Study on the Regional Logistics Capability Based on Factor Analysis under the Background of Belt and Road Initiative

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Abstract. The implementation of the Belt and Road Initiative puts forward higher requirements for regional logistics capabilities. But the uneven development of logistics industry in various provinces restricts the B&R initiative. Basing on the relevant studies, this paper builds a regional logistics capability index system, which covers the logistics industry scale, logistics infrastructure, logistics human resources, social economy and internet development level. This paper adopts the factor analysis to comprehensively evaluate the logistics capacity of 18 provinces along the B&R, proposing corresponding countermeasures to these provinces under the B &R initiative.

Keywords. Regional logistics capability, Factor analysis, The Belt and Road Initiative.

1. Introduction
Since the B&R Initiative was put forward in 2013, the logistics industry has played significant role in the implementation of the initiative. On the one hand, constructing modern logistics, providing efficient international and domestic logistics services are important contents of the initiative [1]. On the other hand, the logistics promotes the integration of different industries [2]. In other words, logistics is a key point in advancing the implementation of the B&R Initiative. The Chinese government has issued a number of policies to clarify the direction of logistics development and promote the efficient circulation of resources across the provinces and cities along the B&R.

However, there are still obvious imbalances in the development of China's logistics industry, which restrict the cooperation of economy, culture, tourism and other industries between the regions, and thus affecting the B&R Initiative. Therefore, we need to construct a reasonable indicator system to evaluate the regional logistics capabilities, and give policy recommendations to improve the logistics capabilities along the B&R Initiative, promoting the development of logistics industry along the B&R Initiative.

2. Literature Review
Many scholars studied logistics [3], including the characteristics the evaluation of regional logistics capabilities.

Scholars used empirical analysis to analyze the regional logistics and indicate the importance of rational construction of regional logistics [4-6]. After analyzing the logistics in Yangtze River Economic Belt, Midwest Region and Yangtze River Delta, Chinese scholars [7-9] found that logistics capabilities varied from region to region, and proposed corresponding development. Scholars paid more attention to the relationship between logistics and economy, as well as the spatial layout characteristics of different regions. Few scholars have studied the regional logistics industry with the background of the B&R Initiative. Ding et al. (2018) believed that the B&R Initiative would push the global logistics industry to a new era [3]. Zhao et al. (2017) pointed out that the B&R Initiative put
higher demands on logistics in various provinces and cities along the route [10]. Generally, the paper evaluates the current status of logistics capabilities in five different regions involved in the B&R Initiative, and finds ways to improve the logistics capabilities, promoting the implementation of initiative.

How to evaluate logistics capability? Starting from the logistics operation process, Dang et al. (2018) constructed a logistics capability evaluation system covering the input link of logistics economic factors, the production link of factors, and the formation link of value [11]. Based on the perspective of enterprise, Liu (2017) designed a low-carbon logistics capability evaluation system including the scale of enterprise, the low carbon management capability, and the low-carbon technology innovation [12].

Although scholars have constructed a number of logistics capability evaluation index systems from different angles, these indicators are all based on the internal reasons of logistics transportation, including the infrastructure, industry scale and human resources status of regional logistics. In fact, regional logistics capabilities are also affected by external factors, such as the regional economic and internet technology. Especially under the background of the B&R Initiative, the regional economy has significant impacts on logistics. Cao et al. (2018) pointed out that the regional economy provides the driving force for logistics, and regional economics should be considered when studying regional logistics [13]. In 2016, the Chinese government issued the "Opinions on the Implementation of Internet Efficient Logistics", which also show that internet technology was the key to improving logistics capabilities and it was inseparable from logistics development.

Therefore, this paper constructs an evaluation system including indicators such as logistics industry scale, logistics infrastructure, logistics human resources, social economy and internet development level, evaluating the regional logistics capabilities of the provinces and cities along the B&R Initiative.

