Hindawi
Advances in Mathematical Physics
Volume 2022, Article ID 2223212, 11 pages
https://doi.org/10.1155/2022/2223212

Research Article

Research on the Measurement of Logistics Capability of Core Cities along "the Belt and Road" in China

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Received 5 July 2022; Accepted 20 August 2022; Published 6 October 2022

Academic Editor: S. E. Najafi

The B&R strategy came into being to promote the free and orderly flow of economic factors, the efficient allocation of resources, and the depth of market integration. Logistics is the artery of element circulation and the basis of the B&R. The logistics capacity of core cities along the R&B will be an essential factor affecting the strategy. In this context, it is of practical significance to measure the logistics capacity of the core cities along the B&R. Since combing domestic and overseas research, this paper first uses clustering analysis to screen out nine core cities along the B&R and then uses fuzzy matter-element analysis to measure their urban logistics capacity and sort them. The results show that the urban logistics capacity in the eastern coastal areas of China is higher than that in northwest and southwest China. The logistics capacity of cities along "The 21st Century Sea Silk Road" is more robust than that of others and through the urban agglomeration could further achieve economies of scale. The logistics capacity of cities along the "Silk Road Economic Zone" should improve the construction of logistics infrastructure and enhance logistics information in the future.

1. Research Background and Significance

1.1. Research Background. The "Silk Road" is an international channel with a long history, which has played an indispensable role in the economic and cultural exchanges between the East and the West since the Western Han Dynasty. With the deepening of global economic integration, this trading artery has also been given a new meaning to the times.

In 2013, President Xi Jinping puts forward a significant initiative to jointly build the Silk Road Economic Belt and the 21st Century Maritime Silk Road (the Belt and Road). As soon as this initiative was put forward, it attracted wide attention at home and abroad. The initiative was promoted to the top-level national strategy in the following important meetings, such as the Third Plenary Session of the 18th CPC Central Committee and the Central Working Conference. It was mentioned many times on international occasions, such as Boao Forum, APEC, and foreign state visits.

The vital role of "the Belt and Road" is to make the circulation of production factors smoother and more convenient. Therefore, in the process of constructing the circulation system of "the Belt and Road," logistics is both a critical connotation and an indispensable vital means. At the same time, implementing "the Belt and Road" will put higher requirements on the logistics capacity of cities along the route.

China's modern logistics industry rose in the 1990s. Although it started relatively late, it has made significant progress, driven by international logistics. As shown above, China's total social logistics was 38.4 trillion CNY in 2004. In 2012, this index increased to 177.3 trillion CNY, with an average annual growth rate of 21.07%. This shows the development speed of China's logistics industry. In terms of logistics cost, in 2004, China's total social logistics cost accounted for 18.8% of GDP; in 2012, it decreased to 18%. Although it has dropped by 0.8 percentage points, there is still a big gap compared with 10% in developed countries. China's logistics efficiency has improved, and the overall development speed is relatively slow.

1.2. Research Significance. Logistics is the derived demand for social and economic development. Implementing "the Belt and Road" has linked the fragmented regional economies along the line, thus increasing trade and investment and accelerating the industrial transfer and material flow. Implementing "the Belt and Road" should also consider the logistics capacity of areas along the line and promote its economic growth through logistics first. Therefore, the logistics capacity of the core cities along the "Belt and Road" will also become a key factor affecting the implementation of the national strategy. At the present stage, although "the Belt and Road" has become an academic hotspot, there is research on the logistics capability of areas along "the Belt and Road." Under this background, it is of theoretical and practical significance to measure the logistics capacity of the core cities along "the Belt and Road" in China.

2. Literature Review

This paper reviews the existing literature from two aspects: "the Belt and Road" and logistics capability.

2.1. Literature Review of "the Belt and Road." Since it was put forward, "the Belt and Road" has attracted wide attention from scholars in various fields at home and abroad.

Mackerras [1] conducted relevant research from the perspective of "the Belt and Road" construction. He believed that Xinjiang, China, as the hub connecting China and Kazakhstan, should pay attention to its construction and development. Li et al. [2] studied from the perspective of environmental protection, pointing out that "the Belt and Road" involves many countries along the route, so we should pay attention to the protection of resources and the environment in the implementation process. Scholars from neighboring countries in India think more from the perspective of international relations. Chaturvedy [3], on the one hand, discusses in detail the development opportunities brought by China's "the Belt and Road" policy to countries along the route; on the other hand, it studies the possible responses of relevant countries, including positive responses and relatively negative confrontations. Sakhuja [4] pointed out that the "Belt and Road" policy put India in a dilemma: on the one hand, India expected to benefit from cooperation, but on the other hand, it was worried that the rise of China brought about by "the Belt and Road" would adversely affect India.

Domestic scholars have also done a lot of research on "the Belt and Road." In terms of the regional economy, Wubin [5] used the GTAP model to simulate and analyze the regional economic integration effect between China and 64 countries along the "Belt and Road," and based on this, predicted the FTA (free-trade area) strategic path under China's "the Belt and Road." The results show that implementing free trade under "the Belt and Road" will bring positive economic and trade incentives to China and countries along the route. In contrast, countries that have not participated in it will face negative effects. In terms of international trade, Wu [6] used the random front gravity model and the trade barrier analysis model for empirical analysis. The results show that the average trade efficiency between China and the Belt and Road-related countries is 0.49, and half of the trade potential has not yet been developed.

