

2014

# BioTechnology

*An Indian Journal*

FULL PAPER

BTAIJ, 10(10), 2014 [4484-4488]

## Construction of the yangtze river port logistics development evaluation system

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### ABSTRACT

This article analyzes the significance of port logistics as well as factors influencing the development of Yangtze River port logistics. On this basis, a scientific evaluation system of the Yangtze River port logistics development and a principal component analysis model of the port logistics development level evaluation are established. Taking the ports group along the Yangtze river in Anhui province as an example, this article justifies the validity of the river port logistics development level evaluation system.

### KEYWORDS

Ports along the Yangtze River; Port logistics; Evaluation system; Principal component analysis.



## INTRODUCTION

At present, related research on port logistics evaluation has become one of the focuses of the theory. Many scholars have done a lot of work in this field, such as Cao Weidong, Cao Wave, Wang Ling, Wei Ran etc. Some use a specific object for the evaluation and analysis of the port logistics system. However, most researches focus on the application of modeling methods while paying little attention to the evaluation index system. In addition, inaccurate understanding of the port logistics' concept leads to a one-sided evaluation index system, which to some extent affects the evaluation result. Combined with previous research, this paper attempts to discuss the connotation of the port logistics, build a relatively reasonable river port logistics evaluation index system on the basis of analyzing influencing factors of port logistics' developmental level, and conduct a case study of ports along the Yangtze river through evaluation model by applying the principal component method<sup>[1]</sup>.

## THE MEANING OF PORT LOGISTICS

Port logistics refers to that the center port cities make use of its own port's advantages, relying on advanced hardware and software environment, to strengthen its radiation ability in logistics activities around the port, highlight the port set of goods, inventory, distribution features, with harbor industry as the basis, with information technology as the support, aim at integration of port resources and develop a comprehensive port service system covering the features of all links in the industry chain of logistics. Port logistics is a special form of the integrated logistics system and also is an irreplaceable and important node, which completes the basic logistics service and the value added service to supply the whole chain logistics system<sup>[2]</sup>.

## THE CONSTRUCTION OF EVALUATION INDEX SYSTEM

### Factors influencing the port logistics' developmental level

Port logistics' developmental ability along the Yangtze River: logistics' developmental ability reflects the existing development of port logistics' capability, based on their own advantages and competitive resource, its outcome and the status of the past and present logistics market's development. The port logistics development ability can be reflected from the logistics' infrastructure equipment, haven dimensions, informatization level, the standardization of logistics and port's developmental level.

The river port logistics developmental environment: port logistics developmental environment is an extrinsic factor for measuring the port's logistical development, and is the guarantee of the present developmental ability and the cultivation basis of potential development. Port's overall environment has very important influence on the development of logistics. For instance, logistics services and hinterland economic development level will have direct impact on logistics service demand and growth potential. Port logistics developmental environment usually depends on the economic environment, policy environment, human resource environment and so on<sup>[3]</sup>.

The port logistics' capability of sustainable development: the sustainable development capacity of port logistics is a measure of port logistics' subsequent development ability. Logistics sustainable development must be in accordance with the carrying capacity of nature. Only by guaranteeing the sustainability of resource and ecology can we make the sustainable development of logistics possible. This requires that in the pursuit of logistics development, we must pay attention to protection of environment and resources to ensure sustainable use of resources. The sustainable utilization of resources and good ecological environment are important symbols of the logistics' sustainable development<sup>[4]</sup>.

### The index system of port logistics evaluation

Based on the analysis of the port logistics' connotation and its influencing factors above, this paper divides port logistics' evaluation index system into three levels: the first level is the target level<sup>[5]</sup>, namely the evaluation of river port logistics development level; the second level is an first-class indicator. Based on the analysis of factors influencing the port logistics, it establishes two first-class indicators, which are logistics developmental ability and environment and influence of logistics development respectively; the third level is the second-class indicator. This is the core part of the index system as well as the operable indicator's component. This article identifies 14 two-level index according to the three factors influencing the port logistics system while considering the theoretical and practical possibility<sup>[6]</sup>.

TABLE 1

Target layer	Level indicator	Two level index
The port logistics development level of	Logistics development	$\mu_1$ Waterfront line length (KM)
		$\mu_2$ Berth number
		$\mu_3$ The port number of employees
		$\mu_4$ Cargo throughput
		$\mu_5$ The level of public information platform
		$\mu_6$ Profit ability
		$\mu_7$ Logistics standardization level
	Logistics development environment and influence	$\mu_8$ The level of logistics services
		$\mu_9$ Investment in fixed assets (Million yuan)
		$\mu_{10}$ Hinterland economy GDP (Billion yuan)
		$\mu_{11}$ Policy environment
		$\mu_{12}$ Hinterland trade (Billion yuan)
		$\mu_{13}$ Total retail sales of consumer goods in the hinterland of (Billion yuan)
		$\mu_{14}$ College school student number