3. Empirical Research on Regional Logistics Capability

3.1. Constructing the Evaluation Index System and Collecting Data

Referring to cor-relational research achievement [13-14], the study designs a total of 5 first-level indicators and 14 second-level indicators to evaluate regional logistics capabilities (table 1).
Table 1. The Evaluation index system of regional logistics capability.

| First-level indicators                  | Second-level indicators                   | Descriptions                                                                 |
|----------------------------------------|------------------------------------------|------------------------------------------------------------------------------|
| Logistics industry scale (A₁)          | B₁₁: Volume of goods transported         | Total number of goods transported throughout the year                         |
|                                        | B₁₂: Turnover volume of freight transport | Product of Tonnage of Goods and Transport Distance                           |
|                                        | B₁₃: Business total of posts and         | The sum of total postal and telecommunication services                       |
|                                        | telecommunications                       |                                                                              |
|                                        | B₁₄: Value added in transportation,      | Value added of transportation, warehousing and postal services in monetary form.|
|                                        | warehousing and postal services          |                                                                              |
| Logistics infrastructure (A₂)          | B₂₁: Mileage of railway and highway      | The sum of mileage of railway and highway                                     |
|                                        | B₂₂: Number of civil trucks             | Number of civil trucks in the area                                           |
|                                        | B₂₃: Investment of fixed assets in      | Total cost of fixed assets in logistics industry                             |
|                                        | logistics industry                      |                                                                              |
| Logistics human resources (A₃)         | B₃₁: Number of logistics employees       | Number of personnel engaged in transportation, warehousing, distribution and other logistics activities |
|                                        | B₃₂: Number of students in colleges and universities | Number of students in colleges and universities |
| Development level of social economy (A₄) | B₄₁: Real GDP per capital                | One of the most important macro-indicators to measure the overall economic development of a region |
|                                        | B₄₂: Total volume of import and export trade | The sum of import trade and export trade in the region                       |
|                                        | B₄₃: Total retail sales of consumer     | Total consumption goods supplied to residents and social groups               |
|                                        | goods                                   |                                                                              |
| Internet development level (A₅)        | B₅₁: Number of Internet users           | Number of internet users in the region                                        |
|                                        | B₅₂: Number of employees in             | Number of employees in information transmission, software and information technology services |
|                                        | Internet-related industries             |                                                                              |

There are many research methods for regional logistics capabilities, including analytic hierarchy process, TOPSIS method, factor analysis method and principal component analysis and so on [13-14]. This paper adopts factor analysis to analyze the data about 18 provinces along the B&R Initiative, which is recorded in the 2017 China Statistical Yearbook [15].

3.2. Factor Analysis
Before the factor analysis, the KMO value is 0.736, which is greater than the threshold value of 0.5, and the P value of Bartlett ball test is 0.000. It shows that the correlation characteristics of the 14
indicator variables are obvious and suitable for factor analysis. According to the principal component analysis and orthogonal rotation with Kaiser standardization, we get the common factor and coefficient matrix. The formulas for calculating the factors are as follows.

\[
F_1 = -0.003B_{11} + 0.205B_{12} + 0.084B_{13} + 0.090B_{14} - 0.249B_{21} - 0.062B_{22} - 0.080B_{23} + 0.119B_{31} - 0.017B_{32} + 0.268B_{41} + 0.154B_{42} + 0.075B_{43} + 0.026B_{51} + 0.159B_{52} \\
F_2 = 0.138B_{11} - 0.118B_{12} + 0.039B_{13} + 0.034B_{14} + 0.335B_{21} + 0.205B_{22} + 0.205B_{23} - 0.004B_{31} + 0.154B_{32} - 0.236B_{41} - 0.049B_{42} + 0.055B_{43} + 0.112B_{51} - 0.052B_{52}
\]

Finally, using the relative variance contribution rate, we obtain the comprehensive evaluation equation for the logistics capabilities of various regions along the route, and the logistics capability scores and rankings of each region (Table 2).