2.2. Literature Review on Logistics Capability. Under the background of the rapid development of logistics, logistics capability has also become a research hotspot in the academic field. The logistics industry in western countries such as Europe, America, and the like has a high level of development, so the relevant scholars in these countries have done more profound research on logistics capabilities.

The Global Logistics Research Team of Michigan State University (MSUGLRT) (1995) researched the measurement of logistics capability. The team divides logistics capabilities into four types, namely, measurement capability, configuration capability, integration capability, and agility capability. This achievement pioneered the research of logistics capability and laid the foundation for subsequent analysis. Follow-up foreign scholars think more from the perspective of enterprise logistics capability. Bowersox [7] believe that logistics capability is the ability of enterprises to provide the best quality logistics services to minimize costs. Morash et al. [8] divided the strategic logistics capability into two parts: the demand-oriented function, which aims to meet customer needs, such as response to the target market, presales and after-sales service, reliability, and punctuality of delivery. The second is the supply-oriented function, which aims to reduce the cost of enterprises, such as distribution scope and cost. Clinton and Closs [9] put information technology into the elements that affect logistics capability, so they think logistics capability includes five components: alliance, information system, EDI, inventory control, and process reengineering. These five elements comprehensively reflect enterprises' logistics integration, information, and process capability. Daugherty et al. [10] explained the logistics capability of enterprises from the perspective of resources. They believe that logistics capability is part of enterprise resources, including all assets, knowledge, and organizational processes of the enterprise. Pfohl and Buse [11] think that a broader range of logistics capabilities includes four key capabilities: flexibility, trade-off, positioning, and merging. Waters and Liu [12] explained the logistics capability from the supply chain perspective. They believe that the logistics capacity of the supply chain refers to the maximum flow of materials in the supply chain within a certain period, from which the optimal output of the supply chain within a limited period can be determined.

2.3. Literature Review. Combined with the above literature, it can be found that the research on "the Belt and Road" covers a vast field. Among them, the research on logistics focuses on the following two aspects. In the aspect of theoretical analysis, it is mainly the idea of building a new logistics development model under the background of "the Belt and Road." Empirical research focuses on the measurement of logistics efficiency and its influencing factors. However, the research on the logistics capability of core cities along “the Belt and Road” is rare.

As for the research on logistics capability, the western countries started earlier, and China only started the related research after 2000. In theoretical research, the definition of logistics capability involves enterprise logistics capability, supply chain logistics capability, urban logistics capability, and regional logistics capability. At present, there is no recognized measurement method for urban logistics capacity, and the following three methods are used in related research: (1) the classical comprehensive evaluation method based on AHP and TOPSIS; (2) the multivariate statistical method based on dimensionality reduction based on principal component analysis and factor analysis; and (3) the self-compiled formula method. However, the above calculation methods have some defects. If the analytic hierarchy process (AHP) constructs different judgment matrices within the scope of consistency and validity, different evaluation results may be obtained; the problem of the TOPSIS method is that if the scores of the two indexes are symmetrical, the connection between the best scheme and the worst scheme, it is difficult to get accurate results. Principal component analysis and factor analysis are difficult to reflect all the information of indicators; however, the self-compiled formula method obtains the weight through the Delphi method, so it cannot accurately and objectively evaluate the logistics capacity of the city. In contrast, the fuzzy matter-element analysis method can effectively avoid the above problems to objectively and comprehensively assess the logistics capacity of the city, which provides a brand-new idea for this paper.

3. Research Innovation and Methods

3.1. Innovation of the Paper. The innovation of this paper is mainly reflected in the following two aspects.

Firstly, the core cities along “the Belt and Road” are selected by cluster analysis, which ensures that the core cities can organize urban logistics and drive regional logistics and avoids subjective assumptions.

Secondly, on the empirical method, this paper adopts the fuzzy matter-element analysis method to calculate and evaluate the logistics capacity of core cities objectively and comprehensively, making this paper’s research results more scientific and reliable.

3.2. Research Methods. This paper mainly adopts theoretical, empirical, comparative, and other research methods to explore the problem and reach a scientific and reliable conclusion.

First, theoretical analysis: by combing and commenting on the existing literature about “the Belt and Road” and logistics capability at home and abroad, we have mastered the research status and development trends of “the Belt and Road” and logistics capability.

Second, empirical analysis: the core cities along “the Belt and Road” are selected through cluster analysis. Then, the fuzzy matter-element analysis method is used to measure the logistics capacity of the core cities.

Third, comparative analysis: this paper compares each city’s logistics capabilities, advantages, and disadvantages and puts forward some pertinent suggestions.

4. A Basic Concept of Urban Logistics Capability and the Analysis of the Current Situation of “the Belt and Road”

4.1. The Basic Concept of Urban Logistics Capability. A city is the center of economy and trade in a region, while logistics is the artery of urban development and the foundation of urban economic growth. A logistics center city should have not only good competitive strength but also provide comprehensive and comprehensive logistics services to its surrounding areas. Therefore, an efficient logistics system must have strong storage capacity, throughput capacity, and radiation capacity, which can meet the needs of modern production mode and management mode.

Based on the research, this paper defines the meaning of urban logistics capability. Urban logistics capability is the comprehensive capability of a city to organize regional logistics and drive the logistics in the surrounding areas. With advanced logistics technology, rational development and utilization of logistics resources can promote the coordinated development of regional overall strength and competitiveness.

