

Development of China's digital economy: path, advantages and problems

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Abstract

Purpose – China has fully capitalized on the opportunities presented by the latest wave of technological revolution and industrial transformation, paving the way for a path with Chinese characteristics in the development of the digital economy. This paper analyzes the development of China's digital economy, outlining its path, advantages and challenges. It aims to provide insights into how China capitalized on technological and industrial transformation to foster a digital economy with distinct Chinese characteristics.

Design/methodology/approach – This paper adopts a descriptive analytical approach to outline the evolution of China's digital economy through various stages of development. It highlights the pivotal role of market demand, the intricate government-market relations and technological advancements in shaping this evolution. The approach also identifies key factors that have contributed significantly to China's success in digital economy development.

Findings – The key findings reveal that China's digital economy has grown rapidly, driven by market demand, technological innovation and government support. The “Chinese path” prioritizes consumer internet, leverages scale advantages and emphasizes data-driven development. However, challenges exist in balancing governance systems, endogenous growth and external environments.

Originality/value – This paper offers original insights into the unique development path of China's digital economy, highlighting its advantages and challenges. It provides valuable insights for other countries seeking to foster their own digital economies, especially in managing government-market relations and leveraging domestic market demand.

Keywords Digital economy, Correlation of advantages, Endowment advantage, Latecomer advantage, Endogenous driving force

Paper type Research paper



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With the deep integration of digital technologies such as the Internet, big data, and artificial intelligence with the economy and society, the digital economy has become a crucial engine for stabilizing growth and promoting transformation globally. It becomes a key force in reorganizing global factor resources, reshaping the global economic structure, and changing the global competitive landscape. Currently, global competition in the field of the digital economy is intensifying, leading to the acceleration of strategic policies and implementations for digital economic development in various countries. On April 20, 1994, China achieved a fully functional connection to the Internet and launched its first set of web pages on May 15, marking its integration into the wave of global digital economy development. Since then, China's digital economy has transformed from imitative innovation to independent innovation, with certain application sectors transitioning from catching up to leading the way, embarking on a path of digital economic development with Chinese characteristics. According to estimates from the China Academy of Information and Communications Technology, from 2012 to 2022, the scale of China's digital economy has grown from 11 trillion yuan to over 50.2 trillion yuan, accounting for a share of GDP that has increased from 21.6% to 41.5%. In 2022, the penetration rates of the digital economy in the three major industries (manufacturing, services, and agriculture) were 44.7%, 24.0%, and 10.5% respectively, providing significant impetus for high-quality economic and social development ([China Academy of Information and Communications Technology, 2023](#)). Since 2013, global digital economy development has shown an overall upward trend, with China, the United States, and Europe forming a three-tier structure in the global digital economy. China's digital economy has consistently maintained the second-largest scale globally. The rapid development of China's digital economy and its rise in international competition have accelerated the shift towards a new stage characterized by deepening application, standardized development, and inclusive sharing. It is necessary for us to summarize experiences, clarify theories, grasp the trends and laws of digital economic development, and provide policy recommendations to strengthen, optimize, and expand China's digital economy, thereby harnessing its positive role in promoting high-quality economic development.

1. Literature review

The research related to the development of China's digital economy focuses on refining the development characteristics. It includes two aspects: one is to discuss the specific role of digital economy in the special environment of China's economic development; The second is to compare the advantages and disadvantages of China's digital economy development from a national perspective.

The former is a study of China's own economic development. From the perspective of research, it is consistent with China's relevant policies and development strategies. For example, some studies focus on the relationship between digital economy and high-quality development, pointing out that at the micro level, digital economy has realized the combination of scope economy and scale economy ([Ren, 2020](#)) which can better match supply and demand and form a more perfect price mechanism and equilibrium level ([Jing and Sun, 2019](#)). On this basis, technologies such as the Internet, big data and artificial intelligence will better realize the value of information and achieve high-quality economic development ([He, 2020](#)). Some studies also discuss the enabling role of the digital economy on traditional industries, which focuses on a specific industry. For example, ([Jiao, 2020](#)) believes that the impact of the digital economy on the manufacturing industry gradually moves from value reshaping to value creation. Similarly, ([Xue et al., 2022](#)) point out that "Internet +" manufacturing industry, New innovative mechanisms will emerge.

The latter is a comparative study under the open economic environment. On the one hand, scholars have pointed out that China has insufficient comparative advantages in the

development of the global digital economy. For example, China has advantages in the digital market due to the huge scale of Internet users, but there is still room for improvement in digital technology and digital governance (Wang *et al.*, 2021); In addition, China is also faced with new problems such as transition to service and reduction of labor dividend (Wang, 2018). On the other hand, the study shows the great power game scenario in the field of digital economy. Many scholars have compared the differences in data application and platform governance of several important digital economies in the world, pointing out that under the premise of believing in liberalism, the United States often adopts relatively loose policy design in data governance and platform governance (Li and He, 2005); China, on the other hand, creates a relatively strict policy environment for domestic security reasons; The policy attitude of the European Union falls somewhere in the middle (Wang *et al.*, 2021).

To sum up, the existing research has not conducted a preliminary exploration of the typical facts and development laws of China's digital economy development. However, in the context of the vigorous development of the global digital economy, it seems that there is a lack of exploration from the perspective of open economy on how China can achieve catch-up and transcendence in the field of digital economy, and the above proposition is precisely related to whether there is a unique path for developing countries. In view of this, this paper first combs the typical facts of the development of China's digital economy, and then theoretically refines the development model of China's digital economy.

2. The development process and experiential characteristics of China's digital economy

During the early stages of the digital economy, China closely followed the global trend and embraced the wave of digital economic development. From 2000 to 2002, the bursting of the dot-com bubble in the United States dealt a severe blow to the internet industry in the United States and Europe. Meanwhile, internet companies in China accelerated their rise, with Tencent (founded in November 1998), Alibaba (founded in September 1999), and Baidu (founded in January 2000) emerging. Sina (founded in April 2000), Sohu (founded in July 2000), and NetEase (founded in July 2000) went public in the United States. Through less than 2 decades of effort, China has successfully caught up with and surpassed some advanced countries in the field of the digital economy, becoming a leading country with the second-largest digital economy in the world. It is important for us to summarize the development process of China's digital economy, identify its typical characteristics, and provide theoretical explanations.