THE CASE STUDY OF THE PORT LOGISTICS DEVELOPMENT LEVEL EVALUATION

The principal component analysis is used to calculate the comprehensive strength index of the port logistics. Its basic principle and steps are: assumption on the N port logistics development in M indexes of comprehensive evaluation, the index set of matrix is  $\mu_{ij}$  ( $I = 1, 2, \dots, N; J = 1, 2, \dots, m$ )<sup>[11]</sup>. In order to eliminate the effects of different classes of magnitude, it is necessary to standardize the original matrix, form a new index set matrix  $Y_{ij}$ , calculate  $Y_{ij}$  correlation coefficient matrix R, obtain eigenvalue  $\lambda_i$  through inner product vector of R, get the corresponding feature vector  $I_{ij}$  by solving inverse compact transform, the characteristic value of the cumulative percentage determination of P components  $Z_i$ , and for each principal component contribution rate  $P_j$ ; calculation of the I port logistics of each principal component scores of  $Z_{ij}$ ; finally, calculated for each port logistics development comprehensive strength index  $Q_i$ <sup>[12]</sup>.

$$Q_i = \sum_{j=1}^p p_j Z_{ij} \quad (i = 1, 2, \dots, n) \tag{1}$$

The value of  $Q_i$  is in proportion to the port logistics' development level of i years, and vice versa. By that analogy, we can calculate the comprehensive strength index of various port logistics development<sup>[7]</sup>.

Anhui port group includes 5 major ports like Ma'anshan, Wuhu, Tongling, Chizhou and Anqing. The port system has unique geographical advantages and important strategic position. With the promotion of Anhui along-river area's openness and development as well as the demand of accepting

industrial transfer, various regions implement the strategy of “port prospers city” one after another and increase haven infrastructure construction. Some areas rely on their regional advantages of port to develop port logistics in order to realize port city’s sustained and rapid economic development, along with the specific characteristics of the port<sup>[8]</sup>.

**Computational results analysis**

Choosing four years, 2003, 2007, 2010, 2013 from 2003 to 2013, according to the “China City Statistical Yearbook” (2004, 2008, 2011 and 2014), “statistical yearbook of Anhui province” (2004, 2008, 2011 and 2014) and the Anhui Yangtze River 5 ports’ statistics report<sup>[9]</sup>, through the establishment of 5 Port Logistics comprehensive strength evaluation index database, using SPSS13.0 software, to analyze and process the data. According to standard extracting main factor with factor eigenvalue greater than 1 and the cumulative contribution rate more than 85%, and according to the formula (1), comprehensive strength index of the port logistics (TABLE 2) for different years are calculated<sup>[10]</sup>.  $Q_i$  represents Port Logistics comprehensive strength index.

**TABLE 2 : Anhui River Port Logistics comprehensive strength index along the Yangtze ( $Q_i$ )**

	2004	2008	2011	2013
Ma'anshan	6.82711	19.57205	5.32404	12.74210
Wuhu,	69.977337	87.99985	67.10115	91.96178
Tongling	-18.49716	-25.48272	-45.71171	-55.06373
Chizhou	-61.99780	-55.49272	-30.70364	-5.56749
Anqing	40.69597	50.40360	18.99016	61.92710

**Analysis of port logistics development level**

From TABLE 2 we can see that Port Logistics comprehensive strength index of Wuhu harbor, Ma'anshan port and Anqing harbor is always positive, indicating that logistics development level in the area of the port logistics development is above the average<sup>[13]</sup>; Chizhou Port Logistics comprehensive strength index has always been negative, which indicates that the port logistics development level has always been below the average; the development of Tongling port logistics has obvious ups and downs, with comprehensive strength index turning from -18.49716 in 2004 into 55.06373 in 2013, and it continues to be negative, suggesting that the port logistics development has been below the average<sup>[14]</sup>.

**Analysis of port logistics’ development and performance**

According to the comprehensive strength index of the port logistics development trend, Anhui port logistics development is divided into the following types: (1)rising type, mainly represented by Chizhou port logistics. Chizhou Port Logistics comprehensive strength index increases from -61.99780 in 2004 into -5.56749 in 2013, a markable rise. (2) declining type, mainly represented by Tongling port logistics<sup>[15]</sup>. Tongling Port Logistics comprehensive strength index drops from 18.49716 in 2004 into -55.06373 in 2013, big dropping range. (3) fluctuations, including Ma'anshan, Wuhu and Anqing port logistics. Ma'anshan Port Logistics comprehensive strength index rise from 6.82711 in 2004 into 19.57205 in 2008, reaching a peak, and then falling to 12.74210 in 2013; 2004 Wuhu Port Logistics comprehensive strength index is 69.977337, reaching the peak of 91.96178 in 2004, while the development of port logistics level will always be in the first place; Anqing Port Logistics comprehensive strength index rank second in 2004, and its value is 40.69597, with its index 18.990162010 falling to its low ebb. In 2013, its port logistics comprehensive strength index rise to 61.92710, ranking second.

On the port logistics development level evaluation system, we should first pay attention to the research of evaluation index system<sup>[16]</sup>. Only with an in-depth analysis of the influencing factors of port logistics system established on the basis of scientific and reasonable index system can we conduct further

evaluation. At the same time, we should also take the development level of hinterland economy as the important evaluation index<sup>[17]</sup>.

### ACKNOWLEDGEMENTS

The paper is funded by Anhui Province Quality Engineering of The Education Department of Anhui Province (2012JYXM711 and 2013sxzx036).

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