Analysis on the Transformation and Upgrading of New Infrastructure

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Abstract: As China's economy shifts to high-quality growth pattern, how to promote high-quality development of new infrastructure has gradually become an issue of common concern for experts and scholars. This paper introduces the development status of new infrastructure in China, analyzes the factors restricting the transformation and upgrading of new infrastructure, and further proposes countermeasures and suggestions to accelerate the transformation and upgrading of new infrastructure.

1. Introduction

Infrastructure investment has always been an important way to stabilize economic growth and safeguard employment. Most people have a general understanding of infrastructure which means highways, high-speed rail, and so on [1]. However, the concept of new infrastructure has become extremely popular this year. Among the infrastructure projects announced by various provinces this year, "new infrastructure" projects such as 5G network construction accounts for significantly increased proportion. Therefore, new infrastructure has become a hot keyword in 2020, attracting large funds in the capital market [2].

2. Problem proposal

In December 2018, the Central Economic Work Conference proposed to accelerate 5G commercialization and strengthen the construction of new infrastructure such as artificial intelligence, the Internet, and the Internet of Things. The concept of "new infrastructure" was thus mentioned for the first time. In 2019, the Central Government Work Report proposed: Strengthen the construction of new-generation information infrastructure. Since 2020, due to the impact of the epidemic, there is increased pressure from economic downturn. Under the dual pressures of economic structural transformation and trade wars, coupled with epidemic blow on Chinese economy, new infrastructure has been mentioned several times in the Central Economic Work Conference due to its counter-cyclical adjustment effect. The central government level has repeatedly emphasized the plan to promote the construction of "new infrastructure". It is estimated that between 2020-2025, intercity high-speed rail and rail transit in the field of "new infrastructure" will demand the most investment, followed by investment in 5G base stations [3].

What is "new infrastructure"? The National Development and Reform Commission clarifies its scope and points out that new infrastructure is an infrastructure system guided by new development concepts, driven by technological innovation and based on information networks that provides services such as digital transformation, intelligent upgrading, and integration innovation in response to high-quality development needs. It mainly includes three aspects, namely information infrastructure, integration infrastructure and innovation infrastructure. The industrial fields involved in "new infrastructure" mainly include seven sectors, namely 5G base station, big data center, artificial intelligence, UHV, new energy charging pile, intercity high-speed rail, rail transit, and industrial Internet. New infrastructure should not only play the role of traditional infrastructure in counter-cyclical steady growth, but also give full play to the pulling efficiency of digital economy. According to statistics, the multiplier effect of high-speed rail construction investment in driving related industries is about three times, while the multiplier effect of 5G, artificial intelligence and other information technology in stimulating related industries is as high as 6 times [4,5].

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3. Development status and foundation of new infrastructure

The National Development and Reform Commission divides new infrastructure into three aspects: information infrastructure, integration infrastructure, and innovation infrastructure. Information infrastructure mainly refers to infrastructure developed based on the evolution of new-generation information technology, such as communication network infrastructure, new technology infrastructure, computing power infrastructure, etc. Integration infrastructure mainly refers to infrastructure developed to support the transformation and upgrading of traditional infrastructure via in-depth application of technologies like Internet, big data, artificial intelligence, which includes intelligent transportation infrastructure, smart energy infrastructure, etc. Innovation infrastructure mainly refers to infrastructure with public welfare attributes that supports scientific research, technological development, and product development, such as major scientific and technological infrastructure, scientific and educational infrastructure, and industrial technological innovation infrastructure.

The current development trend of new infrastructure in China features guidance by the east and regional coordination. According to the annual key infrastructure project investment plans of 26 provinces (municipalities and autonomous regions) compiled by CCID, the proportion of new infrastructure projects of each region in key infrastructure construction is as follows: Zhejiang, Guangdong, and Anhui have a relatively large number of new infrastructure projects, reaching 109, 165 and 280 items respectively. Guangdong, Shandong, and Hebei account for a relatively high proportion in new infrastructure projects, reaching 34.1%, 35.0% and 43.5% respectively. According to statistics from the Ministry of Industry and Information Technology, by the end of 2019, China has built more than 130,000 5G base stations, and as of the end of February 2020, 164,000 5G base stations has been opened nationwide. On June 6, 2020, the Ministry of Industry and Information Technology stated that basic telecommunications companies have built more than 250,000 5G base stations. Wu Hequan, an academician of the Chinese Academy of Engineering, predicts that by the end of 2020, the number of base stations in China will reach 650,000, and number of 5G package users will reach 200 million, thus achieving indoor coverage of key scenes, key coverage of counties and towns, and continuous coverage outside prefecture-level cities across the country.