2.1 *Typical characteristics of China's digital economy development*

Many economic studies have continuously explored and researched how to narrow the gap with developed countries in terms of economic development and even surpass them. From the perspective of technological imitation and economic catch-up, the development of China's digital economy exhibits the following four major characteristics:

- (1) China fully seizes the new opportunities brought by the new round of technological revolution and industrial transformation. China is almost on the same starting line as developed countries in the development of the digital economy. China has a certain foundation in digital technology. When comparing the global development of the digital economy, China and the United States do not show significant lag in the time and business models of commercializing the internet. For example, in 1990, the United States witnessed the birth of the first commercial dial-up internet service provider, The World, and shortly after, China saw the emergence of a batch of internet enterprises such as Sitong Lefang (1993) and Yinghaiwei (1995). Since the 18th

National Congress of the Communist Party of China, the central government has made three basic judgments on the development of the digital economy: First, the digital economy is the main form of the future economy, and developing the digital economy is a strategic choice to seize the new opportunities of the new round of technological revolution and industrial transformation. The healthy development of the digital economy is conducive to promoting the construction of a new development pattern, building a modern economic system, and enhancing national competitive advantages. Second, the digital economy is becoming a key force in reorganizing global factor resources, reshaping the global economic structure, and changing the global competitive landscape. We must seize the initiative and occupy the commanding heights of future development. Third, from the perspective of coordinating the overall strategy of the great rejuvenation of the Chinese nation and the unprecedented global changes in a century, we should coordinate the domestic and international situations, and develop and secure two major matters, constantly strengthen, optimize, and expand China's digital economy (Xi, 2022). Developing the digital economy aligns with the development needs of China's economy and society and is a major strategic task of the country. As a latecomer, China can better enjoy the dividends of technology in both industrial digitalization and digital industrialization, ultimately achieving catch-up.

- (2) China's digital economy has followed a path from imitation and local transformation to independent innovation. During the early stage of global internet commercialization, although China lagged behind the West in terms of accumulated digital technology, a group of Chinese entrepreneurs quickly seized market opportunities. Internet companies emerged rapidly in areas such as instant messaging, search engines, online shopping, and social networks, as shown in Table 1. In several typical sectors of the digital economy, Chinese internet companies were born slightly later than those in the United States, and their main business models were based on imitation and learning from foreign experiences. At the same time, during the process of imitation, Chinese internet companies underwent localization transformations. For example, in the field of e-commerce, Alibaba announced the launch of Taobao, a C2C (consumer-to-consumer) online platform, in 2003. In 2004, Alibaba innovatively developed a third-party payment model and introduced an online escrow transaction solution to address trust issues in online retail. Following the introduction of Alipay by Alibaba, a series of similar payment platforms emerged in China, promoting the C2C and B2C (business-to-consumer) business models to become mainstream in the Chinese e-commerce market. In 2012, China's online retail penetration rate surpassed that of the United States, and in 2013,

Area	Chinese enterprises (birthtime/year)	US enterprises (birthtime/year)
Instant messaging	Tencent OICQ(1999)	MSN(1995)
Search engine	Baidu(2000)	Google(1998)
Online shopping(B2C)	JD(1998)	Amazon(1994)
Online shopping(C2C)	Taobao(2003)	eBay(1995)
Online payment	Alipay(2004)	Paypal(1998)
Online social networking	Sina(2009)	Titter(2006)
Shared mobility	Didi Dache(2012)	Uber(2009)

Table 1.
The birth time of internet enterprises in similar fields in China and the United States

Note(s): OICQ was the predecessor of QQ. After integrating its operations in 2015, Didi Dache changed its name to Didi Chuxing.

Source(s): Compiled by the author.

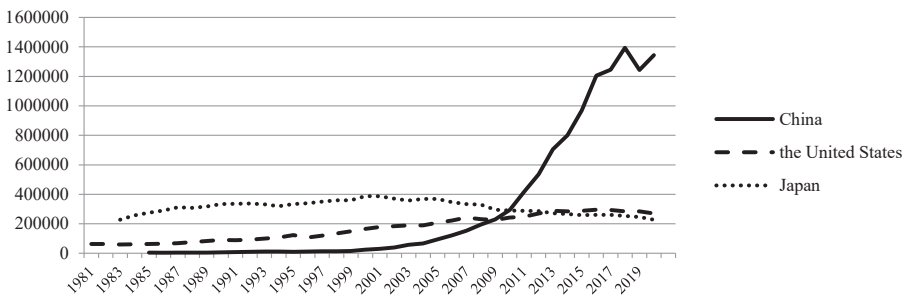
China's online retail transaction volume exceeded 1.85 trillion yuan, making it the world's largest online retail market. Internet retail, instant messaging, and social networking companies have become bridges connecting consumers with the digital economy, nurturing a vast demand market in China.

