A Study on the Measurement of High-Quality Economic Development in China

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Abstract. China has moved into a new era of economic and social development, and the key to leading the new normal of economic development is high-quality development. Based on the new development concept, the economic high-quality development index system is established. 2014–2019 China's inter-provincial economic high-quality development index is measured by the system. The quality of growth index reveals that the development of each region is uneven, showing different characteristics in each dimension of the five development concepts of innovating, coordinating, greening, opening and sharing.

Keywords: High-quality Development · New Development Concept · Indicator System · Entropy Method

1 Introduction

China's economy has already joined a new age and the economy has changed from a high growth rate to a stage of high qualitative development as emphasized in the report of the 19th National Congress of the Communist Party of China. At present, the core issue of China's economic development is to promote high-quality development, which is considered an important element of building a modernized economic system. However, some problems have emerged in the process of developing: the increasing resource and environmental pressure brought by the crude growth, the increasingly prominent structural contradiction between the excess capacity at the low end and the lack of supply at the high level, the large gap between scientific and technological and innovative capabilities compared with that of developed countries, the unbalanced development of the countryside and urban areas, and the large income distribution gap have become the constraints affecting the coordinated economic development. Mr. Xi Jinping, General Secretary of China, suggested in the 19th report of the Communist Party that the connotation and judgment criteria of high-quality development be explored through the direction of the new development concept, the evaluation index system of high-quality development level of China's economic in the new age was constructed, the spatial distribution pattern of each region was analyzed based on the index system, and the policy suggestions for further optimization were put forward through the analysis of the causes, and the suggestions made had important theoretical value and practical significance.

2 Literature Review

2.1 Connotation of High-Quality Development

On the basis of the connotation of high-quality development, Jin Bei [2] believes that high-quality development is considered to be the state of economic development in terms of mode, structure and dynamics that can better meet the increasing real needs of the people. Hong Yinxing [3] pointed out that the new development conception is the basis of high quality development and stipulates the core content of high quality of development. Pang Jinju [7] pointed out that high-quality of development is to meet the better living needs of the people, sharing development, is the development of innovation and efficiency improvement, is the development of national economy proportion, structure coordination and economic developing way optimization, is the development of green, human and nature in harmony. Zhang Junbao [6] and others believe that the essential connotation of high-quality development is to meet the people's increasing needs for a better life, and the goal is highly efficient, equitable and environmentally sustainable development.

2.2 Evaluation System Measurement of High-Quality Development

For the measurement of the current level of high quality economic developments in China, Yiming Wang [9] argues that the quality of economic development can be examined at three levels: micro (products and services), meso (industries and regions) and macro (national economy as a whole). Wei Min and Li Shuhao [10] used the entropy TOPSIS method to empirically measure the level of high level economic development in China in the new era. Li Jinchang [5] et al. constructed an evaluation index system based on the two aspects of the main social contradiction, and the level was constructed from five parts: economic vitality, innovation efficiency, green development, people's life, and social harmony, and 27 indicators were selected. Shi Bo and Zhang Bingyao [8] measured the national level of economic quality development of cities above prefecture level from 3 dimensions: fundamentals of development, social outcomes and ecological outcomes.

To sum up, the new development concept is identified as the theoretical basis for constructing the index system of high-quality economic development because "the development concept is the precursor of development action, and it is something that governs the overall situation, the root, the direction and the long term, and is the centralized embodiment of development ideas, development direction and development focus". To this end, from the new development concept, the construction of high-quality development evaluation index system.

3 Construction of High-Quality Development Evaluation Index System

3.1 Basis of Index Selection

Five development concepts were used as the basis for selecting indicators of high-quality development, so this paper constructs the system of high quality economic development which contains 5 secondary indicators and 20 tertiary indicators of innovation, coordination, green, opening and sharing. (See Table 1).

