus being more competitive. In 2020, due to the impact of the international epidemic, the average value of niche width decreased, but the pattern of niche width did not change greatly in space. However, Wuhu, Nantong, Shijiazhuang, Changsha, Huai'an, Lianyungang, Wuxi and Zhuzhou cities changed from high niche width to medium niche width in 2015. During the study period, 82 cities showed an overall upward trend, accounting for 82. 8%, and 57 cities showed a downward trend between 2015 and 2020, accounting for 57. 6%. It can be seen that the resource aggregation capacity of most hub cities in China is in a stage

of continuous improvement and growth. Hub in the Midwest and the northeast of urban ecological niche width is generally low, reflects the relative lack of resources and environment of its own resource competitiveness is relatively low, overall hub urban ecological niche width in the time, space dimension of development imbalance and China's unique national conditions, and the inadequate distribution of resources, unbalanced facts.

4.3. Ecological niche overlap degree analysis

Between the 99 hubs in 2005, 2010, 2010 and the 2020, 0.7980, 0.7702, 0.7715 and 0.7436, respectively. It reflects that the overall niche overlap has a downward trend, and the competitiveness among hub cities is decreasing, but the range of change is not large.

Of 99 hub city formed 4851 of the overlapping relationship between the two, found that Jinan-Changsha, Nanjing, Wuhan-Jinan, Jinan, Nan'an, Nan'an, Yantai-Luoyang, Nanjing-Changsha, Wuhan, Hefei, Hefei, Changzhou, Changsha, Hefei, Jinan, Suzhou, Wuxi, Hefei-xi and Xi'an city-the 14 of the city in 2005, 2010, 2010 and 2020 in the overlap are in the first one hundred in the city. Jinan, Changsha, Nanjing, Wuhan and Hefei have appeared many times. The overlap between them is the largest both in time dimension and in space, indicating that the competitiveness between these hub cities is strong. Using ArcGIS software, the ecological niche values of 99 hub cities are depicted on the spatial network atlas and analyzed in the temporal dimension.

Among them, the red lines represent the top 200 cities with the highest overlap in this year. From the spatial network genealogy in 2005, the red line distribution is mainly concentrated in central China, with the largest overlap between Wuhan and Xi'an, with a value of 0.9953. Xi'an-Jiayuguan has the smallest overlap, and its value is 0.1307. In the 200 sets of data, Changchun and other cities appeared 15 times, followed by Nanjing, Nantong, Nanyang 11 times and Jinan 10 times, shows that the competition between these cities and other cities, and the width of the city niche width in the low, shows that the homogeneity between the city competition mainly occurs in the same grade and low niche width city, economic development between urban regional development elements for increasingly fierce. In 2010, the red line distribution of spatial network genealogy was shifted compared with 2005, and the competition between Kunming and Nanning and other cities was increasing, and the overlap value of cities in coastal areas decreased. The overlap between Hangzhou and Shenyang was 0.9932, the largest leap from the 164th in 2005, followed by Nanjing-Wuhan and Nanjing-Zhengzhou. In the top 200 groups, Hefei, Jinan and Luoyang appear the most frequently. The three geographical locations are relatively superior, but the resources cannot meet the demand, resulting in competition and exclusion with other cities. From the red line of the spatial network genealogy in 2015, we can see that there are more hub cities with high overlap degree in the southern coastal cities, which are generally prefecture-level cities with low ecological niche width. The overlap of the five hub cities of Kunming-Xi'an, Nanyang-Zhanjiang, Yueyang-Yibin, Shangqiu-Zhanjiang and Tangshan-Xiangyang shows a growth trend from low to high. The competition between these cities is also gradually increasing, and the utilization rate of resources, development environment and logistics resources of the ecological niche is more and more similar. The change of 2020 in spatial

development is not obvious, but the decrease of the annual average indicates that the development competition relationship between hub cities is reduced. However, in this case, the urban overlap index of the same grade niche width is relatively high, which reflects the unreasonable urban system and the increasing homogeneous competition under the condition of limited resources. There is no high overlapping urban relationship in large first-tier cities. Beijing, Shanghai and other cities have unique ecological niche resources and perfect resource system, realizing stable and sustainable development of hub cities

4.4. Analysis of ecological niche suitability

According to the formula, the niche suitability value of logistics industry in each hub city can be measured, and the natural breakpoint classification method is used to rank 99 hub cities; set inappropriate(0.596455-0.750663), low suitability (0.750664-0.892122), and appropriate (0.892123-0.950550), Medium suitability (0.950551-0.975132)and highly suitability (0.975133-0.994079), suitability map of hub cities in Arc GIS software and further analysis.