- (3) China prioritizes the development of the consumer internet in its digital economy, forming a “market-driven” digital development model. Unlike the “technology-driven” digital economy development approach of early adopter countries, China, due to its technological gap in core areas, demonstrates a greater reliance on existing industrial foundations or market demands to drive digital economy growth. This is manifested in two aspects. First, China possesses a vast market advantage and has immense prospects for the digital economy in the consumer sector. According to data from the China Internet Network Information Center (CNNIC), by the end of June 2008, the number of Chinese internet users reached 253 million, surpassing the United States for the first time and becoming the world's largest. China's large market, high consumer acceptance, relatively relaxed regulatory environment, abundant human capital, and continuous improvement in supporting systems such as logistics and payment systems have created favorable conditions for the development of the consumer internet in China, leading to the flourishing state of the digital economy in the consumer sector. Prioritizing the development of the consumer internet has become the most prominent aspect of China's digital economy development (Ouyang, 2022). Second, China has established a comprehensive industrial system and a complete industrial chain foundation, enabling the construction of an advanced and comprehensive digital industry system. It has the capability to provide all-round digital economy products, services, and solutions for the digital transformation of traditional industries. China is the only country in the world that covers all industrial categories classified by the United Nations. This provides a foundation for the integration of digital technology with traditional industries. China has achieved comprehensive leadership in 5G technology, industry, networks, and applications, and has made significant progress in integrated circuits, artificial intelligence, high-performance computing, electronic design automation (EDA), databases, operating systems, and other fields. Since 2014, China's digital technology applications have gradually expanded from the consumer sector to the industrial sector, permeating various stages of enterprise research and development, production, sales, and services, promoting the digitization, networking, and intelligence of industries. From the consumer internet to the industrial internet, China's digital economy covers all domains of the digital economy and has successfully established a convergence path for the integrated development of digital economies domestically and internationally.
- (4) The development of China's digital economy has evolved from business model innovation to digital technology innovation, exploring the path of leveraging scale advantages to drive innovation. With the advancement of the digital economy, diversified demands have been further stimulated, which in turn have driven the application and even the research and development process of emerging technologies. This has resulted in a coexistence of business model innovation and technological innovation (Jing, n.d.). Firstly, Chinese digital enterprises have combined new technologies with traditional businesses to achieve business model innovation. For example, the integration of artificial intelligence, big data technology, and information recommendation services has led to the emergence of intelligent recommendation services. These services have been widely applied in various fields such as online shopping, short videos, and news portals, fostering new business

models such as live-streaming e-commerce, short-video e-commerce, content e-commerce, and instant retail. Secondly, Chinese digital enterprises' business models have successfully entered the international market, transitioning from imitators to leaders. For instance, TikTok, the international version of the short video platform developed by the Bytedance group, has become a new platform for American users to express themselves and meet new friends. Alibaba's "overseas warehouse" model has also been widely applied in the development of cross-border e-commerce in Russia. Thirdly, Chinese digital enterprises have gradually stepped into the forefront of technological innovation. In the increasingly complex international environment, China's "Born Digital" enterprises, relying on strong economic and social demands and the integration of technology and innovation, are transitioning from being driven by business models and products to being driven by technological innovation. China's capabilities and momentum in technological innovation continue to strengthen. World Bank data shows that China's patent applications and the number of scientific journal articles began to grow rapidly around 2000. In 2011, China became the world's top applicant for patents, and in 2016, the number of scientific journal articles exceeded that of the United States (see [Figures 1 and 2](#)). This coincided with the period of rapid development in China's digital economy.

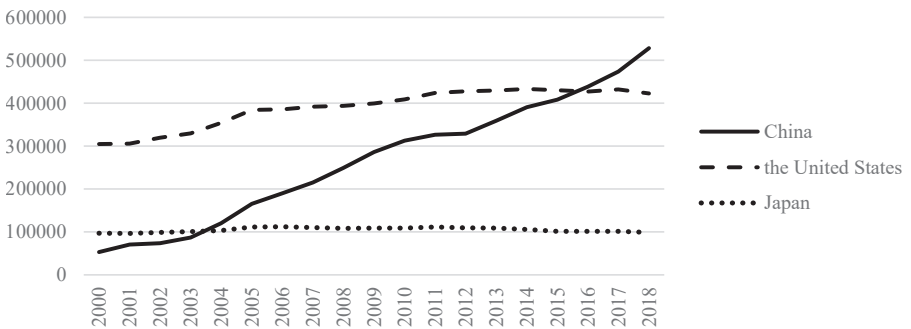
- (5) Building a data-driven digital economy and exploring the path of innovation and development in the digital economy. China attaches great importance to the

Figure 1.
Number of patent applications in China, the United States and Japan



Source(s): World Bank open database, same below

Figure 2.
Number of published articles in scientific journals in China, the United States and Japan



Source(s): World Bank open database, same below

development and utilization of information resources for promoting economic and social development. As early as 2004, the Opinions of the General Office of the Communist Party of China Central Committee and the General Office of the State Council on Strengthening the Development and Utilization of Information Resources pointed out that as a factor of production, intangible asset, and social wealth, information resources are equally important as energy and material resources and have an irreplaceable position in the structure of economic and social resources. From the 2016 Go match between humans and AI to the emergence of artificial intelligence language models in 2022, the importance of data resources has been recognized globally. Since the beginning of this century, China has continuously deepened the application of information resources. In 2017, it proposed that big data represents a new stage of informatization development and advocated the construction of a data-driven digital economy. This is a significant theoretical innovation and a summary of practical experiences. On one hand, the Party and the government have implemented a national big data strategy to accelerate the construction of a digital China. The Fourth Plenary Session of the 19th Central Committee of the Communist Party of China, as outlined in its Decision, added data as a production factor for the first time. The Party and the government have issued multiple policies to design a top-level framework that regards data as a key element and fully unleashes the value of data elements. In recent years, various regions have actively carried out practices such as the open, shared, exchanged, and traded use of data elements, accelerating the cultivation of data element markets, and promoting data elements to become the core engine driving the development of the digital economy. On the other hand, sectors such as government, defense, telecommunications, finance, transportation, healthcare, and manufacturing have explored ways to realize the value of data elements in practice. Firstly, governments and enterprises achieve effective operation and integration of data in information systems through business digitization, improving internal management efficiency. Secondly, by processing, analyzing, and modeling data, data elements synergize with other elements, achieving multiplier effects, and enhancing the level of precise supply-demand matching and intelligent decision-making, thereby promoting the transformation and upgrading of traditional industries. Thirdly, high-quality data from different sources converge and integrate in new business requirements and scenarios, giving rise to new industries, new formats, and new models driven by digital technologies such as artificial intelligence, big data, and cloud computing.

