Research on the Impact of Digital Economy on Industrial Structure

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Abstract:

Given the rapid progress of digital technology innovation, the digital economy will have some impact on the level of industrial structure. This study first clarifies the literature analysis of the relationship between the digital economy and the industrial structure level, then evaluates the current status of development and challenges pertaining to this relationship, and finally makes recommendations for relevant policy.

Keywords: digital economy; industrial structure; impact

1. Introduction

In October 2018, Anhui Province issued a high-value "digital economy policy", which mainly includes ten aspects, including supporting digital technology innovation, primarily supporting the construction of industrial Internet innovation centers; cultivating "Internet + manufacturing" demonstrations, and providing a one-time reward of up to 1 million yuan to national pilot demonstration enterprises (projects) in the fields of manufacturing and Internet integration, industrial Internet, big data industry, and software "soul-casting" projects. Speakers from the Ministry of Industry and Information Technology, the Cyberspace Administration of China, and the National Data Bureau were among the groups represented at the July 2024 Global Digital Economy Conference. They issued policy signals aimed at improving policy supply, accelerating data system development, intensifying industry digital transformation, and fostering the innovative growth of digital industries. Eight institutional papers on data property rights, data circulation, income distribution, security governance, and best practices for developing data infrastructure will be released in 2024.

A revised version of the "Guidelines for Industrial Structure Adjustment (2024 Edition)" was published by the National Development and Reform Commission on December 27, 2023. These principles form an essential basis for guiding social investment, government oversight of investment initiatives, and the formulation and implementation of financial, tax, credit, land, import and export, and other policy sectors. The "Catalog" now contains key industry categories and related areas that enable industrial optimization and upgrading, such as "intelligent manufacturing," "agricultural machinery and equipment," "CNC machine tools," and "cybersecurity," in the encouraging section.

The following are the study subjects for this paper: After reviewing the relevant literature on the industrial structure level and the digital economy, the issues these fields are currently facing and their current growth trajectory will be explored. Appropriate solutions and countermeasures will then be recommended. This article is special because it first thoroughly classifies pertinent literature on the subject of the digital economy and industrial structure level. This is followed by an analysis of the problems and state of the field in the context of China's unique national circumstances.

2. Literature Review

2.1 Related research on the digital economy

The digital economy, which follows the industrial and agricultural economies, is considered advanced. Together with increasing total factor productivity, its development enhances abilities in penetration, integration, coordination, and resource allocation. As a result, it becomes an effective instrument for promoting the strategic realignment of the industrial structure and achieving the sustainable development of the Chinese economy (Pei Changhong et al., 2018). The 1990s saw the start of the digital economy's ascent. When American scholar Don Tapscott first used the phrase "digital economy" in 1996, it lacked a clear definition. The Internet and information technology have a major role in the early digital economy's development. As we ushered in the twenty-first century, technical advancements were facilitated by persistent economic prosperity. China is where the term "Internet +" originated in 2015, and it is also where the concept of "Internetization" was first proposed in 2008. The development of Internet technology has led to a faster growth of the digital economy, which is being used globally. The digital economy has grown more quickly as a result of new digital technologies including big data, cloud computing, and artificial intelligence. The term "digital economy" was coined and gained widespread recognition at the G20 Hangzhou Summit in 2016. The conference defined the digital economy as a collection of commercial endeavors that leverage contemporary information networks as vital conduits, digital knowledge and information as essential production inputs, and efficient utilization of ICTs as a catalyst for increasing productivity and optimizing the structure of the economy. The digital economy, which has information technology at its heart, is widely employed in many different types of societal companies and is seen as a cutting-edge, long-term, and viable economic structure (Pei Changhong et al., 2018). The increased flow of knowledge and information brought about by this new economic framework has increased production. This has the potential to alter the conventional economic paradigm and enhance both economic efficiency and social wellbeing.

