Research on the Integrated Development System of Digital Economy and Real Economy With Chinese Characteristics

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Abstract. The deep integration of the digital economy and the real economy has become an important driving force for high-quality economic development.Based on the current development situation at home and abroad, this paper summarizes the connotation of the integrated development of digital economy and real economy, and estimates the degree of the integrated development.And further put forward the theoretical basis and path of constructing the integrated development system of digital economy and real economy.This paper aims to explore the mechanism of digital economy on the traditional economy, and provide an analysis perspective of the whole industrial chain with Chinese characteristics for the integrated development system of digital economy and real economy.

Keywords: Digital economy, Real economy, Integrated development, Chinese characteristics

1 Introduction

"Accelerate the development of the digital economy, promote the deep integration of the digital economy and the real economy, and build a digital industrial cluster with international competitiveness," the Party's 20th National Congress report stressed. And the government work report also prioritized "vigorously developing the digital economy".The real economy generally refers to the industries engaged in production and service activities, such as agriculture, industry and services.With the wide application of information technologies such as mobile communication, Internet, big data and artificial intelligence, digital economy has emerged.Digital economy refers to a series of economic activities, such as production, circulation, distribution and consumption, which take data as production factors.The data in the digital economy comes from the real economy, and the digital economy serves the real economy through data.The deep integration of the digital economy and the real economy will provide new growth points for the development of the real economy, stimulate its vitality and support its high-quality development.According to the Digital China Development Report (2022), the size of China's digital economy reached 50.2 trillion yuan in 2022, ranking second in the world and accounting for 41.5% of China's GDP. The integration of digital technologies and the real economy has been further deepened, with the informatization rate of agricultural production exceeding 25%, the penetration rate of industrial digital tools reaching 77%, and the proportion of online retail sales of physical goods in total retail sales reaching 27%, all of

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which have reached a record high. It can be seen that the digital economy has become an important engine for steady growth and transformation.

2 Connotation and Current Situation of the Integrated Development

2.1 Connotation of the Integrated Development

In recent years, many scholars have conducted in-depth studies on digital economy and real economy. The research on the connotation of digital economy mainly focused on four aspects. Firstly, Scholars believed that the essential feature of digital economy is production by means of digital technology(Shi, 2021)[1]. The second was to define the digital economy from the systematic characteristics. Zhang, L. N. summarized the connotation of digital economy mainly from the characteristics of technological system, industrial system and institutional system(2022)[2]. The third was to define the digital economy from the aspect of economic form. Wen, T. P. believed that Digital economy was a new economic form following agriculture, industry and service economy. Therefore, comprehensive and more thorough analysis should be made on the connotation of digital economy(2022)[3]. Fourth, from the perspective of governance. Xie, K. defined the connotation of digital economy from the perspective of academic theory, established a theoretical framework of digital economy and summarized its research characteristics(2023)[4]. In the study on the measurement of digital economy, Akaev finally calculated the scale of American digital economy through the calculation formula of GNP(2019)[5].

In terms of the real economy, the literature mainly focused on the theoretical connotation and evaluation analysis. At present, scholars mainly defined the real economy from two perspectives: one is the perspective of discrimination from virtual economy, and the other is the perspective of industry(Cai, Chen, 2019)[6]. In addition, most studies mainly focused on the impact and significance of digital economy to the real economy, but the integration system of the two are rarely discussed. Du, C. Z. verified the performance enhancement effect of digital economy on enterprise digital transformation through empirical method(2021)[7]. Jiang, S. proved the macro "crowding out effect" of digital economy on real economy through empirical analysis(2021)[8].

2.2 The Current Situation of Integrated Development

Since 2015, the degree of digitization of Chinese industry has been increasing year by year. Firstly, the integration of the digital economy and manufacturing continued to deepen. By June 2022, the penetration rate of digital tools in Chinese manufacturing enterprises had reached 75.1 percent, an increase of 26.3 percent over 2012. At the same time, the utilization rate of resources increased by 22%, and the operating cost decreased by 19%. Secondly, the digital economy is promoting the transformation and upgrading of agriculture. By 2021, 72% of China's agricultural farming have been mechanized, with more than 600,000 Beidou terminals being used. Thirdly, the degree of digitization in the service sector has increased significantly. By 2021, China's online retail market has ranked first in the world for nine consecutive years. China's e-commerce transaction volume reached 42.3 trillion yuan in 2021, with an average annual growth rate of 20.3 percent compared with 8 trillion yuan in 2012.