- (6) Local governments have initiated digital economy championships to explore distinctive paths for digital economic development that align with local characteristics. Developing the digital economy is not only an important measure for promoting the transformation of new and old driving forces and creating high-quality development hubs in various regions but also a crucial means to accelerate the market-oriented allocation of factor resources and construct a modern economic system that fosters new competitive advantages. According to the central government's deployment, local governments have localized and decomposed the national strategic goals for the digital economy based on regional industrial foundations, resource endowments, and locational characteristics. They have formulated specialized plans and implementation schemes for digital economic development. The interregional competition in the digital economy has not only fostered a development trend of competition-driven growth, but has also explored distinctive paths for digital economic development that align with local characteristics (Qi and Zhang, 2023). In December 2020, the China Regional and

Urban Digital Economy Development Report (2020) published by institutions such as the China Academy of Information and Communications Technology summarized six types of development models for the Chinese digital economy: comprehensive economic strength-driven, industry cluster-driven, digital policy, and environment-driven, integrated application-driven, innovation factor-driven, and market demand-driven. China has continuously accumulated experiences in the development of the digital economy.

2.2 China's experience in the development of the digital economy

Since its full-scale access to the Internet in 1994, China's digital economy has developed for nearly thirty years, making it a highly regarded Internet powerhouse and ranking second globally in terms of the total size of its digital economy. China has embarked on a distinctive path of development in the digital economy, contributing to the global advancement of the digital economy and creating its own unique experience.

- (1) **Optimizing Policy System and Proactively Building Digital Infrastructure.** Since the 18th National Congress of the Communist Party of China, especially after 2015, the Party and the state have established a policy support system that encompasses top-level design, strategic deployment, and specific measures. A series of policy documents have been issued, including the Guiding Opinions on Actively Promoting the "Internet Plus" Action, Outline of the National Cyberpower Development Strategy, Outline of the Development Strategy for the Digital Economy, and the 14th Five-Year Plan for the Development of the Digital Economy, among others. These policies have elevated the digital economy to the level of a national strategy. The Party and the government respect the laws governing Internet development and leverage the advantages of the socialist system, the innovative national governance system, and the immense scale of the domestic market. They have proactively advanced infrastructure construction and have successfully built the world's largest and most technologically advanced network infrastructure. As of the end of 2022, China has constructed and put into operation 2.31 million 5G base stations, and its gigabit broadband network has the capacity to cover over 500 million households. China's leapfrogging development in the digital economy can be attributed to the proactive approach taken by the government in the field of digital infrastructure over the years. The 14th Five-Year Plan for the Development of the Digital Economy further provides a comprehensive deployment for the development of China's digital economy in eight aspects, including optimizing and upgrading digital infrastructure, fully leveraging the role of data elements, and vigorously promoting the digital transformation of industries. It sets targets for key indicators such as the share of core digital industries' value-added in GDP, the number of active IPv6 users, and the scale of e-commerce transactions.
- (2) **Promoting Deep Integration of Digital Technologies and the Real Economy.** Positioning industrial digitalization as the primary driving force for the development of the digital economy and promoting the deep integration of digital technologies and the real economy are important experiences that have enabled China to achieve rapid growth in the scale of its digital economy. In the early stages of China's digital economy development, lacking technological advantages, the country leveraged its immense market advantage to expand the application space for digital technologies. By driving the development of the digital economy through demand and expanding the application of digital economy in various sectors such as agriculture, industry, and services, China achieved penetration and application in

these fields. Practice has shown that the integration of digital technologies has led to improved productivity and changes in production modes, serving as an important driving force for industrial transformation and upgrading. In recent years, Shenzhen has made efforts to promote the deep integration of advanced information technologies such as the Internet Plus, big data, and cloud computing with its own digital hardware industry advantages. Industries such as financial cloud service platforms, the Internet of Things (IoT), and intelligent manufacturing have developed rapidly. Industrial Internet applications represented by companies like DJI and Huaxing Optoelectronics have become one of their most significant advantages. In the 14th Five-Year Plan and the Vision 2035 outline, China has outlined ten major application scenarios for the digital economy, including intelligent transportation, smart energy, intelligent manufacturing, smart agriculture and water conservancy, smart education, smart healthcare, smart tourism, smart communities, smart homes, and smart governance. The comprehensive deployment of these application scenarios reflects China's emphasis on promoting the deep integration of digital technologies with various sectors of the real economy, creating new space for digital economy development.

- (3) Innovation-driven is the intrinsic force behind the rapid development of China's digital economy. Innovation serves as the gene and primary driving force for digital economy development, with business model innovation and technological innovation as its two core pillars. China consistently prioritizes innovation, strengthens the research and development of core technologies, and encourages business model innovation, providing strategic support for the high-quality development of the digital economy. On one hand, China focuses on the development of new-generation information technologies such as big data, artificial intelligence, blockchain, and quantum science. It enhances research and development efforts in core technologies of the digital economy, aiming to master the initiative in digital economy development. Significant scientific and technological achievements have been made in areas such as 5G, quantum information, high-end chips, high-performance computers, operating systems, industrial internet, and intelligent manufacturing. On the other hand, China encourages and supports the healthy development of new industries, new formats, and new models such as e-commerce, live streaming e-commerce, instant retail, intelligent manufacturing, industrial internet, social media, and financial technology. China's online retail transaction volume and mobile payment transaction scale rank first globally. The digital economy has become the most innovative, fastest growing, and widely influential sector in China's economic development.
- (4) Optimizing the business environment to facilitate the pivotal role of platform enterprises. Upholding the combination of proactive government intervention and an effective market, and fully leveraging the decisive role of the market in resource allocation, China aims to create a market environment that encourages innovation, fairness, inclusiveness, and prudence to ensure the rapid development of the digital economy. The Chinese government has made continuous efforts in areas such as the proactive construction of digital infrastructure, ensuring cybersecurity, and improving governance systems. By utilizing digital technology and platforms, China has effectively reduced various costs associated with systems, transactions, funds, and management. The cultivation of an effective market has nurtured a group of internationally influential and innovative digital enterprises, which serve as the driving force behind digital economic development. Firstly, domestic internet

entrepreneurs have successfully explored business models that align with China's synchronized Four Modernizations, enabling rapid implementation and continuous iteration of new digital economic products or models. Secondly, large internet platforms have grounded themselves in the real economy and built comprehensive digital ecosystems that cover the entire industrial chain, thereby transforming traditional enterprises into important carriers and key drivers of deep integration between the digital and real economies, promoting the digital transformation of upstream and downstream enterprises in the supply chain. Thirdly, China has fostered the growth and strength of leading enterprises in the digital economy while also supporting the vitality and development of small and medium-sized enterprises (SMEs) in this sector. This has resulted in a development pattern where leading companies such as Huawei, Tencent, Alibaba, Baidu, [JD.com](#), and Meituan, coexist with numerous SMEs. The market dynamics of the digital economy continue to strengthen as a result.