3.2 Model Selection of High-Quality Development Measurement

Currently, scholars have used equal weight method, factor analysis, principal component assignment method, hierarchical analysis method, and longitudinal and horizontal pull-out grade method to evaluate the high-quality Chinese economic development. Since different measurement methods will bring different measurement results, the selection and design of measurement methods should be based on the characteristics of the evaluation system and the research objectives. This paper refers to the entropy weight method. In the index evaluation system, the greater the weight of the index indicates that the selected index plays a great role in the comprehensive evaluation [4]. The advantage of entropy method is to avoid the bias brought by human factors, by setting the entropy weight method to sum up the standardized basic indicator values to get the comprehensive indicator values, and observe the trend of changes in time series, inter-provincial and regional. The entropy paper adopts the efficacy coefficient method to dimensionlessly process the raw data. The advantage of this method is that it can effectively avoid the adverse effects of zero or negative values on indicator weights in the dimensionless calculation process, thus improving the accuracy and scientificity of the measurement and evaluation [1].

In this paper, the efficacy coefficient method is used to dimensionlessly process the raw materials. It effectively avoids the adverse effects of zero or negative values on the index weights in the dimensionless calculation process, thus improving the accuracy and scientificity of the measurement and evaluation.

1). *Index Deprogramming:*

$$Y_{ij} = 40 + 60 \times \frac{X_{ij} - X_{ij\,min}}{X_{ij\,max} - X_{ij\,min}} \tag{1}$$

$$Y_{ij} = 40 + 60 \times \frac{X_{ij\,max} - X_{ij}}{X_{ij\,max} - X_{ij\,min}} \tag{2}$$

In formula (1) and formula (2), i represents each indicator, j represents each province.

2). *Calculate the share of the i province in the indicator under the j indicator:* $p_{ij} = \frac{Y_{ij}}{\sum_{i=1}^{n} Y_{ij}}$.

3). *Calculate the Share of the I Province Under the J Indicator for that Indicator:*

$$e_j = -k \times \sum_{i=1}^{n} \left[p_{ij} \times \log(p_{ij}) \right], k = \frac{1}{lnn}$$

4). Calculate the coefficient g_{ij} of variation of the j indicator: $g_j = 1 - e_j$.

5). Calculate the weights of each indicator. $w_j = \frac{g_j}{\sum_{j=1}^{m} g_j}, j = 1, 2 \cdots m$.

where m is the number of indicators.

6). Calculate the composite index. This paper uses the linear weighting method to calculate the economic quality development index: $Q_j = \sum_{i=1}^{i=20} (X_{ij} \times w_i)$.

Table 1. China's inter-provincial quality development index systems

Dimension	Weights (%)	Measurements	Weights (%)	Indicator Properties
Innovation Index	29.32	GDP Per capita	5.79	+
		Science and technology expenditure / local general public budget expenditure	6.78	+
		Number of higher education schools per 10,000 people	5.55	+
		R&D expenditure/GDP	3.76	+
		Number of patents granted per 10,000 R&D personnel	7.44	+
Coordination Index	21.41	GDP per capita by province/GDP per capita nationwide	5.79	+
		Consumption level of residents by province/national average consumption level	5.19	+
		Urban-rural income level ratio	3.90	-
		Urban-rural consumption level ratio	2.73	-
		Tertiary sector value added/GDP	3.80	+
Green Index	17.23	Chemical oxygen demand emission	6.54	-
		Sulfur dioxide emissions	6.71	-
		Electricity consumption per unit of GDP	3.98	-
Openness Index	10.12	Total imports and exports/GDP	5.33	+
		International tourism income per capita	4.79	+
Share Index	21.92	Number of hospital beds per 1,000 population	5.32	+
		Education expenditure per capita	4.14	+
		Number of health technicians per 1,000 people	3.14	+
		Disposable income per inhabitant	5.86	+
		Urban registered unemployment rate	3.45	−

4   Measurement of China's Inter-provincial Economic Quality Development Index

4.1   Sample Selection

This paper selects data of relevant indicators from 31 provinces (except Hong Kong, Macao and Taiwan) from 2014–2019. Data sources: The number of patents granted to R&D personnel, R&D expenditure, etc., are from the China Science and Technology

Statistical Yearbook; the rest of the measured indicators are from the China Statistical Yearbook.