International organizations and both local and foreign specialists have carried out a number of studies with startling findings about the size of the digital economy. The United States Bureau of Economic Analysis (BEA) has defined the digital economy globally. BEA has also used supply and use data to calculate the total production and added value of the US digital economy (Barefoot et al., 2018; BEA, 2019). International businesses have also conducted pertinent estimates about the GDP contributions of various nations and the added value of the digital economy (Dean et al., 2016). The 2017 Digital Economy Index was created by the China Academy of Information and Communications Technology using a big data platform. It evaluated the growth of all "Internet +" digital economies in my nation from four angles: digital foundation, digital industry, innovation and entrepreneurship, and digital livelihood.

The digital economy is a modern, effective, and sustainable economic system that has had a dramatic impact on all aspects of society. Opinions among academics regarding the evolution of the digital economy are divided. To begin with, the quality of life and production efficiency will both be much enhanced by the digital economy (Wang Kaike et al., 2022; Bulturbayevich et al., 2022). Second, high-quality economic development will be greatly aided by the digital economy (Zhao Tao et al., 2020; Wang Jun et al., 2023; Jianing et al., 2022). By streamlining the industrial structure, the digital economy can foster more rapid economic growth (Cao, 2022).

2.2 Related research on the level of industrial structure

In accordance with Song Jinjian's (2000) proposal, industrial-organizational structure detection, industrial regional structure, and index groups that measure the sophistication of the industrial structure can all be used to ascertain the level of industrial structure. In order to optimize and upgrade the level of industrial structure, Ma Tao et al. (2004) suggested using seven index categories as the statistical index system, such as the industry's spatial location and degree of sophistication. Cheng Lifen (2005) offered seven metrics, including the GDP share of the tertiary sector and the ratio of each industry's added value, to quantify industrial structure. Song Guoyu and Liu Wenzong's 2005 suggestion of seven index categories was based on five concepts: three, dynamic optimization, demand efficiency, and competitive advantage. These index categories included the industrial correlation index group, the industrial structure rationalization index group, and the industrial structure sophistication index group. Zhang Lizhu et al. (2007) suggested using advanced industrial structure and industrial structure rationalization to determine the level of industrial structure.

Xie Xu (1987) provided a theoretical explanation of the elements influencing the level of industrial structure. He identified five components of technical advancement that positively influence the level of industrial structure: optimization, innovation, demonstration, and innovation. According to Mao Zili's (1988) theory, advancements in technology and the sensible integration of production elements are what drive an increase in the degree of in-

dustrial structure. Simultaneously, he suggested that trade structure optimization influences and directs industrial structure optimization, while industrial structure optimization dictates trade structure optimization. According to Yang Xinghua's (1991) proposal, the level of industrial structure can be influenced by various elements, including policies, science and technology, demand structure, import and export commerce, and natural and economic resources. The degree of industrial organization and urbanization are inextricably linked, according to Zeng Fenyu's (2002) theoretical explanation. There is a suggestion that urbanization contributes positively to my nation's increased industrial structure level. Zhang Heng and Guo Ya (2013) used the VAR model to examine the relationship between the level of urbanization and the industrial structure in Anhui Province. The results showed that the two have a positive reciprocal affect on one another.

2.3 Studies on how the digital economy affects the structure of industries

Some researchers have had theoretical talks as part of their investigation into the effects of the digital economy on the level of industrial structure. Zhang Yuzhe considered how the digital economy may support the modernization of the industrial structure. He maintained that integrated development should be prioritized over other objectives, with the digital technological revolution at its center, and that innovative applications might be used to encourage the modernization of the industrial structure. In order to promote industrial upgrading, Wang Dehui and Wu Ziang researched the workings of the digital economy, identified its issues, and offered workable remedies. Xu Xianchun and associates examined the effects of the digital revolution from the perspectives of statistical theory, survey systems, standards, and applications on China's social and economic development.