- (5) Steadily expanding international cooperation in the digital economy to promote the global sharing of digital dividends. The digital economy has become a new area and a new track for international cooperation, and countries with relatively lagging digital economic development are actively seeking international cooperation to enhance their own digital economy. China's development of the digital economy has always emphasized the utilization of both domestic and international markets and resources to seek cooperative development. In recent years, China has actively established open platforms such as the World Internet Conference, World Digital Economy Forum, and Global Digital Economy Conference, actively participated in international negotiations on digital economy issues, and promoted the establishment of frameworks such as the BRICS Digital Economy Partnership and the China-Central Asia Five Countries Data Security Cooperation Initiative, as well as the application to join the Digital Economy Partnership Agreement. China has actively promoted the building of a community with a shared future in cyberspace, conducted cooperation with developing countries along the Belt and Road in areas such as digital infrastructure, cross-border e-commerce, and digital services trade. China has also engaged in cooperation with leading countries in digital economic development in specific areas such as digital technology and data elements. China has signed e-commerce cooperation memoranda of understanding and established bilateral e-commerce cooperation mechanisms with 28 countries. China is actively promoting international cooperation in the digital economy, committed to building an open, fair, and non-discriminatory digital business environment. China contributes its own solutions and wisdom to the global development of the digital economy, while also creating new opportunities for the development of its own digital economy.

3. The intrinsic logic of China's digital economy development

China's development of the digital economy emphasizes innovation-driven and integrated applications, with a priority on developing the consumer internet, thereby forming a distinct development path. China's digital economy has transitioned from following and keeping pace with others to taking the lead, yet there is limited literature analyzing the underlying mechanisms behind China's rapid development and catching up in the digital economy. The theoretical explanation of the "Chinese path" in the digital economy requires addressing two questions: firstly, where does the sustained driving force for China's high-speed growth in the digital economy come from? Secondly, how is the catch-up with other economies achieved? The former involves summarizing the mechanisms and principles of the static

dimension of the digital economy's development in China, while the latter entails summarizing the theoretical logic of China's dynamic development in the digital economy. The combination of these two aspects leads to the convergence of production capacity towards the production frontier, which in turn drives technological progress and creates a new production frontier. This initiates a new cycle of factor accumulation and efficiency improvement. This represents the fundamental intrinsic logic of China's digital economy development path. The combination of an effective market and an enabling government facilitates the dynamic connection between China's inherent advantages and latecomer advantages in the development of the digital economy. The emergence of a new production frontier, coupled with the continuous approximation of production capacity to this frontier, enables China's digital economy to maintain long-term high-speed growth, ultimately achieving catch-up development.

3.1 The source of motivation in China's digital economy: endowment advantages

The endowment advantage of China's digital economy lies in its vast consumer market. China's digital economy places priority on the consumer sector, following a development path from "2C" (consumer-to-consumer) to 2B (business-to-business). This trajectory indicates a clear target domain of the market-driven model at the initial stage of China's digital economy development, which aligns with the national conditions and endowment advantages of China. Thus, China's digital economy development has a relatively unique source of motivation. In theory, the main driving force behind economic development propelled by digital technology comes from cost reduction on the supply side. However, the core motivation behind China's digital economy development clearly stems from the market potential on the demand side. This raises the question: How does the market function in the demand-driven Chinese path of the digital economy? We can explore this question from both static and dynamic perspectives.

At the static level, there is a harmonious relationship between digital technology and market development. Digital technology and platforms have played a positive role in increasing the consumer base, innovating consumption patterns, expanding consumption dimensions, and extending consumption space. On one hand, digital technology has significantly expanded the domestic market by enabling the connectivity between supply and demand through digital economy-related technologies. This breakthrough in time and geographic limitations has made remote non-contact transactions possible. Digital platforms continuously create new consumer scenarios, cultivate consumer habits, and lower the barriers for consumers to utilize digital technology, which helps to better tap into the enormous potential of the Chinese market (Liu and Xia, 2021). Additionally, within digital platforms, information friction is reduced, and there is higher coordination along the industrial chain. This enables more efficient global resource reconfiguration, expanding the market not only through network effects but also by effectively integrating consumer internet and industrial internet, forming a circular process encompassing production, circulation, and consumption. On the other hand, the commercialization of digital technology meets the diverse demands of China's vast domestic market. Firstly, online retailing is coupled with the long-tail effect. Content e-commerce, live-streaming e-commerce, and instant retail constantly innovate online retail formats. Companies utilize internet platforms to deepen user participation in product design, customized application scenarios, content provision, and more, meeting the increasingly personalized and diversified needs of consumers. By leveraging the long-tail effect, the market potential is further developed. Secondly, the application of digital technology has created a more precise matching mechanism. With the support of technologies such as big data and intelligent recommendation, digital platforms keenly and accurately grasp various characteristics of

segmented demands, transforming demand incentives from quantitative to qualitative. The upgrade of demand brings about a broader transaction space and more vibrant market activities.

