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Analysis on Innovation Ability of Huaihe River Economic Belt

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Abstract

Huaihe Economic Belt is located in the economic low-lying areas of China. Innovation is an important driving force to achieve regional development and enhance competitiveness. This paper constructs innovation ability evaluation index system of Huaihe Economic Belt, and longitudinally compares the evolution characteristics of the innovation ability of Huaihe Economic Belt in the period from 2011 to 2015. Through the principal component analysis and cluster analysis, the paper horizontally compares the innovation abilities of the 21 cities in Huaihe Economic Belt in 2015. The research finds that the innovation ability of Huaihe Economic Belt had been steadily improved in the past five years, the improvement speed of technological innovation was obviously higher than other factors, and the development of service innovation has fluctuated. The innovation abilities of the 21 cities are different; the innovation abilities of Taizhou, Yangzhou and Xuzhou in the lower reaches of Huaihe River are strong, and the cities in the middle and upper reaches of Huaihe River have generally lower innovation abilities.

Key words: Huaihe Economic Belt, Innovation Ability Evaluation Index System, Longitudinal Comparison, Horizontal Comparison

Introduction

Huaihe River flows through Jiangsu, Anhui, Henan, Hubei and Shandong. In the river basin, there were frequent disasters and the economic development ability was weak. Thus, this region faces both ecological and economic pressures[1]. In 2010, Huaian City, Jiangsu Province, took the lead in putting forward the strategic concept of "Huaihe Eco Economic Belt" from the perspective of the coordinated development of Huaihe River Basin, and expected to build the ecological economic belt of Huaihe River into an ecological economic community that regards Xinyang of Henan, Bengbu- Huainan of Anhui and Huaian of Jiangsu as the cores. At the beginning of 2012, Huaian City of Jiangsu entrusted China International Economic Exchange Center to undertake the research project of "constructing Huaihe Eco-Economic Belt pilot area". As the research progressively deepened, other cities like Bengbu, Xinyang, Yancheng and Huainan along the Huaihe River sequentially joined this project, and the name of the project was changed to "Development Plan of Huaihe Eco Economic Belt". In March 2016, the Development and Reform Commissions of Jiangsu, Anhui and Henan provinces, the China International Economic Exchange Center and Huaihe Water Conservancy Commission of the Ministry of Water Conservancy held a joint seminar to preliminarily determine the planning scope of the Huaihe Eco-Economic Belt in the three provinces: Jiangsu, Anhui and Henan, mainly including 21 cities, and proposed to build the Huaihe basin in Northern Jiangsu, Northern Anhui and Southern Henan into a technical and ecotype economic corridor. In short, the strategic conception of Huaihe Eco Economic Belt emphasized the necessity of changing the traditional development mode and promoting the healthy, coordinated and rapid development of the whole region with innovation.

In recent years, have the innovation ability of Huaihe Economic Belt been improved? Are there any inherent differences in the innovation ability of the 21 main cities? How to achieve the overall promotion of regional innovation ability? This paper constructes a regional innovation evaluation index system and uses factor analysis method to longitudinally compare the innovation ability of Huaihe Economic Belt in the last 5 years, and explores the general trend and cause of evolution; this paper uses the principal component analysis and cluster analysis method to horizontally compare the difference of the innovation abilities of the 21 cities, and on the basis of quantitative analysis, puts forward beneficial suggestions for the overall improvement of the innovation ability and coordinated development of Huaihe Eco Economic belt.

Literature Review

Regional innovation ability is the representation of comprehensive ability of a region, and it is the core force that affects regional comprehensive competitiveness, as well as a reflection of the regional sustainable development ability [2,3]. At present, there are many researches on regional innovation ability. Most of the scholars set up innovation ability evaluation index system to carry out quantitative analysis. In the aspect of construction of innovation ability evaluation index system, there are great differences between different scholars. Some scholars pay attention to the five aspects: knowledge creation ability, knowledge flow ability, enterprise technology innovation, and innovation environment and innovation economic performance[4]. Some scholars built the index

system[5] from the four dimensions: innovation input, collaborative innovation, innovation environment and innovation output; some other scholars comprehensively considered innovation input, innovation output and innovation environment to construct the index system, and selected 18 representative indexes, such as: enterprises, universities and scientific research institutions, intermediaries and local governments, infrastructure, innovation network, openness and agglomeration, etc. [6].