Other academics have carried out quantitative study on how the digital economy affects the industrial structure. Digital infrastructure was split into two categories by Zhang Yongqing and Chen Mianmian: networks and communications. They developed a thorough index system for evaluation based on data from previous studies. Simultaneously, China's degree of industrial progress was empirically investigated using the linear regression model. The research suggests that although the eastern area has demonstrated a greater level of development, the digital economy has played a role in the modernization and restructuring of the industrial structure. Using the MIMIC model and the three elements of technology, economy, and society, Lin Yuhao and Chen Yingkui assessed the economic development level of each region and carried

out an empirical investigation. It has been shown that the different stages of China's digital economic development are significantly correlated spatially, and that this correlation can effectively support the modernization and optimization of the industrial structure. Han Ping and Li Yingjie have created the multivariate regression model. The advantages of digital infrastructure are greater because, as the analysis of elements such as the development of digital infrastructure, industrial digitization, and digital industrialization demonstrates, these elements have contributed to the more sophisticated and logical development of the industrial structure. Li Xiaozhong and Wu Jiaxu consulted the National Center for Information Statistics to develop a comprehensive measuring index after looking at infrastructure and industrial growth from a variety of angles. This study examined the association between industrial structure and growth in digital economy in several regions of China using impulse response and panel vector autoregression models. Though its driving forces vary by region, the digital economy may effectively advance China's industrial integration and the reform of its industrial structure. Li Linhan, Tian Weimin, and others examined the relationship between changes in the industrial structure and regional digital finance and regional economic development using the spatial Durbin models and the mediation effect. The research indicates that the emergence of digital finance in adjacent nations has a notable adverse influence on GDP, notwithstanding the evident positive spillover effects of regional economic expansion. Additionally, there is a considerable positive association between the development of digital finance in the region and GDP growth. There is also a strong mediating effect with relation to China's modifications to its industrial structure.

3. Current Status and Existing Problems of Digital Economy and Industrial Structure

3.1 Current status of the development of the digital economy and industrial structure

a. Analysis of the current status of the development of digital economy

The digital economy is currently growing rapidly. According to the "Global Digital Economy White Paper (2024)" published by the China Academy of Information and Communications Technology, the combined digital economies of the US, China, Germany, Japan, and South Korea will surpass 33 trillion US dollars in 2023, indicating a year-over-year growth of over 8%. Between 2024 and 2025, we anticipate an acceleration of the global dig-

ital industry's sales growth rate. The National Bureau of Statistics' director, Liu Liehong, forecast that by 2023, the top Chinese digital economy firms will have achieved the goals of the "14th Five-Year Plan" ahead of schedule and produced value of over 12 trillion yuan, or about 10% of GDP.

The primary sectors of the digital economy are growing together with its overall size. It just takes a few seconds to create a 3D digital avatar; multimodal large models are accelerating the usage of smartphones and intelligent robots; by donning VR iris devices, users may quickly identify and validate their identities in the metaverse world. A vivid picture of the digital world is presented by the numerous cutting-edge products and technologies that are on display together.

The "Global Digital Economy White Paper (2024)" uses artificial intelligence as an example. It reveals that as of the first quarter of 2024, there were around 30,000 AI enterprises worldwide, with China making up 15% of the total.

b. Analysis of the current status of the development of industrial structure

An actual country's economy is its foundation. The deep integration of the digital and real economies must be encouraged, traditional industries must be modernized and transformed, emerging industries must be nurtured and strengthened, future industries must be planned and built, digital industrial clusters must be built faster and with greater international competitiveness, and high-end, wise, and environmentally friendly industry development must be encouraged.

The People's Republic of China has steadily improved its capacity to produce a broad variety of agricultural products since its inception seventy-five years ago. The primary industry's added value has risen from 34.3 billion yuan in 1952 to 8975.5 billion yuan in 2023, with an average annual growth rate of 3.5% at constant prices. From traditional agriculture, which was primarily concerned with planting, to contemporary agriculture, which includes the advancement of forests, fisheries, animal husbandry, and agriculture as a whole, it has been feasible. The internal organization of agriculture has also been significantly improved. Planting was a major part of Chinese agriculture from the country's founding until the reform and opening up. Up to 85.9% of the entire production value of agriculture, fisheries, animal husbandry, and forests combined was derived from agriculture in 1952. Following the reform and opening up, which also led to a major emancipation of rural social productivity, the fields of agriculture, forestry, animal husbandry, and fisheries were fully developed with the introduction of the home contract responsibility system and the agricultural product circula-

