Measurement and Analysis of China's Digital Infrastructure Level

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Abstract: This paper measures the level of digital infrastructure in different provinces of China from 2013 to 2022 using the entropy weight method. The research findings indicate that China's digital infrastructure has been improving over the years, but regional disparities exist, with the eastern region having a higher level compared to the central and western regions. Therefore, it is crucial for each province to strengthen the construction of digital infrastructure to promote the development of the digital economy and achieve balanced regional growth.

***Keywords*:** digital infrastructure, index system, regional disparities

1. Introduction

Since the 21st century, the digital economy has emerged as an important economic form, following agricultural and industrial economies, and has become a significant driving force for economic growth worldwide. Against the backdrop of the booming digital economy, China's digital economy reached an astonishing scale of 50.2 trillion yuan in 2022, ranking second in the world, with the digital economy accounting for a high proportion of 41.5% of the GDP. The growth rate of the digital economy is more than three times that of the GDP, making it a key driving force for sustaining economic growth. However, as the material foundation and technological support for the development of the digital economy, the importance of digital infrastructure is increasingly prominent. Digital infrastructure has become an important component of national strategy, and its level has become a symbol of national strength.

China has a vast territory, and there are differences in the level of economic development and infrastructure construction among provinces. Through research on the digital infrastructure level of each province, we can uncover existing issues and shortcomings, provide scientific basis for the government to formulate relevant policies and development plans, and promote balanced regional development. Therefore, it is crucial to measure the level of digital infrastructure.

2. Literature Review

In the 1980s, the National Science Foundation of the United States proposed the Digital Library Initiative, defining digital infrastructure as "a way to provide unrestricted access, communication, utilization, and distribution of digitized information resources on a global scale using modern computer and communication technologies." It encompasses various technological and application facilities such as computers, networks, servers, data centers, application systems, platforms, and services. In the rapidly advancing 21st century of technology, the concept of digital infrastructure has evolved, incorporating new technologies such as cloud computing, big data, artificial intelligence, and blockchain, providing support for the development of the digital economy and the creation of an intelligent society.

Regarding the measurement of digital infrastructure, foreign scholars have not directly studied it but have included it in other indicator systems. For example, the World Economic Forum considers "digital infrastructure" as a sub-indicator of "network readiness" [1]. The International Telecommunication Union includes digital infrastructure as a sub-indicator in constructing the ICT Development Index [2].. In domestic research, scholars have generally approached the measurement of digital infrastructure in two ways. First, they use core single indicators as proxies. Second, they construct indicator systems to calculate composite indices. Many researchers have used the pilot implementation of the "Broadband China" policy as a virtual variable representing the level of digital infrastructure [3,4,5,6]. Zhu Zhiyong and Liu Changchang [7] (2022) constructed a digital infrastructure indicator system by selecting 12 secondary indicators from the dimensions of construction, application, and utilization rate of digital infrastructure. Zhang Hengshuo and Li Shaoping [8] (2022) selected indicator data from eight dimensions, including the number of internet broadband access ports, and used principal component analysis to comprehensively measure the level of digital infrastructure construction.

However,as new types of digital infrastructure such as 5G, big data, and artificial intelligence have become increasingly important components, it is necessary to incorporate relevant indicators into the measurement system to keep up with the times.

3. Indicator System for Digital Infrastructure Level

To explore the digital infrastructure level of each province, selecting indicators solely based on the construction of digital infrastructure is insufficient. Therefore, this paper incorporates indicators from the perspectives of digital infrastructure application and output. Drawing from the research of Zhu Zhiyong and Liu Changchang [7] (2022) and Yang Bin [9] (2023), this paper selects 11 tertiary indicators to construct the indicator system for digital infrastructure. Data sources include the National Bureau of Statistics, CSMAR database, and International Federation of Robotics database (Table 1).

In addition to traditional digital infrastructure such as mobile base stations and optical cables, there are new types of digital infrastructure represented by artificial intelligence. Following the approach of Sun Zao and Hou Yulin [10] (2021), this paper calculates the weight of industrial robot installations in each province based on the share of industrial value-added (the proportion of industrial value-added to the national industrial value-added). This weight is then multiplied by the data on industrial robot installations in the industrial sector from the International Federation of Robotics database, yielding the input of industrial robots in the manufacturing industry for each province.

Based on relevant studies [11,12], this paper evaluates the level of digital infrastructure in different provinces of China from 2013 to 2022 using the entropy weight method.

Table 1. Indicator system for digital infrastructure construction

First-level indicator	Second-level indicator	third-level indicator
Level of Digital Infrastructure	Digital infrastructure construction	Mobile base station density
		Optical cable density
		Installation of industrial robots
	Digital infrastructure applications	number of Internet broadband access ports per capita
		Domain names per capita
		Computers per 100 people
		Number of websites per 100 companies
		information transmission, software and information technology services in urban units of employment
	Digital infrastructure output	Software revenue as a percentage of GDP
		The proportion of average sales per thousand e-commerce enterprises in GDP
		The proportion of total telecommunications business in GDP

4. Measurement Results and Analysis of Digital Infrastructure Level

The results show that from 2013 to 2022, the level of digital infrastructure development in China has been continuously improving but with regional disparities (Figure 1). The development level of digital infrastructure in Chinese provinces consistently follows an East-Central-West decreasing trend. The eastern region has the most advanced digital infrastructure compared to other regions and consistently surpasses the national average level, maintaining a leading position. On the other hand, the comprehensive scores of the central and western regions are consistently lower than the national average score for digital infrastructure.

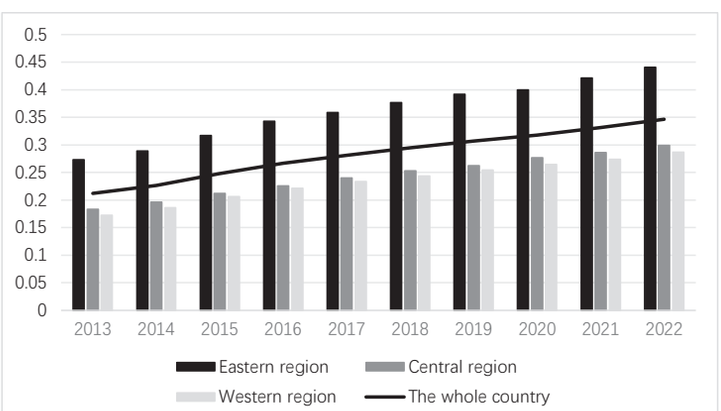

Figure 1. Digital Infrastructure Level in Different Regions of China

5. Conclusion

China's digital infrastructure is continuously improving, with regional disparities. The eastern region has advanced infrastructure, while the west lags behind. Strategies should integrate digital technologies with industries in the east and accelerate infrastructure construction in the central and western regions. This will drive high-quality growth in the digital economy and ensure sustainable development.

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