As for the quantitative analysis method of urban innovation ability evaluation, there are great differences in relevant research results. The commonly used quantitative methods include DEMATEL-ANP evaluation model, Analysis Hierarchical Processing (AHP) and AHP- Fuzzy Comprehensive Evaluation Method [7].

Although there are many related studies, scholars are more inclined to study the innovation ability of provinces and cities and more mature regions. At present, no scholar has studied the regional innovation ability of Huaihe Economic Belt.

Construction of Innovation Ability Evaluation Index System

At present, there is no universally accepted standard for innovation ability index system. On the basis of the existing literature, this paper followes the principles of scientificity, systematization, representativeness and maneuverability[8], and built evaluation index system. The paper divides the factors that influence Huaihe Economic Belt innovation ability into 5 clusters: knowledge innovation, technological innovation, system innovation, service innovation and economic development level. On this basis, it constructes 21 secondary indexes and determines their weights (TABLE I).

Analysis of Innovation Ability of Huaihe Economic Belt

A. Longitudinal Analysis

The longitudinal analysis focuses on exploring the evolution trend of the innovation ability of Huaihe Economic Belt in the past years from 2011 to 2015. First, it processes the original data of each index according to the same standard. Then this paper calculates the score of each factor according to the total weight, and calculates the total score according to the factor's weight. The final calculation results are shown in TABLE II.(for convenience, all results are multiplied by 10).

According to the analysis of TABLE II, we can see that the innovation ability of Huaihe Economic Belt has been steadily improved from 2011 to 2015. Comparing the changes of each innovation factor, we can see that all the innovation factors generally show an upward trend, but the evolution trends of innovation factors are different. Among them, knowledge innovation, system innovation and economic development level were comparatively stable; the rate of technological innovation development is obviously higher than other factors; and the development of service innovation has some fluctuation and declines in 2013. The main reason is that the number of secondary vocational education schools and the total amount of actual utilization of foreign capital of the whole year have declined.

B. Horizontal Analysis

The paper uses principal component analysis and cluster analysis methods to make sorting analysis and cluster analysis over the 21 core cities of Huaihe Economic Belt, including Xinyang, Zhumadian, Zhoukou, Luohe, Shangqiu, Pingdingshan, Nanyang, Bengbu, Huainan, Fuyang, Liu'an, Bozhou, Suzhou, Huaibei, Chuzhou, Huaian, Yancheng, Suqian, Xuzhou, Yangzhou and Yangzhou.

(1) Sorting analysis and results

In this paper, SPSS24.0 is used to process data. First, the original data is processed according to the same standard, and then the principal component analysis method is used to analyze the data[8]. After processing, the system automatically extractes 4 main factors, and the cumulative variance contribution rate reaches 84.367%. The principal component No. 1 has the highest load for the engineers and technicians in large and medium-sized enterprises, which can be interpreted as technological innovation; the principal component No. 2 has the highest load for the science and technology and education expenditure, which can be interpreted as an innovation system; the principal component No. 3 has the greatest load for the actual utilization of foreign capital in the whole year, which can be interpreted as external contact degree; the principal component No. 4 has the greatest load for the number of Internet users, which can be interpreted as economic development conditions. New data is obtained from the data editing window by principal component analysis, that is, the scores of 4 principal components. The total score is calculated according to the principal component score and the variance contribution rate. Finally, the different principal components of the 21 cities are sorted and the sorting is comprehensively compared and evaluated. Analysis results are as follows:

First, from the perspective of comprehensive innovation ability, Taizhou, Yangzhou and Xuzhou rank the top three. From the perspective of innovation factors, Taizhou, Yangzhou and Xuzhou rank at the first three positions in terms of science and technology innovation. The three cities are prefecture-level cities of Jiangsu province. Taizhou has the pharmaceutical industry base that had been included in national Torch Program, national science and technology export innovation base and the national biological industry high-tech industrial base. It is the pilot city of the national technology innovation. Yangzhou ranked the top 25 among the most innovative cities in mainland China in 2012. Xuzhou is the world's largest solar polysilicon production and development base, the national science and technology progress advanced city, and has very strong R&D ability.

Second, from the perspective of innovation system, Yancheng, Huainan, Suqian ranked the top three. The three cities all have very convenient water and land transportation; Yancheng has beautiful environment; Huainan and Suqian have rich resources.

Third, from the perspective of external contact degree, Bengbu, Yancheng and Taizhou rank the top three. Bengbu is an important transportation hub in China and a member city of the Yangtze River Delta. Yancheng is located in the superposition area of coastal development strategy of Jiangsu and Yangtze River Delta city group strategy. Taizhou is an important center city of the Yangtze River economic belt and

Shanghai metropolitan area, with obvious regional advantages and close external relations.

Last, Xuzhou, Luohe and Yancheng rank top three in terms of economic development conditions. The three cities have convenient transportation, and close internal and external contacts, and the economy develops very fast.

(2) Cluster analysis results

Based on principal component analysis, this paper carries out cluster analysis to the 21 core cities. It regards the scores of the 4 main factors in the main component as the basic data matrix. Then, the 21 cities are divided into 4 cluster (see TABLE Ⅲ).

Cluster1: Taizhou. Taizhou is a city that enjoying the title of "National Advanced City with Scientific and Technological Progress", ranking the first in terms of science and technology innovation ability, ranking the third in terms of external contacts and ranking the first in terms of comprehensive innovation ability.

Cluster2: Yangzhou and Xuzhou. The two cities respectively rank the second and third in terms of scientific and technological innovation and comprehensive innovation; especially, Xuzhou ranks the first in terms of macro development. The two cities have unique geographical locations, convenient land and water transportation and close external contact, which have perfect driving effect on the overall economic development of the city, and thus the innovation ability has been promoted.

Cluster3: Bengbu, Yancheng, Zhoukou and Luohe. Bengbu ranks the first in terms of external contacts; Yancheng respectively ranks the first, second and third in terms of innovation system, external contacts and macro development conditions; Luohe ranks the second in terms of macro development conditions. The four cities have perfect infrastructure and middle level of comprehensive innovation ability.

Cluster4: Chuzhou, Nanyang, Huaian, Huainan, Suqian, Bozhou, Huaibei, Shangqiu, Fuyang, Zhumadian, Suzhou, Pingdingshan, Xinyang and Liu'an. Among them, Huai'an has strong comprehensive innovation ability and ranks the fourth, and the other cities have relatively poor comprehensive innovation ability; these cities have weak external contacts and develop very slowly and the construction of science and technology needs to be further improved.

Summary and Implications

According to the longitudinal and horizontal comparison on Huaihe Economic Belt, this paper has drawn the following conclusions: according to the longitudinal comparison, the comprehensive innovation ability of Huaihe Economic Belt had been steadily improved in the last 5 years, especially the improvement speed of technological innovation ability is obviously higher than other innovation factors, and the development of service innovation has fluctuated. According to the horizontal comparison, through the principal component analysis, the results show that the comprehensive ranking of the 21 cities' innovation ability is as follows: Taizhou, Yangzhou, Xuzhou, Huaian, Yancheng, Nanyang, Chuzhou, Pingdingshan, Shangqiu, Bengbu, Suqian, Xinyang, Liu'an, Zhoukou, Huaibei, Luohe, Fuyang, Zhumadian, Huainan, Suzhou, and Bozhou. Through cluster analysis, the 21 cities are divided into 4 clusters. The first type of city: Taizhou, has the strongest science and technology innovation and comprehensive innovation ability; the second type of cities: Yangzhou and Xuzhou have the second strongest innovation ability; especially, Xuzhou's economic development conditions have some advantages, and the innovation ability was therefore improved; in the third type of cities, Bengbu has strong external contact; Yancheng has perfect innovation system and middle level of innovation ability; in the fourth type of cities, Huaian ranks the fourth in terms of comprehensive ability, and the other cities all have weak innovation ability. These cities have poor external contacts and develop very slowly.