tion system. The percentage of forestry, animal husbandry, fishery, and agricultural, forestry, animal husbandry, and fishery professional and auxiliary activities increased to 3.9%, 30.7%, 9.7%, and 3.7%, respectively, while the percentage of agriculture fell to 51.9% in the total output value of agriculture, forestry, animal husbandry, and fishery in 2012. The CPC Central Committee and the State Council have been promoting measures to advance, strengthen, and improve agriculture ever since the 18th CPC National Congress. They have also been promoting the supply side of agriculture's structural restructuring. While the agricultural sector has continued on a steady development track, the industrial structure has undergone additional optimization. Professional and auxiliary operations related to forestry, fishery, animal husbandry, and agriculture made for 54.9%, 4.4%, 24.6%, 10.2%, and 5.9% of these industries' total output value in 2023. Grain production has produced 20 straight bumper harvests, enhancing security and reinforcing agriculture's central position. China is expected to produce 695.41 million tons of grain in 2023, along with a large amount of high-quality produce, meat, poultry, eggs, milk, and fisheries products.

The secondary sector in my nation has grown significantly since the People's Republic of China was founded 75 years ago, contributing significantly to the steady and robust growth of the national economy. The added value of the secondary sector increased from 14.1 billion yuan in 1952 to 482589 billion yuan in 2023. The average annual growth rate, when constant prices are taken into account, is 10.3%, which is 2.4 percentage points higher than the average GDP growth rate. From 20.8% in 1952 to 38.3% in 2023, the secondary industry's share of GDP-added value increased by 17.5 percentage points. When the People's Republic of China was founded, the only industries included in my nation's early industrial base were mining, textiles, and simple processing. The socialist industrialization of my country produced a large, independent industrial structure before it was reformed and opened up. My nation's industrial development has entered a phase of rapid development since the reform and opening up; the average annual growth rate in industrial added value was 11.4% from 1979 to 2012. Since the 18th National Congress of the Communist Party of China, my country's industry has accelerated its transformation and upgrading, gradually moving towards the middle and upper classes, driven by major national strategic initiatives like supply-side structural reform and innovation-driven development. High-tech product and equipment manufacturing is expanding quickly. Producing equipment will account for 33.6% of the total added value of industries over the authorized size in 2023, up 5.4 percentage points from the previous year. Similarly, industries above the authorized size that

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produce high-tech products will make up 15.7% of all industries with added values over the necessary size, an increase of 6.3 percentage points from 2012. Companies are becoming more adept at innovating on a constant basis. 1936 will have seen a 1.7-fold increase from 2012 and an average annual growth rate of 10.4%.Industrial businesses would spend two billion yuan (beyond the permissible limit) on research and development (R&D) by 2022.

The tertiary industry in China has grown and strengthened since the People's Republic of China was founded seventy-five years ago. With an average annual growth rate of 8.2% at constant prices, the added value of the tertiary industry increased from 19.5 billion yuan in 1952 to 68823.8 billion yuan in 2023, 0.3 percentage points faster than the average annual growth rate of the GDP. The GDP proportion of the sector increased by 25.9 percentage points between 1952 and 2023, from 28.7% to 54.6%. Prior to the reform and opening up, my country's tertiary sector developed very slowly and had a very straightforward structure from the beginning of the People's Republic of China. It was largely dominated by traditional service industries like transportation, retail and wholesale, etc. Because of the continuous progress of the economic system transformation since the reform and opening up, the service sector has experienced tremendous growth. In 2012, the tertiary industry overtook the secondary sector as the largest sector of the national economy, with an added value of 45.5% of GDP. The quality of the tertiary industry's development has steadily improved since the 18th National Congress of the Communist Party of China implemented more significant improvements in the service sector. Furthermore, the modern and emerging service sectors have expanded quickly and now contribute a significantly larger portion of GDP. The added value of information transmission, software and IT services, leasing, and business services will increase GDP by 2.2 and 1.5 percentage points in 2023, respectively; online retail sales of physical goods will reach 1,301.74 billion yuan, or 27.6% of total retail sales of consumer goods, up 18.4 percentage points from 2014.

3.2 Problems in the digital economy and industrial structure

a. Problems in the development of the digital economy
The development paths of the digital economy are becoming more and more comparable, and the competition for essential resources such as capital and skill is exacerbating the disparities in development.