At the dynamic level, the development of China's digital economy is driven by significant incentives for innovation. Currently, certain traditional sectors of the digital economy, such as e-commerce and portal websites, have experienced a decline in transaction volume or user growth rates. For instance, the growth rate of China's e-commerce transaction volume has gradually decreased from 57.5% in 2014 to 4.5% in 2020. To unleash the potential of the digital economy in generating consumption, it is essential to foster new driving forces for its development and enhance innovation capabilities. Firstly, intensified competition in the industry, driven by the traffic-oriented mindset, compels enterprises to rely on innovation for survival. As a result, major digital companies have started to emphasize technological research and development (R&D) and shift from business model innovation to technological innovation. For example, prominent players like BAT have ventured into emerging technologies such as artificial intelligence, blockchain, and virtual reality. They have also created application scenarios to facilitate the deep integration of digital technology and the real economy, enabling the provision of higher-quality services at lower costs. Secondly, breakthroughs in technology have given rise to new business forms and models within the digital economy, nurturing emerging areas of information consumption. For instance, applications based on intelligent recommendation services have propelled the rise of platform enterprises like Douyin, Kuaishou, and Toutiao. The emergence of new technologies and their application in turn stimulate more vigorous demand, creating a more dynamic market environment. Thirdly, innovation and application of digital technologies enhance the capacity for consumption creation, thereby facilitating rapid growth for businesses. New technologies such as internet-based browsers, search engines, artificial intelligence, and big data have not only reduced costs in search, replication, transportation, tracking, and verification (Goldfarb and Tucker, 2019), but also provided technical support for enterprises to engage in flexible production based on personalized and diversified demands, adopt commercial models like customer-to-manufacturer (C2M), and tap into the consumption potential of emerging markets. Consequently, in the context of the digital economy, enterprises have gained greater space for survival and sources of profit on the demand side, and those that identify the "window of opportunity" will experience rapid growth.

3.2 The mechanism of catching up in the context of China's digital economy: latecomer advantage

While endowment advantages explain the driving forces behind the rapid development of China's digital economy, they fail to fully elucidate the catching-up phenomenon achieved by China in the field of digital economy from the perspective of an open economy. Existing literature has provided explanations for the catch-up paths of latecomer countries in the digital economy, considering factors such as technological progress, market systems, government intervention, international competition, and even cultural institutions. These explanations have formed some normative theoretical paradigms, such as the "Forging Ahead" theory and the "Leapfrogging" theory. Drawing on these theoretical perspectives and returning to Robert Merton Solow's fundamental understanding of growth [1], we can discuss how China has achieved catch-up in the field of the digital economy.

Firstly, China has been continuously approaching the level of developed countries in the field of the digital economy through factor accumulation. If we consider the existence of a frontier production function, which represents a set of input factors that can generate the maximum output, it is evident that China, in the early stages of digital economy development,

did not operate at this production frontier but consistently moved closer to it. This process is primarily achieved through factor accumulation. With the development of the digital economy, the construction of supporting infrastructure, which is a form of endogenous investment (Li and Wang, 2021) driven by the vast demand market, has activated China's abundant factor accumulation. This is an important pathway for factor accumulation. Since 2012, the scale and level of China's digital infrastructure have significantly improved. By the end of 2022, there were 2.312 million 5G base stations in operation, with 561 million 5G users, both accounting for over 60% of the global total. The number of mobile IoT terminal users reached 1.845 billion households, making China the first major economy to achieve things surpassing humans. Industrial Internet coverage has exceeded 85% across major industrial sectors, and more than 5,000 kilometers of roads have been transformed into smart roads. (Cyberspace Administration of China, 2022) According to the dynamic transformation theory, reaching the production frontier leads to steady-state growth, while economies below the steady-state level exhibit faster growth rates. Although China initially lagged behind the United States, the birthplace of the digital economy, as well as developed economies like the United Kingdom, Germany, and Japan, due to insufficient technological readiness and imperfect market cultivation, the accumulation of factors driven by the super-large market and forward-looking infrastructure investment has laid the foundation for China's rapid growth in the digital economy.

Secondly, changes in the production function have enhanced China's production capacity in the digital economy. The economic growth achieved through factor accumulation faces a drawback: as factors approach the production frontier, the growth rate is bound to slow down, converging with other developed countries. However, in the digital economy domain, China has consistently maintained high-speed growth, and one possible reason is the emergence of new factors that have reshaped the production function, allowing China to approach the production frontier more rapidly. Specifically, the incorporation of data as a factor is likely to have an impact on the form of the production function. The scale of data in China continues to expand, and the integration and application of various storage, big data, and algorithm technologies enable the better realization of data value, making it a new key production factor. Data, along with traditional factors such as talent, capital, and technology, synergistically interact, leveraging their enabling and general-purpose characteristics. The data chain, which is based on the Internet, driven by big data, and powered by artificial intelligence, interconnects and links the industrial chain, integrates the data chain, connects the innovation chain, activates the funding chain, and cultivates the talent chain, thereby achieving data integration, business integration, and value integration. (Wang and Tong, 2020) For example, intelligent recommendation services rely on data accumulation and the application of technologies such as artificial intelligence. By utilizing data such as browsing history and order records and employing machine algorithms, intelligent recommendation services can more accurately match supply and demand. The intelligent recommendation has gradually become a technological foundation for new business models or a necessary requirement for updating traditional business models. It is widely used in fields such as e-commerce, short videos, and news portals. As a latecomer in the field of the digital economy, China has seized the key production factor of data, which serves as a link for innovation, activation of funding, cultivation of talent, promotion of industrial upgrading, and economic growth, in the global wave of the digital economy. This represents an innovative catching-up process.

Finally, technological innovation and integrated applications have helped China achieve a leap to the forefront of production in the digital economy. From the early dispute between the United Kingdom and the United States over network protocol standards to the current competition for dominance in fields such as 5G, artificial intelligence, and quantum computing, the global technological competition in the digital economy has remained at a