4.2. The Development Status of “the Belt and Road” and the Choice of Node Cities along the Route

4.2.1. Development Status of “the Belt and Road.” “The Belt and Road” includes “Silk Road Economic Belt” and “21st Century Maritime Silk Road.” The two international channels involve 26 countries and regions, covering about 4.5 billion people, accounting for 62.5% of the global population. The regional GDP along the line is about 23 trillion USD, accounting for 29.5% of the worldwide GDP. The implementation of this strategy will significantly promote the free and orderly flow of economic factors along the line, optimize resource allocation, and promote the deep integration of the market. “The Belt and Road” can not only become a new economic growth point in China but also play a significant role in driving the economic development of the areas along the line.

Internationally, the “the Belt and Road” strategy crosses Asia and Europe, connects the Asia-Pacific economic circle in the East, and can enter the European economic process through Central Asia and West Asia in the West. Among them, the Silk Road Economic Belt is supported by the Second Asia-Europe Continental Bridge and the node cities along the route to jointly build international economic cooperation corridors such as New China-Indo-China Peninsula and China-Central Asia-West Asia, and gradually spread to more expansive areas such as Western Europe and North Africa in the later period. In the twenty-first century, the Maritime Silk Road takes ports as its node, further deepening the cooperation between China and ASEAN and extending to countries in Africa, the Mediterranean, and other regions later.

Domestically, the "the Belt and Road" strategy has infiltrated and cooperated with various domestic economic regions. Vision and Action is authorized by the State Council. The location of each region has been clearly defined, which will give full play to the comparative advantages of each region, adjust measures to local conditions, and comprehensively improve the opening level of China's economy. Among them, Xinjiang, as an essential window for opening to the West, has become the core area of the Silk Road Economic Belt with its unique location advantages; as an important gateway to the Indian Ocean and the South Pacific, Fujian has been entrusted with the vital task of building the core area of the 21st Century Maritime Silk Road.

4.2.2. Selection of Node Cities along "the Belt and Road." The Silk Road Economic Belt scope mainly includes five provinces in northwest China, namely, Shaanxi, Gansu, Qinghai, Ningxia, and Xinjiang, and four provinces in southwest China, namely, Chongqing, Sichuan, Yunnan, and Guangxi. This paper selects nine cities, Xi'an, Lanzhou, Xining, Yinchuan, Urumqi, Chongqing, Sichuan, Kunming, and Nanning, as the node cities along the "Belt." In the twenty-first century, the maritime silk road mainly relies on the ports of Shanghai, Tianjin, Ningbo, Guangzhou, Xiamen, and Haikou, so this paper chooses these six cities as the node cities along the "One Road."

Therefore, this paper selects the above 15 cities as the node cities along the "Belt and Road."

5. Measurement of Logistics Capacity Research Methods and Model Building

5.1. Fuzzy Matter-Element Analysis Method. Fuzzy matter-element analysis organically combines fuzzy mathematics with matter-element analysis, describing research problems using three elements: things, characteristics, and values. Its basic idea is to analyze the fuzziness of the values corresponding to the attributes of things and the incompatibility among many factors that affect things to solve the problem of numerous indicators and fuzzy incompatibility.

5.1.1. Matter-Element and Fuzzy Matter-Element. The three elements in the meta-analysis are things, characteristics, and corresponding values (the same below), which are recorded. Suppose a matter-element has something, and each thing corresponds to a feature. In that case, the matter-element has a total of values, which can be called the dimensional compound matter-element of each item, namely,

$$Rm \times n = \begin{bmatrix} x11 & \mathrm{L} & x1n \\ \mathrm{M} & \mathrm{O} & \mathrm{M} \\ xm1 & \mathrm{L} & xmn \end{bmatrix}. \quad (1)$$

If the quantity is fuzzy, and the fuzzy quantity is, then the matter-element represents the dimensional compound fuzzy matter-element of a thing. The fuzzy value is calculated according to the principle of preferential membership, and the specific calculation method is:

$$\text{Benefit}: \mu_{\mathrm{ij}} = \frac{x_{ij} - \min x_{ij}}{\max x_{ij} - \min x_{ij}}, \quad (2)$$

$$\text{Cost}: \mu_{\mathrm{ij}} = \frac{\max x_{ij} - x_{ij}}{\max x_{ij} - \min x_{ij}}, \quad (3)$$

where indicates the maximum (minimum) value of all the quantities under the *i*th characteristic of each thing max xij (min xij).

By combining formulas (2) and (3), the dimensional compound fuzzy matter element of the corresponding item in formula (1) can be obtained, namely,

$$\tilde{R}m \times n = \begin{bmatrix} \mu 11 & \mathrm{L} & \mu 1n \\ \mathrm{M} & \mathrm{O} & \mathrm{M} \\ \mu m1 & \mathrm{L} & \mu mn \end{bmatrix}. \quad (4)$$

Order, that is, the difference square of each item corresponding to the standard fuzzy matter-element and the dimensional compound fuzzy matter-element is called the difference square compound fuzzy matter-element, that is,$\Delta ij = (\mu oj - \mu ij)^2$.

$$\tilde{R}\Delta = \begin{bmatrix} \Delta 11 & \mathrm{L} & \Delta 1n \\ \mathrm{M} & \mathrm{O} & \mathrm{M} \\ \Delta m1 & \mathrm{L} & \Delta mn \end{bmatrix}. \quad (5)$$

Among them, it is the preferential membership degree of each index calculated according to the preferential membership degree. In this paper, if the maximum value is optimized, the subordination degree of each index is 1.