4.2 Overall Evaluation Analysis of China's Inter-provincial High-Quality Development

From 2014–2019, the comprehensive index of inter-provincial economic quality development all showed a kind of steady growth. The data show that the ranking of most provinces remained basically stable year by year, with Beijing holding the first place, followed by Shanghai, Jiangsu, and Zhejiang, and southwestern and northwestern provinces such as Guangxi, Guizhou, Yunnan, Gansu, and Xinjiang lagging relatively behind (see Table 2 on the next page). The ranking of individual provinces fluctuated greatly over the five-year period, with six provinces, including Hebei, Tianjin, Shanxi, Henan, Shaanxi and Tibet, declining in ranking to varying degrees, and six provinces, including Heilongjiang, Jiangxi, Hubei, Hainan, Sichuan and Qinghai, rising in ranking to varying degrees, and two provinces, Anhui and Hunan, changing in ranking to a greater extent over the five-year period. The comparative advantages of each province in China are different, and the conditions of scientific and creative ability, foreign investment intermingling business environment, etc. vary from place to place, and the radiation spillover effect of the city circle has reconstructed the distribution of inter-provincial production factors, and the development trend of high quality is uneven to some extent in all regions of the country.

4.3 Evaluation Analysis of Five Dimensions of CHINA'S Inter-provincial High-Quality Development

The below is a brief analysis of each province's scores in the five dimensions of innovation, coordination, green, exploration, and sharing.

4.3.1 Innovation Development

The highest average score of the innovation index is Beijing, and the lowest score is Gansu. It show that the inter-provincial variation in the level of innovation-driven development in China are very obvious. Looking at the innovation index scores of all provinces, those with higher scores are Beijing, Guangdong, Shanghai, Zhejiang and Jiangsu, which belong to the first echelon and are all located in the eastern region; those with lower scores are Tibet, Qinghai, Inner Mongolia and 15 other provinces, most of which are located in the western region. It shows that China's innovation-driven economic quality development needs to be further improved.

4.3.2 Coordinated Development

The highest average score of the Coordination Index is Beijing, and the lowest score is Guizhou, and the difference in the level of coordinated development is still very obvious. Looking at all provinces, those with higher scores in the Coordination Index are Beijing, Shanghai, Tianjin, Jiangsu, Zhejiang, Jiangxi, Fujian and Shandong, while those with

Table 2. China's inter-provincial economic quality development index

	2014		2015		2016		2017		2018		2019	
	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking
Beijing	90	1	92	1	92	1	92	1	90	1	92	1
Tianjin	82	6	70	7	86	3	84	3	81	6	79	6
Hebei	72	24	69	27	71	25	71	25	72	27	70	28
Shanxi	75	11	72	17	71	26	71	26	72	29	70	30
Neimenggu	74	12	72	21	74	18	72	18	73	23	70	26
Liaoning	78	7	75	9	75	12	75	12	75	12	72	22
Jilin	74	14	72	20	75	13	74	13	75	16	73	15
Heilongjiang	73	20	75	11	74	17	74	17	75	19	72	20
Shanghai	89	2	89	2	90	2	90	2	88	2	89	2
Jiangsu	83	3	84	3	82	6	82	6	82	5	79	5
Zhejiang	83	4	83	4	83	5	83	5	82	4	82	3
Anhui	75	10	75	10	75	15	75	15	75	11	74	12
Fujian	76	8	75	8	79	7	79	7	78	7	77	7
Jiangxi	73	18	72	18	73	20	73	20	74	21	72	21
Shandong	74	12	75	12	75	10	76	10	75	14	73	16
Henan	72	25	71	25	73	19	74	19	75	18	73	18
Hubei	74	13	73	13	77	8	77	8	77	9	76	9
Hunan	74	15	73	15	74	16	74	16	75	13	74	13

Table 2. (*continued*)

	2014		2015		2016		2017		2018		2019	
	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking	Index	Ranking
Guangdong	83	5	81	5	83	4	83	4	83	3	82	4
Guangxi	71	26	71	26	72	23	73	23	73	22	73	19
Hainan	74	14	73	14	75	14	75	14	75	15	75	10
Chongqing	82	6	81	6	77	9	77	9	77	8	77	8
Sichuan	73	19	72	19	73	21	73	21	74	20	73	14
Guizhou	70	30	69	30	71	30	70	30	71	30	70	27
Yunnan	70	29	70	29	71	29	71	29	72	25	72	24
Xizang	72	24	71	24	73	22	73	22	75	17	73	17
Shanxi	72	23	71	23	75	11	75	11	76	11	74	11
Gansu	70	31	69	31	71	31	70	31	71	31	70	31
Qinghai	73	16	73	16	71	27	71	27	72	26	72	23
Ningxia	72	22	72	22	71	28	71	28	73	24	71	25
Xinjiang	70	28	70	28	72	24	72	24	72	28	70	29