4. Factors restricting the transformation and upgrading of new infrastructure

4.1 5G Construction Cost is High and Popularization is Difficult

Information infrastructure highlights "new technology", and 5G construction is at the forefront. 5G, the Internet of Things, the Industrial Internet, artificial intelligence, cloud computing, and big data are all new-generation information technologies. The infrastructure developed by relying on these information technologies is information infrastructure. Take the 5G network as an example. It can transmit larger-scale data at high speed and with low latency. 5G has very fast transmission speed of 10 to 100 times that of 4G. Also, 5G can connect to larger-scale equipment, thus becoming important support for development of new industries such as artificial intelligence, industrial Internet, online economy. However, 5G has high construction cost and great popularization difficulty. The difficulty of popularizing 5G lies in "its expensiveness", that is, 5G construction cost is still very high. China Mobile once announced a rough estimate that the cost of building a 5G base station is about three times that of 4G. Secondly, the signal coverage area of 5G base stations is much smaller than that of 4G base stations, so more 5G base stations may be needed. Recently, China Mobile announced the centralized purchase results of main 5G Phase II wireless network equipment in 2020. A total of 232,143 5G base stations are required, and the total purchase amount is 37.088 billion yuan. Based on this calculation, the cost of a 5G base station is about 160,000 yuan.

4.2 The Weakness of AI Basic Research Urgently Needs Improvement

Artificial intelligence provides the core driving force for the fourth industrial revolution, which can affect the economic development of the future society to a large extent. 5G, cloud and AI constitute the foundation and base of digital facilities. Artificial intelligence and big data rely on each other, and

the development of artificial intelligence relies on data intelligence or computational intelligence. In China's previous financial investment, a lot of funds are invested in the basic hardware platform, while few funds are invested in the basic software platform. Experts from the National Bureau of Statistics believe that compared with developed countries, China's overall research and development is still large-scaled but not strong, big in number but not excellent. Ranking of 31 provinces in scientific research investment in 2019 reveals that China's scientific research expenditure is nearly 2 trillion yuan, and Huawei's research and development expenditure outgoes that of 25 provinces. Non-manufacturing companies' R&D investment accounts for about 14.9%, far below the US's 33.1%. Compared with foreign developed countries in basic AI research, we fall behind for at least 4 to 8 years. Therefore, in order to strengthen AI basic research, there is need to strengthen basic intelligent software system research in addition to increasing the investment in basic algorithms.

4.3 Industrial Internet Technology Integration is in Urgent Need of Improvement

At present, China has formulated basic research standards. Some companies are leading the way in 5G, artificial intelligence, big data and other applications, but there is still a gap compared with foreign advanced levels, especially in artificial intelligence chips and underlying open source frameworks. Although China has rapid development in industrial Internet, it still acts as follower due to failure to master the key core technologies. China's industrial Internet big data resources are isolated, scattered, and closed, and data values cannot be fully and effectively utilized. Data sovereignty and data security are facing major threats. A unified industrial Internet big data management, service and security system has not yet been formed.

5. The realization path for transformation and upgrading of new infrastructure

5.1 Give Full Play to the Joint Role of the Government and the Market

At present, China's new infrastructure has set off a new round of investment boom. According to preliminary calculations by China Merchants Securities, in 2020-2025, among the seven major industries involved in China's "new infrastructure" construction, intercity high-speed rail and rail transit demand the highest total investment which is expected to reach 34,400 trillion yuan; next comes 5G infrastructure construction whose investment scale is expected to reach 24,000 trillion yuan. Therefore, it is necessary to give full play to the joint role of the government and the market to promote the transformation and upgrading of new infrastructure. In addition to government debt, bank loans and state-owned enterprise investments, private capital should also play a role.

Give full play to the subjective role of the government, coordinate central and local government funds, and focus on new infrastructure projects with long investment cycles, low investment returns, and strong public welfare. For example, at a time when digital economy is booming, integrated circuits are the core to digital economy development of big data, the Internet, and artificial intelligence. Chip industry is characterized by long investment cycles and complex processes. To cultivate domestic chip industry, in 2014, China established the National Integrated Circuit Industry Investment Fund (commonly known as the "National Big Fund Phase I") and local funds. National Big Fund Phase I has an investment scale of 138 billion yuan, and local funds have an investment scale of nearly 140 billion yuan. Where, about 50 billion of funds are invested in IC manufacturing. The market scale of China's integrated circuit industry has grown from 250.85 billion yuan in 2013 to 653.2 billion yuan in 2018, with a year-on-year growth rate of about 20%. On October 22, 2019, National Big Fund Phase II was established with a registered capital of 204.15 billion yuan, mainly to support China's integrated circuit industry.