2.3 Estimation of Integrated Development Degree

According to Tian, J. T. and Zhang, C. H, the proportion of digital economy in the real economy is used to measure the integration degree of the two (2023)[9]. Digital economy is divided into digital industrialization and industrial digitization, in which industrial digitization includes virtual economy and real economy[10]. According to Marxist political economy, virtual economy refers to the financial and real estate industries that are not directly involved in the production of real goods. By the exclusion method, the real economy is the entire national economy except the virtual economy. Therefore, the digital industrialization part and the parts of industrial digitization other than the digitization of the financial and real estate industries belong to the real economy. The specific formula of integration development degree is as follows.

$$D = \frac{GDE-VAFD-VARD}{GRE} = \frac{GDE-VAFD-VARD}{GDP-VAF-VAR} \quad (1)$$

GRE is the size of the real economy, VAF stands for value added in the financial sector, VAR stands for value added in real estate, GDE is the total size of the digital economy，VAFD is the value-added part of the financial industry in industrial digitization, VARD is the value-added part of the contribution of real estate in industrial digitization.

In order to conveniently deduct the impact of virtual economy, this paper adopts the calculation results of Cai, Y. Z. and Niu, X. X. on the added value of digital economy (2021)[11].The calculation divides industrial digitization into substitution effect and synergy effect.At the same time, the integration degree is calculated using the data of China Statistical Yearbook.Taking the data of 2018 as an example, formula (1) is used to calculate the integration degree of the digital economy and the real economy in that year.

According to formula (1), GRE=GDP-VAF-VAR=919281.1-70610.3-64623=784047.8

The digital part of the real economy= GDE-VAFD-VARD = (73007.09+84754.44) - 17049.74 = 140711.79

Integration degree D=140711.79/784047.8=17.95%

By analogy, the results of the integration degree calculated by formula (1) are summarized in Table 1.

Table 1. Estimated Data of the Integration Degree of Digital Economy and Real Economy (unit: 100 million yuan)

Year	Digital industrialization	Industrial digitization	Digitization of financial and real estate industries	Digital economy (physical part)	GDP	Real economy	Integration degree
2012	32784.92	43996.9	6193.24	70588.58	538580	472143.3	14.95
2013	37520.41	49771.22	8292.07	78999.56	592963.2	515784.6	15.31
2014	42887.84	55002.61	9750.34	88140.11	643563.1	558897.1	15.77
2015	48702.64	60792.62	11405.49	98089.77	688858.2	589984.6	16.63

2016	53758.62	67097.02	13042	107813.64	746395.1	636461.7	16.94
2017	64083.28	74531.03	14920.98	123693.33	832035.9	710105.6	17.42
2018	73007.09	84754.44	17049.74	140711.79	919281.1	784047.8	17.95

The line diagram of the degree of integration is shown in Figure 1.

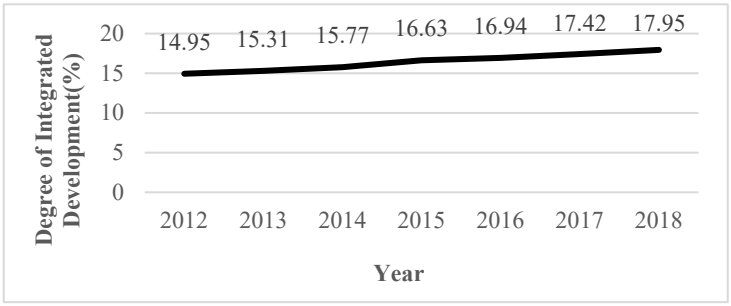

Figure 1. Degree of Integration Between Digital Economy and Real Economy(2012-2018)

As can be seen from Figure 1, the integration of China's digital economy and the real economy has increased by 3 percentage points from 2012 to 2018.

3 The Problem of the Integrated Development in China

In recent years, some problems have emerged in the process of the integrated development in our country. These problems mainly focus on the imbalanced integrated development, insufficient depth of integration and insufficient technical support.

3.1 Imbalanced Integrated Development

The core of the integrated development is to use digital technology to upgrade the whole industrial chain of traditional industries. However, there still exists imbalanced development among various industries, industries and regions in our country.

Firstly, the degree of digitization of the three industries is unbalanced. By the end of 2021, the digital penetration rate of China's primary, secondary and tertiary industries were 10 percent, 22 percent and 43 percent, respectively. From figure 2, we can know that the integration of tertiary industry and digital economy is far ahead in recent years, but the primary and secondary industries lag behind obviously.