5.1.2. Composite Fuzzy Matter-Element of Weight and Euclidean Closeness. From the perspective of information theory, information is a measure of the degree of system order; on the contrary, entropy is a measure of the system's disorder. However, in the specific process of evaluating the index system, its entropy value is determined by the variation degree of the index value: the high variation degree indicates that the index system contains comprehensive information, and its contribution to the information of the system is high, so the uncertainty is small, and the entropy value of the index is low, and the weight is significant; on the contrary, if the variation degree is low, the entropy value of the index is high, and the weight is small. In this paper, the entropy method is used to calculate the index weight, and the specific calculation process is as follows.

Step 1: normalize the initial matrix to obtain the normalized judgment matrix. Among them,

$$bij = \frac{xij - \min xij}{\max xij - \min xij}. \quad (6)$$

In formula (6), it represents the most satisfactory value (the least satisfactory value) among different things under the same feature max xij(min xij).

Step 2: according to the definition of entropy in information theory, calculate the entropy of item features of item events:

$$Hi = -\frac{1}{\ln n}\left[\sum_{j=1}^{n} fij \ln fij\right]. \quad (7)$$

Among them,

$$fij = \frac{bij}{\sum_{j=1}^{n} bij}. \quad (8)$$

At that time, it was 0, and currently, it was infinite, so it was necessary to translate. The revised formula is the correction formula:

$$fij = \frac{A + bij}{\sum_{j=1}^{n}(A + bij)}. \quad (9)$$

In formula (9), the translation amplitude is 1.

Step 3: calculate the entropy weight of features:

$$\omega i = \frac{1 - Hi}{m - \sum_{i=1}^{m} Hi}. \quad (10)$$

Satisfy in formula (10).

Step 4: calculate the European closeness of things and the compound fuzzy matter element:

$$\rho Hj = 1 - \sqrt{\sum_{i=1}^{m} \omega i \Delta ij}, \quad (11)$$

$$R\rho H = \begin{bmatrix} & M1 & M2 & \cdots & Mn \\ \rho Hj & \rho H1 & \rho H2 & \cdots & \rho Hn \end{bmatrix}. \quad (12)$$

The closeness degree is used to measure how close everything is to the best thing, and the larger the value, the closer the measured thing is to the best thing.

5.1.3. Fuzzy Matter Elements of Panel Data. Those mentioned above fuzzy matter-element analysis method can be directly used to process cross-sectional data or time series data, but if it is applied to panel data, the data must be dimension-reduced; that is, things in different years are regarded as new things and incorporated into the original dimension complex element, to construct the following new dimension complex element:

$$Rm \times n(y) = \begin{bmatrix} x11(1) & \text{L} & x1n(t) \\ \text{M} & \text{O} & \text{M} \\ xm1(1) & \text{L} & xmn(t) \end{bmatrix}. \quad (13)$$

It indicates the magnitude corresponding to the first feature of the first thing in a year. $xij(y), (y = 1, 2, \cdots t)$ represents the year y and the I and x.

Because the panel data complex element absorbs the information of time and things, it keeps the differences between groups, which makes the finally calculated European closeness comparable. $Rm \times n(y)$ absorbed the information of time and things, thus keeping the differences between groups and making the finally calculated European style close.

5.2. WARD Cluster Analysis. Clustering analysis divides observation samples into different groups or classes based on their similarities or differences among multiple groups of indicators. Its basic idea is to maximize the homogeneity of objects in the same category by classifying individuals or objects. In contrast, the properties of research objects in different types are pretty other so that the problems can be classified according to the characteristics of research objects. This paper adopts the Ward method, a systematic clustering method, and its specific steps are as follows.

The first step is to measure the correlation.

We should first measure the similarity when extracting a relatively simple class structure from a group of complex data. In this paper, the Ward cluster analysis method is adopted, so its corresponding measurement method is Euclidean distance, which is widely used.

Let (x, y) be two cluster variables that measure similarity, containing values. The specific measurement formula is as follows:

$$d(x, y) = \sqrt{\sum_{i=1}^{m} (xi - yi)^2}. \quad (14)$$

In practice, the index data often have different dimensions, impacting the correlation measurement. Therefore, before measuring the correlation, the data should be dimensionless. This paper adopts an extreme difference method to deal with it. The specific calculation method is as follows:

$$x_i' = \frac{xi - \min xi}{\max xi - \min xi}. \quad (15)$$

The second step is clustering or grouping.

Systematic clustering methods mainly include the aggregation method and decomposition method. The aggregation method is to regard each sample as a class and combine the two classes with the closest properties to form a new class, and then, there are common classes. Then, two types with the closest properties are selected from the new classes and merged to obtain classes, and so on, until all the samples are grouped into one class, and a cluster diagram is obtained. On the contrary, the decomposition method treats all samples as one class at first and then divides them into two classes according to the optimal criterion; then, according to this criterion, each subclass is divided into two classes, and a subclass with better objective function is selected so that the two classes become three classes, and so on, until there is only one sample in each category.

Ward clustering is an aggregation method that uses variance analysis to minimize the differences between groups and maximize the differences between groups. That is, because of Euclidean square distance, when the number of classes is fixed, the sum of squares of intraclass deviation will be minimized. This clustering method is very effective in theory and practice and is widely used.

6. "The Belt and Road" along the Core Cities Logistics Capacity Measurement Empirical Analysis

6.1. Selection of Core Cities. Urban energy level reflects a city's comprehensive ability and influence on the surrounding areas. The stronger the comprehensive strength of a city, the higher its energy level, and the lower the energy level. This part measures the energy levels of the node cities selected in Section 1 by constructing the relevant index system and classifies 15 cities by Ward cluster analysis to screen out the core cities along "the Belt and Road."