Figure 2. Distribution of Niche Suitability in Hub Cities

Which is not suitable for the hub city of Shanghai, Beijing, Shenzhen and Guangzhou, low suitable city of Tianjin, Nanjing, Wuhan, Suzhou, hzhou, Zhengzhou, Chengdu and Chongqing, suitable city has Quanzhou city, Nantong, Nanchang and Shijiazhuang 20 hub city, moderately appropriate Yichang, Zhuzhou city, Zhanjiang and Guilin 26 hub city, highly suitable fangshen city, Jiayuguan, Jiuquan city and Ezhou 41 hub city. Suitability high characteristics of cities in the spatial characteristics in northeast China, northwest China, north China, the central Yangtze river and the coastal areas of Guangxi, the urban niche width is low, but on the resource competition is fierce, resource utilization tends to be reasonable, upward development space is larger, appropriate as a logistics hub city.

5. Conclusion and Suggestion

5.1. Main conclusions

.3935.5002.2116-0.9945Based on urban ecological niche theory, build the theoretical model and evaluation index system, by calculated in 2000-2021 of the niche width, niche overlap and niche suitability, the results found that:(1) the hub of the niche width from 0 in 2001 to 0 in 2021, the overall rising trend, shows that the hub city of logistics resources

gathering ability in increasing growth stage. (2) In 2020, the overlap change interval of hub cities is 0. There is excessive competition among cities with the same grade of niche width, increasing homogeneous competition under the same limited resources, and there is no high overlap urban relationship in large first-tier cities. (3) From the perspective of ecological niche suitability, there are 71 hub cities higher than the average, indicating that the logistics resources and environment of most hub cities have a very high demand for the establishment of hub cities, especially in northeast China, northwest China, North China, the central part of the Yangtze River and the coastal areas of Guangxi. The mean value of niche suitability was ranked from high to low to northwest China, northeast China, Central China, South China, Southwest China, North China and East China. (4) From the perspective of comprehensive evaluation of ecological niche, the ecological niche value of Beijing, Shanghai, Guangzhou, Chongqing and Shenzhen is relatively high, indicating that the logistics competitiveness of these cities is relatively strong.

5.2. Policies and suggestions

1). Implement the "double-coordinated development strategy" to achieve high-quality development of hub cities.

First: In the research, it is found that the niche width of most hub cities is generally low, and the low width niche cities occupy less resource dimensions. In view of this phenomenon, the city should strengthen the all-round expansion of logistics resources, and promote the coordinated development of different resources of internal resources, so as to improve the urban aggregation ability and radiation ability. Second, most hub cities compete highly with each other, and the development pattern of hub cities can be changed by promoting the division of labor, functional complementarity and coordinated development between big cities and surrounding small and medium-sized cities. At present, the construction of urban agglomeration in China has entered the stage of high-quality development, and the optimization of the logistics network expands the utilization scope of logistics resources and can support the development of logistics; on the other hand, improve the utilization efficiency of logistics resources and prevent the waste of logistics resources. Form the development trend of "double coordination" within and between cities, and promote the high-quality development of the logistics network system.

2). Implement the dislocation competition strategy and realize regional differentiated development

In central China, northeast China and East China, the logistics competition chain has a high degree of niche overlap, and the resources and logistics industry among the hub cities within the region. There is a large competitive relationship between each other, and the logistics network system is repeated. In view of this situation, we should pay attention to the role and industrial positioning of the hub cities between regions, pay attention to the layout of logistics network system, and avoid the problem of high homogenization of logistics chain. Jinan, Changsha, Xi'an land port national hub city and Nanjing, Lianyungang and Wuhan port hub city should adopt the strategy of the separation of port logistics, port, strengthen the construction of port logistics infrastructure, form the radiation from coastal to inland areas, coastal logistics drive the development of inland logistics, realize the unique logistics development mode, to their own logistics resources integration, effective use, improve their

comprehensive niche. At the same time, for cities with high ecological niche overlap, such as Lianyungang and Xiangyang, mutual cooperation should be strengthened. Lianyungang should rely on its own natural good port to strengthen exchanges and cooperation with inland cities Xiangyang, so as to realize the linkage development mode of coastal and inland logistics.

3). Strengthen the symbiotic strategy of logistics network

Regional cooperation in the logistics industry can not only reduce logistics costs, but also improve logistics efficiency. In order to realize the regional cooperation of logistics, with the planning and support of national policies, the cities should effectively exchange and cooperate and realize the mutual circulation of logistics resources. The cities should strengthen the cooperation with the surrounding provinces and cities, so as to realize the common development of urban logistics.

Based on the construction of logistics industry cluster as a national hub city, China builds a logistics network system, forming a comprehensive logistics hub with a wider radiation area, stronger agglomeration effect, better service function and higher operation efficiency. Strengthen the business docking between national logistics hub, standard coordination and information interconnection, speed up the construction of unicom inside and outside, woven into a network, efficient and convenient "channel+hub+network" logistics operation system, promote the formation of national logistics hub network framework and basic support, promote regional balanced coordinated development and national unified market construction, lay a solid foundation for economic development with high quality. The national logistics hub will leverage the implementation needs of major national strategies, such as the coordinated development of the Beijing-Tianjin-Hebei region, the development of the Yangtze River Economic Belt, the development of the Guangdong-Hong Kong-Macao Greater Bay Area, and the integrated development of the Yangtze River Delta.

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