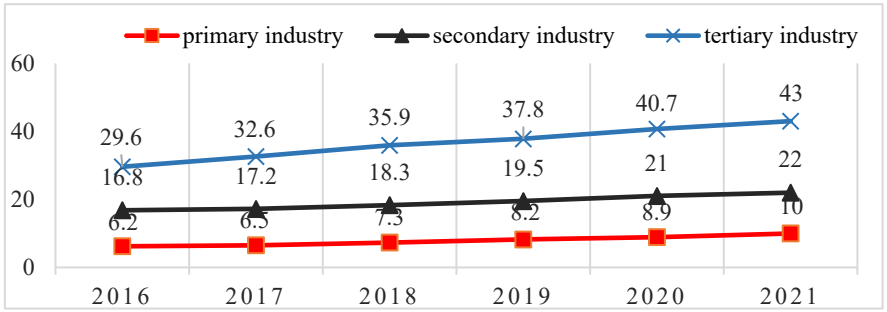

Figure 2. Penetration Rate of Digital Economy in Three Domestic Industries From 2016 to 2021(%)

Secondly, there is also an imbalance in the integration of various industries and digital economy. The digital penetration rate of scientific research, entertainment, retail is high, while the degree of digital transformation of agriculture, forestry and fishery industries is weak.

Finally, the degree of digital application in different regions is not balanced. According to the registered information of digital enterprises in each region, the digitization degree of industries in Shanghai, Hainan, Beijing and other regions is relatively high, reaching more than 50% in 2021, while the digitization degree of Guizhou, Heilongjiang, Yunnan and other regions is only about 30%. In 2021, Shanghai's digital economy accounted for more than 50 percent of its GDP, while western provinces such as Gansu and Qinghai only accounted for 20 percent.

3.2 The Degree of Integrated Development is not Deep

At present, the digital economy of our country has not empower the real economy in-depth from the angle of whole life cycle and whole industrial chain. The main reasons are as follows.

Firstly, digital technology has not been applied to the main parts of manufacturing. The digitization rate of important manufacturing aspects of most products is less than 50%, especially among small and medium-sized enterprises. It can be seen that most enterprises have not realized the effect of improving productivity through digital technology.

Secondly, the digital transformation of the industrial chain is still in initial stage. If enterprises want to carry out large-scale digital upgrading of industrial chain, they need to rely on industrial Internet platforms. Our industrial Internet platforms are mainly set up by leading industry enterprises, which are mainly used to meet their own needs and have not been widely connected to the upstream and downstream enterprises in the industrial chain.

3.3 Prominent Security Problem

With the wide application of digital technology, all kinds of security problems have gradually appeared. First, privacy protection risks are increasing. At present, The risk of private data theft is increased, and device vendors may even set up programs on devices to remotely steal information. Second, there are security problems in the supply chain. Many digital products are characterized by strong professionalism and complex technology. The supply of the whole product involves multiple manufacturers and even spans multiple countries, which makes security vulnerabilities possible in all links of the supply chain. Take chip manufacturing for

example, its production line may involve dozens of industries, thousands of processes, parts may come from multiple countries, its supply chain exists huge security risks.

4 Building the Integrated Development System of Digital Economy and Real Economy With Chinese Characteristics

4.1 Foundation Path

Building an integrated development system of digital economy and real economy with Chinese characteristics requires the joint efforts of all sectors of society. Tian, J. T. once compared new infrastructure and the Internet to the "road" and "car" for the integrated development(2020)[12]. Sufficient data and computing power can ensure the integration of the digital economy and the real economy. In addition, data elements are needed to provide the "energy" for integrated development. "Road", "car" and "energy" can form the basic path of integrated development.

(1) Computing infrastructure should be vigorously developed to provide a digital foundation for the real economy. According to data from the China Academy of Information and Communications Technology, from 2016 to 2020, global computing power grew at an average annual rate of about 30%, driving an average annual GDP growth of 2.4%. At present, the domestic industrial application of computing power is insufficient, mainly applied in finance, transportation and other fields, which fails to give full play to economic effects. Firstly, we should actively explore the industrialization application of computing power, and then build a more extensive computing application system. Secondly, innovation and entrepreneurial activities related to computing power should be actively carried out to explore broader application scenarios of computing power. Finally, we should increase foresight and reasonably plan the development route of computing technology, especially in quantum mechanics, brain computing and other promising fields.

(2) The application of artificial intelligence should be expanded to provide impetus for the development of the real economy. We should integrate artificial intelligence into the real economy, and provide a foundation for industrial digitization. Using the new generation of information technology to break the boundaries of traditional three industries, promote the integration of emerging service industries with primary and secondary industries. So as to expand the development direction of traditional agriculture and manufacturing. In addition, the application of the artificial intelligence can promote the innovation of the production process, reduce energy consumption, and realize low-carbon transformation.