6.1.1. Index System and Data Source for Measuring Urban Energy Level. The core city is the hub of the circulation of production factors in "the Belt and Road." This function requires it to have a robust external circulation capacity. An efficient logistics system cannot be separated from the perfect infrastructure, so it needs a particular economic strength as support. Based on the existing research of Lijun and Yaolin [13] and Chhetri et al. [14], this paper selects six indicators from three aspects, urban economic strength, urban investment, and construction capacity and urban external circulation capacity, and constructs a comprehensive measurement system of urban energy level. Among them, the indicators that characterize the city's economic strength are GDP, total retail sales of social goods, and the proportion of GDP of secondary and tertiary industries. The index of urban investment and construction ability is the fixed asset investment of the whole society. The indicators that characterize the external circulation capacity of cities are urban freight volume and urban passenger volume. See the following table for the specific index system and data sources (Tables 1 and 2).

As the statistical caliber of passenger traffic indicators of individual cities was adjusted in 2013 and 2014, it is not comparable with previous years' data. Therefore, this paper selects the panel data of 15 cities from 2010 to 2012 as samples.

6.1.2. Establishment of Core Cities Based on Ward Cluster Analysis. Because cluster analysis cannot directly process panel data, this paper takes the average value according to the year to get the cross-section data of 6 indicators in 15 cities and uses the range method to dimensionless the cross-section data to get the cluster analysis raw data with the distribution interval of [0, 1]. See the following table for details:

Using the above data, 15 node cities along "the Belt and Road" are analyzed by the Ward cluster, and the statistical software used in this part is stata13.1, and the hierarchical tree diagram is obtained.

In this paper, 15 node cities are divided into four categories. Shanghai, Chongqing, Tianjin, Chengdu, and Guangzhou have a robust economic foundation and superior geographical position, which are far ahead of other cities in terms of economic strength and circulation capacity, so they are classified as the first category. Nanning, Kunming, Xi'an, and Ningbo are classified in the second category. Although these cities are relatively backward in the economic aggregate, they play an important role in collection and distribution. Haikou, Urumqi, and Xiamen are divided into the third category. Although Haikou and Xiamen are located in the southeast coastal areas, their economic hinterland is relatively narrow compared with Guangzhou, Shenzhen, and other cities, and their contribution to "the Belt and Road" is limited. Urumqi is the gateway of China to Central Asia and the export station of the new Asia-Europe Continental Bridge, which has an irreplaceable strategic position. However, its infrastructure is weak, and it is difficult to meet the demand of modern circulation. Yinchuan, Xining, and Lanzhou, deep inland in the northwest, are divided into the fourth category. Limited by geographical factors, these three cities are weak in all aspects. To better serve the construction of "the Belt and Road," these three cities still have many places to be improved.

According to the results of cluster analysis, this paper selects the first two types of cities, namely, Shanghai, Chongqing, Tianjin, Chengdu, Guangzhou, Nanning, Kunming, Xi'an, and Ningbo, as the core cities along the "Belt and Road," and calculates the logistics capacity.

6.2. Calculation of Logistics Capacity of Core Cities

6.2.1. Index System and Data Source of Urban Logistics Capability. Combining with the definition of urban logistics capability given in Section 1.1 of this paper and based on previous studies, eight indicators are selected to measure urban logistics capability from three aspects: logistics basic level, transportation volume level, and logistics informatization capability. Among them, the indicators to measure the basic level of logistics are an investment in fixed assets and the number of employees in the logistics industry; the indicators to measure the level of transportation are cargo turnover, passenger turnover, and total freight volume; the indexes to measure logistics information ability are the number of postal marketing outlets, the total amount of postal services, and the length of postal routes. See the following table for the specific index system [15].

The data on the total freight volume and the number of postal marketing network points in this paper come from the National Bureau of Statistics. The data of the other six indicators come from the Statistical Yearbook of Cities, the Statistical Yearbook of Transportation, the Statistical Bulletin of National Economic and Social Development, and the statistical yearbooks of the provinces to which each city belongs [16–18]. The statistical caliber of the total post and telecommunications business in Xi'an, Nanning and other cities changed significantly in 2011, which is not comparable

Table 1: Urban energy level index system and data source.

Primary index	Secondary index	Data source
Urban economic strength	GDP	Wind database
	The total volume of retail sales	National Bureau of Statistics (NBS)
	The proportion of gross product of secondary industry in GDP	Wind database
Urban investment and construction capacity	Investment in fixed assets of the whole society	Wind database
Urban external circulation capacity	Urban freight volume	National Bureau of Statistics (NBS)
	Urban passenger traffic	National Bureau of Statistics (NBS)

Table 2: Cluster analysis of raw data.