high level. On one hand, China currently possesses strong capabilities for digital technology innovation. For example, China has achieved comprehensive leadership in 5G technology, industry, networks, and applications. In 2022, China accounted for 37% of international patent applications related to the information sector under the PCT system. China's development index in artificial intelligence is second only to that of the United States, and it holds a leading position in quantum communication. From the perspective of technological innovation, developed countries may delay the development of new technologies due to high wage levels and vested interests, which can result in their technological positions being locked into existing paths. When major technological breakthroughs occur, developing countries are more likely to actively pursue research and development in new technologies with significant market potential, thereby achieving technological catch-up. For example, in recent years, China's digital enterprises have continuously strengthened their innovative development capabilities, with a total research and development investment of 338.4 billion yuan in 2022 among the top 100 internet companies by market value, representing a year-on-year growth of 9.1%. On the other hand, China is guided by the integration of digital technology with various fields and promotes cross-sectoral innovation among industry enterprises, platform enterprises, and digital technology service enterprises. Technological progress is the core driving force for industrial upgrading, and the key for latecomer countries to achieve economic catch-up lies in shifting towards high value-added economic activities. This implies that allocating production factors to sectors with high value-added will significantly increase economic output. In practice, industries such as artificial intelligence and biotechnology, which are considered to have high value-added, are products of technological progress. What is more important is that based on the continuous integration of 5G, industrial Internet, Internet of Things, cloud computing, and other digital technologies, China has gradually formed an innovative ecosystem of technology clusters - core technology research and development - integrated innovation application. When the integration and application of technologies in different levels and fields reach a sufficient scale, breadth, and depth, it will inevitably trigger technological leapfrogging and open up a situation of leapfrog development in digital industrialization and industry digitization collaboration. For example, instant retail, centered around real-time demand, local supply, and immediate fulfillment, utilizing a variety of digital technologies, has become a new frontier for retail mode innovation.

3.3 The advantageous association in the development of China's digital economy

The sustained and rapid development of China's digital economy is the result of the combined effects of endowment advantage and latecomer advantage, where the former contributes to the formation of growth momentum and the latter enables the process of catching up. However, relying solely on these "two advantages" does not fully explain China's catching up in the field of digital economy. Looking at the global landscape, there are other countries or economies within international organizations such as the G20, BRICS, and OECD that possess similar advantages. The difference lies in the fact that China's two advantages do not exist independently; instead, they are interrelated, finding an inherent connection between endowment advantage and latecomer advantage in the digital economy, which synergistically supports the development of China's digital economy. This article summarizes this connection as an advantageous association where the two advantages are mutually dependent in the long term. The key to establishing this association is that China has effectively managed the relationship between the government and the market in the digital economy domain, facilitating the formation of a logically closed loop involving factor accumulation, efficiency improvement, and technological innovation. As a result, China's exploration and determination at the forefront of production are more rational.

On the one hand, China's institutional design approach in the field of the digital economy helps to activate market vitality and fully leverage its endowment advantage. China's institutional design in the digital economy domain has consistently adopted a balance between flexibility and precision approach, creating a lenient market environment while cautiously handling emerging phenomena and making timely adjustments. Taking e-commerce as an example, during its early development stage, the government adopted a tolerant and flexible attitude towards emerging phenomena. From the establishment of the China Commodity Exchange and China Chemical Network in 1997 to the issuance of the first policy document specifically guiding the development of e-commerce, the Opinions of the State Council General Office on Accelerating the Development of E-commerce (Guo Ban Fa [2005] No. 2), there was a policy gap of nearly eight years. Moreover, the aforementioned document provided guidance to address issues such as the limited scope and low level of e-commerce applications in China. A decade later, in 2015, the Chinese government issued the second policy document on e-commerce, the Opinions of the State Council on vigorously developing e-commerce and accelerating the cultivation of new economic drivers (Guo Fa [2015] No. 24), aimed at eliminating institutional barriers that hindered the development of e-commerce and further harnessing its potential in cultivating new economic drivers, integrating traditional and emerging elements, and expanding towards the international stage. E-commerce is an integral part of China's digital economy, and the two national-level e-commerce policies reflect the government's development philosophy regarding the digital economy: respecting the laws of economic development, understanding the trends of emerging phenomena, refraining from intervening in technological and model innovations of enterprises, continuously adjusting policies, and systematically constructing an appropriate policy and institutional framework. The lenient policy environment has brought about a vibrant digital economy market, leading to rapid growth and expansion of China's digital economy, fully leveraging its endowment advantage.

On the other hand, the timely and moderate intervention by the government has overcome irrational factors in technological innovation and accelerated the catching-up process. The theory of latecomer advantage suggests that latecomer countries can benefit from imitating and learning from the technological frontier. However, countries at the technological frontier inevitably face the challenge of finding the correct production frontier. Deviations in technological paths can cause economies to miss the window of opportunity and eventually fall behind. The characteristics of government intervention in the digital economy field in China have to some extent avoided the aforementioned issues. First, the flexibility in the formulation of industrial policies can effectively respond to the uncertainty of technological changes. In many industries related to the digital economy in China, the formulation of competitive policies involves the collaboration of government, enterprises, and research institutions. The Chinese government has consistently pursued strategies that are conducive to building independent technological capabilities, facilitating rapid adjustments, and fostering both competition and cooperation among market players to achieve dynamic adaptation between industrial development and the external environment. Second, the government encourages and supports the integration of market and technology, reducing the costs associated with large-scale trial and error. Currently, China has the largest number of internet users in the world and has built the largest and most advanced network infrastructure globally. This has facilitated the innovation of industry formats and business models on digital platforms, leveraging the vast domestic market. Furthermore, the deep integration of technologies such as big data, cloud computing, and artificial intelligence with traditional enterprises enables better identification of user preferences, ensuring an understanding of demand from both the dimensions of scale and precision. In addition, the increasing application of digital governance at the government level not only promotes a higher level of balance but also reduces the blind spots in technological innovation during the demand-driven development process.

4. Internal dilemmas and external challenges faced by China's digital economy

The unique development path of China's digital economy can be characterized as a progressive self-growth under market-driven forces. If the domestic and international environment can support the smooth operation of China's digital economy, it has the potential to break free from technological constraints and transition from demand-driven growth to a dual-driving force of demand-supply, achieving both Smithian self-growth and leapfrog development. However, it is important to soberly acknowledge that the current overall development of China's digital economy still relies heavily on a massive consumer market. Excessive emphasis on the service sector may lead to Baumol's disease, where new goods supply and international trade competitiveness cannot be formed. Meanwhile, there are risks of breakpoints in the growth logic associated with technological innovation and the challenges posed by both internal institutional and market-related factors in the transition between old and new business models, as well as external pressures from developed countries' suppression and competition from other emerging economies.