(3) Actively develop data factor market, construct a whole industry digital chain. As a new factor of production, data has changed the way of production and life from circulation, distribution, consumption and many other links. According to the calculation of the National Industry and Information Security Center, the data factor market will exceed 170 billion yuan in 2025. Firstly, we should improve the system of data property rights. We can realize data transaction on the basis of standardizing data collection and processing behavior. Secondly, the supervision mechanism should be perfected, laws and regulations should be formulated to standardize data trading.

4.2 Building a System for Integrated Development

Building an integrated development system of digital economy and real economy with Chinese characteristics is a systematic process. It covers the effective allocation of all elements of the whole industrial chain, so it is necessary to build a digital network ecology.

(1) Building a digital infrastructure ecology. Digital infrastructure is the foundation for the integration of digital economy and real economy. It is necessary to strengthen the construction of block-chain infrastructure, big data centers, super-computing centers and other digital technology facilities to enrich the integration of the digital economy and the real economy.

(2) Building an industrial ecology. Industrial ecology is a whole composed of economic activities, production factors and operation rules. It is necessary to encourage enterprises increase investment in research, integrate various resources, and help enterprises establish an industrial Internet ecosystem.

(3) Building a policy ecology. The government should improve the policy system, establish a supervision mechanism, reasonable and standardized guidance. We will improve rules for applying artificial intelligence and big data in the real economy. Establishing data governance mechanism to ensure the safe and orderly circulation of data elements.

(4) Building a safe ecosystem. We should improve the data security management of the integrated development system, and build a risk management mechanism and a security guarantee system. In addition, the data protection system should be improved to strengthen risk protection and avoid security problems such as confidential information and privacy information disclosure.

5 Conclusions

This paper starts from the connotation and current situation of the integrated development of digital economy and real economy, analyzes the problems in the process of our country's development, and puts forward countermeasures to build the integrated development system.Accelerating the integrated development of China's digital economy and the real economy will play an important role in improving China's economic system and help enhance the capacity of intelligent manufacturing.We should seize the development opportunities of the digital economy, take the industrial field as a breakthrough point, give full play to comparative advantages, expand application scenarios, and further promote the transformation and upgrading of China's traditional industries.

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References

[1] Shi, Y. P.: Integrated development of the digital economy and manufacturing industry: path and progress. Frontiers. No.6, pp.34-39(2021)

[2] Yi, Q. P., and Liu, Y. J.: New solution of value chain reconstruction of traditional manufacturing industry under the condition of digital economy. Northern Economy and Trade. No.11, pp.42-46(2022)
[3] Wen, T. P., and Ouyang, R. H.:The scientific connotation,theoretical contribution and practical requirements of the General Secretary's important discussion on digital economy. Journal of China Executive Leadership Academy Jinggangshan. Vol. 15, No.5, pp.5-17(2022)
[4] Xie, K.: The innovation mode in the digital economy: data-based interactive innovation between enterprises and users. Journal of University of Chinese Academy of Social Sciences. Vol. 43, No. 2, pp.79-94+162+165(2023)
[5] Akaev, A. A., and Sadovnichii, V. A.:On the choice of mathematical models for describing the dynamics of digital economy. Differential Equations. Vol.55, No.5, pp.729-738(2019)
[6] Cai, Y. Z., and Chen, N.: Artificial intelligence and high-quality grown & employment in the era of new technological revolution. Journal of Quantitative & Technological Economics. Vol. 36, No. 5, pp.3-22(2019)
[7] Du, C. Z., and Zhang, Y.: Research on the influence mechanism of digital economy development on enterprise productivity growth. Securities Market Herald. No. 2, pp.41-51(2021)
[8] Jiang, S., and Zhou, X. Y.:An empirical study of the impact of digital inclusive finance on high-quality economic development. Finance Forum. No. 21, pp.1-2(2021)
[9] Tian, J. T., and Zhang, C. H.: The integration of digital economy and real economy : connotation, mechanism and promotion strategy. Journal of Technology Economics. Vol.42, No.1, pp.25-33(2023)
[10] Vovchenko,N.G., Andreeva O.V., Orobinsky A.S.: Risk Control in Modeling Financial Management Systems of Large Corporations in the Digital Economy. International Journal of Economics and Business Administration. No.1, pp.3-15.
[11] Cai, Y. Z., and Niu, X. X.: Scale measurement and structural analysis of the value-added of China's digital econmy. Social Sciences in China. No.11, pp.4-30+204(2021)
[12] Tian,J. T., and Yan, D. L.: New infrastructure and industrial internet: the road and car of the digital economy accelerating after the pandemic. Journal of Shandong University(Philosophy and Social Sciences). No. 3, pp.1-8(2020)