City	Urban economic strength			Urban investment and construction capacity	Urban external circulation capacity	
	GDP	The total volume of retail sales	The proportion of secondary and third industry in GDP	Investment in fixed assets of the whole society	Urban freight volume	Urban passenger traffic
Ningbo	0.289	0.257	0.725	0.288	0.330	0.200
Xiamen	0.096	0.076	0.971	0.102	0.099	0.071
Guangzhou	0.635	0.730	0.921	0.424	0.704	0.474
Nanning	0.080	0.119	0.000	0.220	0.241	0.053
Seaport	0.000	0.016	0.487	0.000	0.069	0.231
Chengdu	0.338	0.381	0.717	0.639	0.410	0.718
Kunming	0.101	0.142	0.626	0.255	0.216	0.075
Xi’an	0.171	0.248	0.704	0.443	0.412	0.219
Lanzhou	0.034	0.055	0.820	0.074	0.065	0.004
Xining	0.001	0.000	0.761	0.017	0.000	0.009
Yinchuan	0.014	0.000	0.678	0.048	0.100	0.000
Urumqi	0.053	0.063	0.942	0.041	0.153	0.004
Tianjin	0.575	0.459	0.938	0.925	0.454	0.159
Shanghai	1.000	1.000	1.000	0.644	1.000	0.048
Chongqing	0.500	0.511	0.390	1.000	0.964	1.000

with the relevant data in 2010, so this paper selects the data from 2011 to 2014 for four years.

6.2.2. Estimation of Urban Logistics Capacity Based on Fuzzy Matter-Element Analysis. Taking the above-mentioned panel data as samples, this paper uses fuzzy matter-element analysis to measure the logistics capacity of core cities along “the Belt and Road.” The operating software used in this part is MATLAB (R2014a).

Firstly, the 8-dimensional compound fuzzy matter-element matrix is calculated according to formulas (1) to (4). This paper adopts the transposed form of the matrix. The matrix shows the relative values of 36 samples on eight indexes [19–21]. The related data of the transpose matrix are as follows:

Then, calculate the entropy weight of eight indexes. According to formulas (5) to (10), the entropy weight vector is:

$$\omega_i = (0.0955\ 0.0741\ 0.0290\ 0.1141\ 0.0622\ 0.1520\ 0.0948\ 0.1983)^T, \quad (i = 1, 2, \cdots, 8). \tag{16}$$

It can be seen from the entropy weight vector that the entropy weights of the eight indexes are between 0.02 and 0.20, with little difference. Among them, the maximum index of entropy weight is the length of the postal route, and the minimum index of entropy weight is the turnover of goods. Under the index system of this paper, the length of the postal route, postal marketing outlets, and passenger turnover have strong explanatory power to the urban logistics capacity, contributing 46.44% of the information cumulatively. It should be noted that the entropy weight does not mean the importance of an index to improve the urban logistics capability, but only the amount of practical information provided by the index when measuring the urban logistics capability [22].

Finally, based on the index entropy weight, the logistics capacity values of nine cities are calculated and sorted by combining the formula (11). The specific calculation results are shown in the following table (the values in brackets are the ranking of logistics capacity of cities in the current year).

6.3. Analysis of Empirical Results of Urban Logistics Capacity Measurement. In this part, nine core cities are selected from 15 node cities along "the Belt and Road" by cluster analysis. Then, the logistics capacity of 9 core cities is measured by fuzzy matter-element analysis.

Overall, the average level of logistics capacity of core cities along "the Belt and Road" has been increasing in logarithm in the past four years, with the fastest growth rate in 2012 and then gradually slowing down. In 2012, to alleviate the declining growth rate of imports and export, the Chinese government timely introduced measures to stabilize the growth of foreign trade in September so that the growth rate of foreign trade picked up. According to the data released by the General Department of Commerce, China's trade volume of goods still ranks second in the world in 2012, against the background that the world's total import and export volume only increased by 0.2%. Driven by international trade, the logistics industry of the core cities along the "Belt and Road" in China is also constantly transforming and upgrading, realizing the leap-forward improvement of logistics capability. After two years, the world economy continued its weak recovery, and foreign trade was relatively weak. As a result, the logistics capacity of core cities along "the Belt and Road" was affected, and the growth rate declined.

Except that the logistics capacity of Tianjin declined slightly in 2014, and the fluctuation range of Xi'an was extensive, the logistics capacity of other cities mostly made steady progress.

As China's international trade center, Shanghai's port imports and exports account for about 1/3 of the country's total, and it is a vital hub of the 21st Century Maritime Silk Road. The establishment of Daxiaoshan Port makes up for the shortcomings of Shanghai's deep-water port; the deepening of the Shanghai Pilot Free Trade Zone has attracted many outstanding enterprises and talents. Shanghai's logistics capability ranks first among the nine core cities with a solid economic foundation and modern logistics infrastructure. It is far ahead and the mainstay of China's connection with the Asia-Pacific economic circle [23].

As the largest city in western China, Chongqing ranks second in logistics capacity. Chongqing is an important node city on the southwest line of the Silk Road Economic Belt and a transit center to ASEAN countries via Guangxi and Yunnan. With the help of perfect logistics infrastructure and substantial collection and distribution capacity, Chongqing has played an indispensable role in the outbound transportation of western resources and industrial raw materials. Chengdu is one of the largest railway hubs in southwest China and one of the most important highway hub cities in China, which plays a vital role in land transportation. However, the positioning and development of Chengdu determine that its logistics capability is slightly inferior to that of Chongqing.

Although Guangzhou is a subprovincial city, its logistics capacity ranks third above that of Tianjin, and it has grown rapidly since 2012, approaching Chongqing. Guangdong has a superior geographical position and excellent infrastructure and has the natural advantage of multimodal transport by sea, land, and air; with a vast hinterland adjacent to Hong Kong and Macao, it is a crucial material distribution center and trading port in South China. In addition, Guangzhou pays attention to the innovation and development of the logistics industry, such as the coordinated development of e-commerce and logistics, actively expanding overseas warehouses, etc., constantly improving the modern logistics capability and playing the vanguard role of "the Belt and Road."