As of right now, every area has identified the digital economy as a priority sector for development during the "14th Five-Year Plan" era. Consequently, there has been an increase in investments made in smart cities, data factor market development, industrial digitization, digital industrialization, and digital governance. However, because there is insufficient general planning, coordination, and division of labor, most locations lack features and highlights and have similar measures and courses in terms of industrial orientation, policy design, project building, etc.All 24 provinces and cities that have released digital economic policies have called for accelerating the area of artificial intelligence development; nevertheless, the majority of the provinces have not listed the important breakthrough directions and sub-sectors. Simultaneously, there is a growing battle for creative resources including data elements, top businesses, and digital skills.

b. Because of the growing risks associated with unpredictability in corporate operations, the digital economy's business environment needs to be further optimized. These days, corporate operations face more unpredictability because of things like the global economic slump and the effects of the epidemic on the global supply chain and industrial chain. In addition, more market participants have entered the market as a result of the ease of access to the market and operation services, which has somewhat exacerbated the business challenges faced by firms. The business demands of firms have evolved from straightforward access to policy stability, accurate subsidies, market docking, and inclusive innovation in response to a market with increasingly diversified wants and faster product iterations. Nevertheless, there are issues with certain of the current rules that need to be further optimized, like poor support accuracy, sluggish reward redemption, and insufficient "rigid redemption".

c. Stricter regulations on digital platform monopolies could impede market innovation, so it's critical to find quick solutions to regulatory challenges like platform autonomy and monopoly. At the moment, as digital platforms continue to grow in size, they have more and more influence over resources like money, traffic, technology, and data. Algorithms are often used to control user behavior; examples of this include "choose one of two" and "big data killing old customers." The platform's ability to independently regulate user conduct, business practices, and market dynamics has been improved over time.

3.3 Problems in the level of industrial structure

The existing problems in China's industrial structure level mainly include :
a.Unreasonable industrial structure
Traditional industries have long dominated the industrial structure of my nation, with the chemical and heavy industries still holding a strong place in the three main

industrial systems. My nation's tertiary industry is still underdeveloped as compared to wealthy nations, and its low percentage of the service sector leads to an illogical industrial structure.

b.High energy consumption and high emissions

The economy of my nation has grown quickly, which has resulted in issues like pollution and excessive energy use. Particularly noticeable are traditional industries' excessive energy use and emissions. Large-scale resource consumption and environmental contamination are now significant barriers to the modernization of the industrial structure in my nation.

c.Low efficiency

The issue of low enterprise efficiency also exists in the industrial structure of my country as the scale of firms keeps growing. Businesses' production costs are rising as a result of intense market rivalry, but their product prices aren't keeping up with the costs, which leads to inadequate business efficiency.

4. Policy Recommendations

4.1 Policy recommendations for promoting the development of the digital economy

a.bolster the high-level strategy for the coordinated expansion of the digital economy even more. In order to support the exploration of effective paths for the development of the digital economy based on local industrial foundations and highlighting regional characteristics and advantages, we should first fully summarize and promote the unique experience of the digital economy innovation development pilot zone, further expand the pilot zone's scope, and promote the pilot subject to sink to the city, district, and county levels. Along with other development issues, we should focus on new infrastructure, digital industrialization, industrial digitalization, data governance, data factor market cultivation, and digital trade. In line with significant national regional initiatives, the second phase entails assisting in the establishment of a regional organization dedicated to the integrated development promotion of the digital economy. This group will be based on the principles of openness, sharing, co-construction, and win-win. The development of "three connections and one cluster" will be fueled by the creation and growth of "digital infrastructure access," "data factor market access," "smart city service access," and digital industry clusters. The digital economy will also be used to facilitate cross-regional, cross-field, and cross-subject resource optimization allocation and factor integration innovation, resulting in the creation of a digital economy regional development highland. Third, use regional advantages to promote the coordinated construction of industrial chains and efficient supply chain configuration; avoid resource waste and duplication of investment caused by the construction of entire industrial chains in different locations; and concentrate on digital industries related to national security and development lifeline, such as high-end chips, operating systems, high-end CNC equipment, etc.