In view of these circumstances, combined with the present situation of Huaihe Economic Belt, this paper believes that the promotion of the overall innovation ability of Huaihe Economic Belt needs to start from the following aspects: (1) this region should pay attention to the cultivation of scientific and technological innovation ability, in order to influence and promote the progress and development of other factors of innovation. (2) Taizhou can be built into the most important innovative node city and Yangzhou & Xuzhou into the secondary level innovation node cities in order to promote the flow of innovation elements in Huaihe River basin. And,Nanyang and Chuzhou can be built into important innovative core cities of the middle and lower reaches of Huaihe River. (3)We should promote the coordinated development between different regions of Huaihe Economic Belt. Meanwhile the innovation investment in the middle and lower reaches of Huaihe River should be increased too.

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TABLE I
EVALUATION INDEX SYSTEM OF INNOCATION CAPABILITY IN HUAIHE ECONOMIC BELT

Factor	Weight	Index	Total weight
Knowledge innovation	20	Volume of patent authorization for the whole year	6
		Total number of books in public libraries per hundred people	3
		Number of scientific research institutions	6
		Professional researchers in scientific research institutions	5
Technological innovation	30	Number of science and technology projects in LMEs	5.5
		Internal expenditures for scientific and technological activities of LMEs	5.5
		Number of LMEs with scientific and technological activities	5.5
		Engineering and technical personnel of LMEs	5
		Output value of high-tech industry (billion yuan)	8.5
Institutional innovation	15	Education expenses (ten thousand yuan)	3
		Science and technology undertaking fee (RMB 10,000)	4
		R & d source of funds proportion of government funds (%)	4
		High-tech project enterprises in LMEs are exempted from tax (10,000 yuan)	4
Service innovation	20	Number of secondary vocational education schools (number)	4
		Actual utilization of foreign capital for the whole year (USD 100 million)	4
		Number of scientific research comprehensive technical service industry (10,000)	6
		Turnover of technical contract (ten thousand yuan)	6
Ecomomic development level	15	GDP per capita (yuan)	4
		Gross output value of tertiary industry (billion yuan)	4
		Number of internet users (10,000)	3
		Total investment in environmental pollution control (10,000 yuan)	4

TABLE II
SCORE OF HUAIHE ECONOMIC BELT IN INNOVATION CAPACITY IN RECENT 5 YEARS

Year	Knowledge innovation	Technological innovation	Institutional innovation	Service innovation	Ecomomic development level	Comprehensive innovation level
2011	-2.742	-3.920	-1.079	-1.592	-1.462	-2.424
2012	-0.889	-1.638	-0.149	0.042	-0.804	-0.804
2013	0.633	0.284	0.082	-0.200	-0.127	0.165
2014	0.899	1.857	0.491	0.554	0.419	0.984
2015	2.098	3.418	0.655	1.197	1.973	2.079

TABLE Ⅲ
CLUSTER ANALYSIS RESULTS OVER 21 CITIES

Cluster	Cities
Cluster 1	Taizhou
Cluster 2	Yangzhou, Xuzhou
Cluster 3	Mengbu,Yangcheng, Zhoukou, Luohe
Cluster 4	Chuzhou,Nanyang,Huai'an,Huainan,Suqian,Haozhou,Huaibei,Shangqiu,Fuyang,Zhumadian,Suzhou,Pingdingshan,Xinyang,Liu'an