Tianjin Binhai New Area, with convenient shipping conditions and developed land transportation, is one of the crucial ports connecting inland areas with Japan and South Korea and also one of the core cities of the 21st Century Maritime Silk Road. However, compared with the Yangtze River Delta, Pearl River Delta, and other regions, Tianjin's logistics cost is higher, and its logistics service is relatively backward, so its logistics capability still has a lot of room for improvement.

As an inland city in northwest China, Xi'an has a weak economic foundation and relatively backward infrastructure compared with the eastern coastal areas. From the table above, the passenger and freight turnover and passenger volume of Xi'an fluctuate considerably, indicating that its logistics capacity is unstable. Kunming and Nanning, which are in the southwest inland, are the gateways of China to ASEAN countries. Still, their development lags, and their logistics capacity is relatively weak. It is undeniable that Kunming's logistics capacity was significantly improved in 2013. Ningbo's economy is small; its logistics capacity is insufficient compared with other municipalities directly under the central government and provincial capital cities and even nearly ten times the gap compared with Shanghai.

To sum up, from 2011 to 2014, the average logistics capacity of the core cities along "the Belt and Road" in China has dramatically improved. From the regional point of view, the overall logistics capacity of the eastern coastal areas is more vital than that of the inland cities in the northwest and southwest. Tianjin and Xi'an and other cities have made different degrees of progress, among which Shanghai's logistics capability is far ahead, Guangzhou and Kunming have made significant progress, while Nanning and Ningbo's development is slightly lagging.

6.4. Policy Recommendations. According to the empirical results of urban logistics capacity measurement, this chapter puts forward the following policy suggestions.

First, strengthen the infrastructure construction of cities along the Silk Road Economic Belt and improve the level of logistics technology to adapt to the modern development of logistics. As seen from Tables 3–5, except for Chongqing,

Table 3: Index system of urban logistics capability.

Primary index	Secondary index	Symbol of this article
Basic level of logistics	Investment in fixed assets of logistics	C1
	Number of employees in the logistics industry	C2
Transportation volume level	Cargo turnover	C3
	The volume of passenger transportation	C4
	Total freight volume	C5
Logistics informatization capability	Postal marketing network	C6
	Total post and telecommunications business	C7
	Length of the postal route	C8

there is still a big gap between the urban logistics capacity in the northwest and southwest regions and that in the eastern coastal areas [24]. With the rapid development of science and technology, the early "Tea-Horse Road" has been unable to meet the needs of modern production and management, and the transportation flow of the route and the transit speed of the hub have become the bottlenecks that limit the improvement of its logistics capacity. Therefore, cities in northwest and southwest China should first strengthen the construction of a transportation network and introduce advanced logistics facilities and professionals to dredge the circulation artery of the Silk Road Economic Belt and enhance the city's logistics capacity.

Second, to build urban agglomerations along the 21st Century Maritime Silk Road and achieve $1+1>2$ urban logistics capacity through urban agglomeration. Each city's location has its advantages and disadvantages. Still, each element in the same urban agglomeration can learn from each other's strong points to make up for one's weak points, define the urban industrial division of labor, accurately position the urban functions, and realize industrial complementarity and infrastructure sharing. For example, Yangshan Deepwater Port in Zhejiang has solved the problem of insufficient water depth in Shanghai port. Similarly, Xiamen's logistics capacity is limited. Still, it can jointly build an urban agglomeration with Fuzhou, Quanzhou, and other cities to expand the economic hinterland, achieve economies of scale, and work together to create the core area of the 21st Century Maritime Silk Road in Fujian.

Third, to better serve "the Belt and Road," cities should actively carry out reform and innovation and give corresponding policy support. For example, implementing the regional customs clearance mechanism along the "Belt and Road" will eliminate cumbersome customs clearance procedures and reduce trade barriers. Further, improve circulation efficiency and promote upgrading urban logistics capacity.

7. Research Conclusions and Prospects

7.1. Research Conclusion. Based on systematically sorting out the related literature about "the Belt and Road" and logistics capability, this paper calculates the logistics capability of core cities along "the Belt and Road." Firstly, cluster analysis selects nine core cities from 15 nodes in the "Belt and Road." Then, the fuzzy matter-element analysis is used to measure the logistics capacity of these nine cities. The main conclusions of this paper are as follows: first, from 2011 to 2014, the logistics capacity of core cities along China's "Belt and Road" continued to improve, but the growth rate declined slightly. Under the background of the weak recovery of the world economy, China should actively take corresponding measures to cooperate with "the Belt and Road" to stimulate foreign trade to enhance the logistics capacity of cities along the route. For example, the regional customs clearance mechanism is implemented along the "Belt and Road." Secondly, the development of logistics capacity in different regions is uneven, among which the logistics capacity of cities in eastern coastal areas is vital. In contrast, that of cities in northwest and southwest areas is weak. To improve the logistics capacity of a town, we should not only rely on international trade but also strengthen the construction of the city's own logistics infrastructure. Therefore, to better serve the construction of "the Belt and Road," the western region should first improve logistics modernization and introduce advanced technical equipment and logistics professionals. The eastern region can build the 21st Century Maritime Silk Road urban agglomeration and realize the specialized division of urban functions through urban agglomeration to realize the scale effect.