In addition, we must let the market play the main role, make full use of capital market, invest in new infrastructure projects with good returns, and build infrastructure such as 5G and big data centers. Where conditions permit, enterprises can log on to the Science and Technology Innovation Board for listing and financing, thereby developing new infrastructure projects under market guidance.

5.2 Build a Solid Foundation for Key Core Technologies

In the post-epidemic era, China must possess internal circulation capabilities of key core technologies to expand and strengthen the domestic demand market. The mission of new infrastructure construction is to take the key core technologies in one's own hands to gain an advantage in the future competition. In all areas related to new infrastructure, 5G will become the top priority of new infrastructure. The acceleration of 5G construction will promote the rise of a group of innovative enterprises with core technologies and characteristic applications. To realize long-term sustainable and stable development of new infrastructure, it is necessary to consolidate the foundation for technological innovation and upgrading, and speed up the compensation for key technical weakness. Therefore, it is necessary to gather national scientific research forces to make up for weakness in high-end chips and basic software. In particular, scientific research institutions, research institutes and industry leaders must strengthen cooperation, deepen basic and applied research, build independent innovation platforms, and carry out independent research and development of key technologies. To this end, the "Guidelines for the Construction of National New Generation Artificial Intelligence Innovation and Development Pilot Zones" issued by the Ministry of Science and Technology in September 2019 proposes that: about 20 artificial intelligence pilot zones should be built by 2023. Artificial intelligence investment mainly focuses on software (AI technology) and hardware (chips, sensors). From 2020 to 2025, the cumulative infrastructure investment in underlying hardware and general AI technologies and platforms is expected to reach about 200 billion yuan.

Megvii Technology has provided a successful case in R&D and utilization of core technologies. In the initial stage of the fight against the epidemic, Megvii Technology developed a set of artificial intelligence temperature measurement system within 10 days, which can detect body temperature of the crowd; within 4 days, it developed an intelligent evaluation system of chest CT for COVID-19, thus realizing image-based healthcare. Also, it developed a public-oriented artificial intelligence assistant "Doctor Xiaoyi" to help identify suspected cases and disease severity... These research and development results have played a very important role in the fight against the epidemic. Yi nan Xie, vice president of Megvii Technology, said that the rapid development of the enterprise in a short period of time benefits from mastery of the independently developed underlying algorithm framework. It can be seen that to achieve steady, long-term and healthy development of new infrastructure, we must build a solid foundation for key core technologies.

5.3 Explore Industry-Specific Service Needs

In transformation and upgrading of new infrastructure, we should not only pay attention to the construction of new infrastructure, but also attach more importance to the transformation and implementation of new technological achievements, and do a good job in the application of new infrastructure. It is necessary to tap the demand for specific services in the market and promote the integration of new infrastructure and traditional industries, thereby driving the development of the industrial chain. The integration and development of new infrastructure and traditional industries is a process reengineering of all links from production means, product design to operations, which cannot be simply regarded as technological transformation and upgrading. The key to the integration of new infrastructure and traditional industries is to search industry-specific service needs, so that the service capabilities of the new infrastructure can match the characteristics of industrial development. In this year's anti-epidemic process, 5G telemedicine, infrared temperature measurement, etc. have been realized; unmanned vehicles and smart city construction have also been greatly accelerated, thus realizing intelligent governance and data integration. Under the support of the industrial Internet of cloud and AI, the government and enterprises speed up resumption of work and production to greatly improve the operating efficiency of enterprises.

Therefore, several cities and regions in China are currently building smart cities, digital governments, smart industries, smart highways, wirelessly charged cars, etc. Enterprises must seize the current development opportunities, tap specific service needs in the market, and accelerate the transformation and upgrading of new infrastructure.

6. Conclusion

To sum up, new infrastructure means both changes and opportunities for various industries and enterprises. The state encourages scientific and technological innovation enterprises to take a foothold in the field of new infrastructure, continuously increase the R&D investment intensity, cultivate and strengthen original innovation capabilities. Enterprises are encouraged to actively expand application of 5G, artificial intelligence and big data in areas like Internet of Vehicles, smart manufacturing, telecommuting, smart cities, etc., and seize development opportunities to make Chinese enterprises bigger and stronger.

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