\[
F = 0.502F_1 + 0.394F_2
\]

| Regions         | Regional ranking | Provinces         | Provincial scoring | Provincial ranking |
|-----------------|------------------|-------------------|--------------------|--------------------|
| Coastal areas   | 1                | Hainan            | -0.58              | 15                 |
|                 |                  | Zhejiang          | 0.76               | 2                  |
|                 |                  | Guangdong         | 2.03               | 1                  |
|                 |                  | Fujian            | 0.25               | 5                  |
|                 |                  | Shanghai          | 0.44               | 3                  |
| Central region  | 2                | Chongqing         | -0.08              | 9                  |
|                 |                  | Liaoning          | 0.28               | 4                  |
| Northeast China | 3                | Jilin             | -0.24              | 12                 |
| China           |                  | Heilongjiang      | -0.14              | 11                 |
| Southwest China | 4                | Tibet             | -0.68              | 18                 |
|                 |                  | Yunnan            | -0.09              | 10                 |
|                 |                  | Guangxi           | -0.04              | 8                  |
|                 |                  | Inner Mongolia    | -0.03              | 7                  |
|                 |                  | Qinghai           | -0.62              | 17                 |
| Northwest China | 5                | Ningxia           | -0.59              | 16                 |
|                 |                  | Gansu             | -0.38              | 14                 |
|                 |                  | Shaanxi           | 0.04               | 6                  |
|                 |                  | Xinjiang          | -0.32              | 13                 |

4. Conclusion
The overall average score of the coastal areas ranks first. Guangdong is a representative city for modern logistics industry, whose comprehensive logistics capacity score is 2.03. In addition, the second-level indicators of Guangdong are better than those of other provinces. It indicates that the logistics industry has a large scale, good infrastructure, sufficient talent reserve, developed social economy and high level of Internet development, and Guangdong has great potential for future development.

The central region only covers one city, Chongqing. Chongqing logistics industry has no obvious advantages and disadvantages. Some second-level indicators, such as investment in fixed assets in logistics industry, real GDP per capital and total volume of import and export trade, are lower than those in other regions. The investment environment of logistics industry is not good enough.

The Northeast China ranks third overall, Liaoning Province ranks fourth among 18 provinces. This is due to the developed industry in Liaoning and the large volume of import and export trade, which provides good conditions for the logistics industry.
The Southwest China ranks fourth in the overall score. The main reason is that the real GDP per capitals of the provinces is lower than that of other provinces, which restricts the development of logistics industry. Tibet ranks 18th, possibly due to bad weather and low population.

The Northwest China ranks last overall. In addition to Shaanxi and Inner Mongolia, the rest of provinces rank in the middle and lower reaches. According to the second-level indicators, Shaanxi logistics industry has a large number of practitioners and sufficient human resources. Inner Mongolia has a good economic foundation, but the level of internet development is low. The construction of modern logistics in Northwest China still has a long way to go.

5. Policy Recommendations
The development advantages of different regions are different. It is necessary to give full play to the regional advantages for promoting the coordinated development of logistics industry in different regions. Specific proposals are as follows.

On the basis of the original development advantages, the coastal areas should continue to improve logistics industry and play an exemplary role. For example, Guangdong may consider accelerating the integration in the Guangdong-Hong Kong-Macao Greater Bay Area, and constructing a comprehensive logistics hub. In addition, the government should promote the intelligent construction of logistics and construct modern logistics.

The central region should enhance inter regional cooperation. Chongqing is located at the junction of the B&R and the Yangtze River Economic Zone, so Chongqing can expand domestic demand and develop foreign trade to build the inland international logistics hub city, which could build an international passenger and cargo transportation system covering major Asian cities by expanding its international airport and international route network.

The Northeast China should strengthen the logistics infrastructure construction such as roads, railways and ports, meanwhile strengthen interconnect with the Russian to build an international transportation corridor for land and sea transport.

The Southwest China should establish an international trade channel with neighboring countries. Guangxi can take advantage of adjacent to the ASEAN countries to establish international trade channels for the ASEAN region. Tibet can make use of the geographical advantages in the South Asian Corridor to carry out border trade cooperation with Nepal and other countries.

The Northwest China should focus on improving the environment and increasing logistics scale. The foundation of logistics is weak. Improving the logistics infrastructure and environment is the first step. After that, we should strengthen the training of the logistics talents and improve the internet development level according to the situation of each province.

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