7.2. Research Prospect. There are three main points to be improved in this paper: firstly, when clustering the panel data, the average value of the data by year is adopted. The disadvantage of this operation is that the dynamic information reflected by the panel data is eliminated, and the development of a specific city index in four years cannot be measured in the classification process. Secondly, this paper uses the same index system to measure "Belt and Road." Considering the integrity of the data, there is no subdivision of cargo turnover and passenger turnover by water, land, and air, and it is impossible to compare the respective advantages of inland and coastal cities accurately. Thirdly, when measuring the logistics capacity of the core cities, the radiation range of the core cities is not deeply considered. The "breaking point" model can be used to calculate the radiation range of the core city and further enrich the index system to measure the logistics capacity of the city [25].

Table 4: Transpose matrix of 8-dimensional compound fuzzy matrix.

City	Age	C1	C2	C3	C4	C5	C6	C7	C8
Shanghai	2011	0.235	0.625	0.997	0.508	0.950	1.000	0.511	0.077
	2012	0.137	0.650	1.000	0.473	0.963	0.737	0.702	0.105
	2013	0.133	1.000	0.873	0.523	0.928	0.896	0.821	0.119
	2014	0.147	0.992	0.914	0.557	0.914	0.878	1.000	0.129
Chongqing	2011	0.511	0.567	0.113	0.249	0.993	0.636	0.264	0.073
	2012	0.691	0.610	0.119	0.280	0.866	0.490	0.303	0.073
	2013	0.930	0.664	0.102	0.237	0.876	0.610	0.361	0.080
	2014	1.000	0.710	0.116	0.267	1.000	0.702	0.459	0.067
Tianjin	2011	0.281	0.248	0.489	0.109	0.354	0.105	0.196	0.025
	2012	0.332	0.273	0.366	0.146	0.391	0.180	0.203	0.029
	2013	0.437	0.335	0.255	0.163	0.439	0.252	0.213	0.028
	2014	0.460	0.440	0.154	0.141	0.431	0.245	0.267	0.020
Chengdu	2011	0.193	0.290	0.002	0.286	0.228	0.048	0.185	0.117
	2012	0.178	0.297	0.004	0.310	0.291	0.056	0.232	0.139
	2013	0.231	0.360	0.002	0.262	0.338	0.055	0.274	0.138
Chengdu	2014	0.281	0.385	0.004	0.303	0.150	0.060	0.350	0.120
Guangzhou	2011	0.199	0.398	0.130	0.744	0.602	0.001	0.342	0.089
	2012	0.240	0.399	0.233	0.824	0.739	0.000	0.369	0.041
	2013	0.365	0.482	0.326	0.908	0.899	0.011	0.503	0.075
	2014	0.399	0.445	0.416	1.000	0.990	0.011	0.555	0.076
Nanning	2011	0.021	0.000	0.007	0.044	0.105	0.000	0.088	0.023
	2012	0.080	0.138	0.013	0.051	0.172	0.001	0.101	0.026
	2013	0.064	0.123	0.016	0.056	0.185	0.001	0.108	0.025
	2014	0.073	0.128	0.019	0.014	0.213	0.001	0.137	0.024
Kunming	2011	0.028	0.004	0.001	0.068	0.000	0.023	0.000	0.241
	2012	0.067	0.015	0.000	0.058	0.011	0.023	0.015	0.443
	2013	0.122	0.030	0.002	0.068	0.140	0.023	0.010	1.000
	2014	0.106	0.031	0.003	0.078	0.146	0.023	0.011	0.974
Xi’an	2011	0.000	0.300	0.014	0.101	0.287	0.018	0.218	0.027
	2012	0.073	0.241	0.018	0.108	0.357	0.018	0.235	0.533
	2013	0.065	0.315	0.020	0.118	0.421	0.018	0.270	0.045
	2014	0.108	0.296	0.019	0.095	0.322	0.019	0.319	0.045
Ningbo	2011	0.108	0.092	0.092	0.025	0.228	0.018	0.006	0.000
	2012	0.121	0.099	0.091	0.027	0.206	0.019	0.004	0.000
	2013	0.070	0.095	0.099	0.019	0.240	0.019	0.006	0.008
	2014	0.081	0.094	0.090	0.000	0.302	0.017	0.005	0.009

Table 5: Logistics capacity value of core cities along “the Belt and Road”.

Age	Shanghai	Chongqing	Tianjin	Chengdu	Guangzhou	Nanning	Kunming	Xi’an	Ningbo	Mean
2011	0.466 (1)	0.288 (2)	0.204 (4)	0.129 (5)	0.212 (3)	0.027 (9)	0.058 (7)	0.077 (6)	0.055 (8)	0.168
2012	0.462 (1)	0.294 (2)	0.212 (4)	0.144 (6)	0.235 (3)	0.050 (9)	0.092 (7)	0.170 (5)	0.055 (8)	0.191
2013	0.490 (1)	0.311 (2)	0.219 (4)	0.153 (5)	0.295 (3)	0.050 (9)	0.143 (6)	0.102 (7)	0.055 (8)	0.202
2014	0.503 (1)	0.333 (2)	0.204 (4)	0.155 (5)	0.318 (3)	0.051 (9)	0.143 (6)	0.102 (7)	0.054 (8)	0.207

This paper uses the fuzzy matter-element analysis method to preliminarily calculate the logistics capacity of the core cities along the "Belt and Road." The empirical analysis shows that this method is feasible for measuring urban logistics capacity, but there are still three problems. Future research can improve on the above three aspects and accurately calculate urban logistics capacity.

Data Availability

All data, models, and code generated or used during the study appear in the submitted article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Authors' Contributions

Zhichao Sun,Tao Wang, Xinuo Xiao, Qing Zhang, and Huiwen Guo contributed to the work equally and should be regarded as co-first authors.

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