b.Keep encouraging innovation in policy and service approaches for the digital economy. First, better understand the needs of businesses in terms of government procurement services, market expansion, upstream and downstream collaboration and matching, training and consulting, and taking the initiative to implement precise policies and improve service efficiency. Next, expand the application of digital technologies such as big data and artificial intelligence in problem analysis, policy design, implementation, and government services. Second, create avenues for businesses and individuals to engage in the policy-making process, raise the standard of decision-making, and enhance the ex-ante and ex-post evaluation systems of significant policies and special funds. Third, assist regions and research institutions that are capable of studying and publishing industry indices relevant to the digital economy. These indexes can offer direction for developing firm strategies and expanding markets.

c.Construct a multifaceted, equitable, transparent, and effective collaborative supervision system. Establish distinct oversight and specific regulations for various categories of digital platforms, and first make clear the roles and rights of the state, businesses, and trade groups. Secondly, enhance the utilization of digital technologies like blockchain, big data, and artificial intelligence in platform governance and supervision, boost the effectiveness of supervision, and develop new models of supervision. Thirdly, adhere to the platform economy's development rules, make clear the duties and obligations of digital platforms, define the parameters of Internet service model supervision, improve business format governance practices, and boost market innovation capabilities.

d.Encourage the coordinated development of digital infrastructure and put distinct policies into place. Assist local governments in creating coordinated investment strategies, on the one hand. To prevent risks like investment bubbles and overcapacity, it is important to establish clear investment priorities and the order in which the various fields involved in "digital infrastructure" should be prioritized. Detailed investment plans and amounts should also be developed, and "one game" construction should be achieved. Conversely, use distinct development approaches to various "digital infrastructure" domains. When it comes to "digital infrastructure," for instance, the government should lead non-exclusive and non-competitive

sectors like 5G base stations, rail transit, energy Internet, etc.; however, when it comes to high-tech and specialized fields like artificial intelligence, industrial Internet, new energy charging piles, and some big data centers, market players' enthusiasm should be fully stimulated and "professional teams" should be allowed to do "professional things," with the government focusing on setting guidelines and creating an environment.

4.2 Policy suggestions on promoting the level of industrial structure

a.bolster policy directives. To direct and encourage the modernization of the industrial structure, the government should develop and implement several focused industrial policies. To start with, it ought to boost funding for important rising sectors. Businesses can be encouraged to invest more and innovate in strategically important developing industries by raising capital investment and streamlining tax laws. Second, to encourage businesses to innovate and undergo technological change, the government can implement policies for upgrading and industrial transformation of existing industries. The government should also take action to raise funding for scientific and technical innovation in universities and scientific research facilities as well as to raise the standard and efficiency of this kind of innovation.

b.Encourage technological innovation. Technological innovation is one of the driving elements behind the need to modernize the industrial structure. The government should increase its investment in technical R&D and strengthen partnerships between enterprises and scientific and technology innovation institutes. In addition, the government ought to establish and improve intellectual property protection mechanisms, support the protection of intellectual property rights, and aggressively promote innovation in the business sector. It should also assist talent introduction and training in order to foster technological innovation with talent.

c.bolster cooperation between research, academia, and industry. Cooperation between industry, academia, and research is vital to improving the modernization of the industrial system. The government should support industry-university collaboration in research more vigorously and encourage companies to establish long-term cooperative partnerships with academic institutions and scientific research groups. Through cooperative research and technology transfer, scientific research discoveries can be transformed and applied. The government can also put in place a system of prizes and incentives to further promote the expansion of industry-university-research cooperation.

d.amplify the support that fiscal and tax policy offers. An essential toolkit for managing the expansion of the industrial sector is fiscal and tax policy. The government should create and put into effect suitable fiscal and taxation policies based on the specifications and characteristics of different industrial development stages in order to promote the upgrading of the industrial structure. To encourage corporations to invest more in strategically expanding industries, for example, financial aid programs and tax benefits may be offered. Lower taxation policies can alleviate pressure on companies in traditional industries to promote modernization and industrial change. Moreover, the optimization and rectification of the industrial structure can be further directed by changing the percentage and direction of capital investment.

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