lower scores are Tibet, Gansu and Xinjiang, showing an overall pattern of "high in the east and low in the west". Specifically, Beijing and Shanghai have the highest GDP per capita in the country. Vigorously develop the private economy to leave wealth with the people and actively promote urbanization, is to narrow the gap between urban and rural areas, to achieve common wealth of the two effective ways. Beijing's higher share of the added value of tertiary industry in GDP is due to its positioning as a political center, cultural center, and science and technology innovation center., indicating that actively developing tertiary industry with higher added value represented by modern service industry is an important direction for China's industrial structure optimization and upgrading.

4.3.3 Green Development

The highest Green Index score is in Beijing, and the lowest score is in Qinghai. It is usually thought that Beijing should not have a high green index due to its high population density and poor air quality, but Beijing, as the capital, has made great efforts in environmental management in recent years, with obvious effects of power saving and discharge reduction, coupled with a high per capita GDP, making it the first in the country. In a comprehensive view, the higher scores of the green index are Beijing, Tibet and Fujian; the lower scores are only in Qinghai and Ningxia. The green index scores better than the other four indices, indicating that the green development concept of "green water and green mountains are the silver mountain of gold" has been effective since the 18th National Congress. In addition to Tibet (less industrial emissions, less ecological) areas, the phenomenon of "developed areas have better energy conservation and emission reduction but less ecological environment, less developed areas have better ecological environment but less energy saving and emission reductions", which is the direction of their efforts to make up for the shortcomings.

4.3.4 Open Development

The highest average score of the openness index is Shanghai, and the lowest scores are Tibet and Qinghai, which shows that the inter-provincial differences in China's openness level are very obvious. Looking at the openness index scores of all provinces, the higher scores are Shanghai, Guangdong, Jiangsu, Tianjin, Beijing and Zhejiang, mainly focusing on the Yangtze River Delta, Pearl River Delta and Bohai Bay region; the lower scores are Tibet and Qinghai, Gansu, Xinjiang, Inner Mongolia, Ningxia, Yunnan, Heilongjiang and Jilin 9 provinces and regions, mainly concentrated in the west and northeast. Seize the "Belt and Road" construction opportunities, the implementation of "two-way open" go out" strategy in the forefront of the country.

4.3.5 Shared Development

The highest average score of the sharing index is Beijing, and the lowest score is Tibet. Beijing is the only one, Shanghai, Zhejiang and Jiangsu are at the leading level, and western regions such as Tibet, Qinghai, Yunnan and Guizhou are relatively lagging behind. This shows that the gap in sharing level among provinces is very large, and

the contradiction of unbalanced sharing level due to unbalanced economic development is very prominent. It is urgent to vigorously promote the equalization of basic public service supply and continuously improve people's living conditions.

5   Conclusion and Countermeasures

According to the quality development evaluation indicator system, the following conclusions are mainly drawn.

First, the national high development trend of quality is rising, but the overall high level of quality development still needs to be improved, the overall level of quality development between regions show "high in the east and low in the west, high in the south and low in the north" situation. Beijing's composite index of high quality development ranked first in China, much higher than other regions in the same period.

Second, the comprehensive index of the development of the five major concepts shows a rising trend, but there are obvious differences between regions. It shows a pattern of highest in the east, next to the center and lastly in the west. The trend of spatial changes in the development of the five concepts is gradually advancing from the eastern coastal areas of China to the inland.

In response to the above results and the problems, the next steps are appropriate:

Adopt a differentiated innovation development strategy to build on our strengths and avoid our weaknesses to stimulate new development momentum. Create an environment that encourages innovation, admires innovation and supports innovation. Insist on implementing a coordinated regional development strategy to improve the efficiency of resource allocation. Develop modern agriculture and promote the "double wheel" of urban and rural areas. Practice the development concept of "green water and green mountains are the silver mountain of gold", and explore the long-term mechanism of green development. Seeking a new situation of openness, improve the institutionalization and legalization of the construction. Proactively integrate into the "Belt and Road" pattern, and expand new areas and space. Solve the shortcomings according to local conditions, share the fruits of development, and improve the effectiveness of poverty eradication.

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