4.1 "Policy failure" and excessive regulation: balancing innovation and risk considerations

Both technological drive and market traction play crucial roles in the development of the digital economy. Technological drive represents the supply-side force that propels the digital industry along the path of technological advancement, while market traction represents the demand-side force that directs technological progress towards economic and social development. The interaction of these two forces, akin to the concept of equilibrium in traditional economic theory, drives the rapid development of the digital economy in the right direction. However, it should be noted that China's digital economy has not achieved or followed a single equilibrium path.

On one hand, the foundation of technological drive is not strong in China's digital economy, which relies heavily on business models and lacks a distinct technological focus compared to developed countries. Recent technologies such as big data, artificial intelligence, and blockchain, are also predominantly imported. In China's development context, the emphasis is more on exploring the industrial applications of these technologies rather than developing new technologies or introducing new concepts.

On the other hand, in the absence of sufficient technological impetus to drive the development of China's digital economy, market demand has become the core driving force. However, the market itself is prone to certain blind spots, leading to a series of development challenges. These challenges include the contradiction between economies of scale and platform monopolies, as well as the conflict between precise matching in the big data environment and information security. These issues can result in market failures within the digital economy, leading to false and short-lived prosperity. Once the bubble behind this prosperity bursts, it not only affects the digital economy's role in driving economic growth but also weakens China's competitiveness in the global digital economy. Therefore, appropriate policy measures are needed to rectify these issues.

The current policy environment still falls short in comprehensively addressing the development of the digital economy based on the logic of the China path. In other words, there are still gaps or hidden risks in the policy system related to the digital economy, which may hinder China's momentum in catching up in the digital economy field. These issues mainly encompass three aspects.

First, institutional preferences to some extent disrupt the logical chain of China's digital economy development. The early institutional arrangements were aimed at protecting and nurturing domestic enterprises for rapid growth, resulting in relatively closed domestic markets. When companies surpass their initial accumulation, it can hinder their growth and constrain the sources of development momentum for the digital economy, making the self-

sustaining growth model potentially unsustainable. Second, there is a lack of precise incentives for technological innovation that connect iterative growth chains. China's innovation-driven development strategy has established a technological innovation system centered on enterprises, market-oriented approaches, and the integration of industry, academia, and research. However, in practical implementation, there are indications of quantity over quality (Chen *et al.*, 2020) and issues such as cheating-oriented innovation and strategic-oriented innovation, suggesting that the incentive policies for technological innovation in China need to be optimized. Third, a static governance system cannot fully cope with the complex changes brought by digital innovation. The current governance mindset and approaches follow the operating mechanism of phenomenon-matching, where specific response measures are chosen for certain phenomena. The rapid development of the digital economy generates systematic new phenomena that challenge the fundamental thinking and system of the governance framework. For example, dealing with the covert monopolistic behaviors of platform giants (such as predatory acquisitions, self-preference, and employee poaching), the discriminatory practices based on big data, and privacy protection, the effectiveness of the existing governance system, governance mechanisms, and regulatory measures has been unsatisfactory, calling for an improvement in government regulatory efficiency.

4.2 Challenges for market entities: the challenges of digital transformation

At the enterprise level, the main challenges lie in the conflicts between traditional industries and new models or formats, which are manifested in three aspects. Firstly, the integration and development of platform enterprises and traditional enterprises face difficulties. Platform enterprises are important organizational forms in the digital economy era. By building a two-sided market, platform enterprises can more accurately match supply and demand and facilitate the digital transformation of traditional enterprises through resource output, data support, operational guidance, and other means. However, the level of coordination between platform enterprises and traditional enterprises in their development is still relatively low. The contradiction between the profit-seeking nature of enterprises and the limited market capacity breaks the boundaries between online and offline, posing an obstacle to the development of the digital economy. Secondly, there exists a digital divide among individuals, enterprises, and industries in digital development. Due to factors such as enterprise size, enterprise type, and transformation foundation, there is evident imbalance in the digital transformation of enterprises. Small and medium-sized enterprises and traditional industrial enterprises lag behind in their digital transformation, and some of them face the dilemma of being unwilling, hesitant, or unable to transform digitally. Different industries, regions, and groups have different digital foundations, leading to significant development disparities and even a tendency to further widen the gap. Lastly, digitalization has a structural impact on employment. Digital technology reshapes the form of labor resource allocation, and repetitive and low-skilled jobs are easily replaced by automation technology. This will lead to technological unemployment and the phenomenon of hollowing out in the labor market, thereby exacerbating inequality issues (Goos and Manning, 2007) in developed economies to some extent.

4.3 External challenges: suppression from developed countries and competition from emerging countries

Currently, a competitive landscape in the digital economy has gradually formed with the United States and China at its core. Both countries demonstrate strong competitive advantages in terms of industry size, talent aggregation, technological innovation, and influence. China's R&D capabilities in multiple fields have reached a world-leading level, and fierce competition

between China and the United States in terms of technological innovation, business model innovation, and market expansion in the digital economy is inevitable. In recent years, the United States has rapidly escalated its strategies to suppress China's digital economy, attempting to create a globally dominant ecosystem for de-China the digital economy and establishing a whole-of-nation approach to shape a de-China camp in the digital economy (Jiang and He, 2022). It can be anticipated that China's digital economy will face greater and larger pressures from international competitors in the future, especially in terms of technological innovation. It is necessary to be prepared for significant tests that may involve turbulent and even stormy situations. From the perspective of great power competition, it is crucial for China to further enhance its independent innovation capability, expand international markets, deepen communication and exchanges among countries in the field of the digital economy, and establish a community of shared destiny in the digital economy. These efforts should be undertaken while maintaining a stable dual-core structure. Addressing these challenges will be critical for China in the next phase of its development.

5. Suggestions for promoting high-quality development of China's digital economy

The internal and external environment of China's digital economy development is also undergoing profound changes. If institutional preferences and insufficient incentives hinder the rapid growth of the digital economy, then the absence of governance systems restricts the standardized development of the digital economy. In summary, only by balancing the speed and norms in the development of the digital economy can it better cope with the contradictions and challenges brought by the new environment at home and abroad, and achieve transition and catch-up. In view of this, this paper puts forward three suggestions.

First of all, pay attention to the technical characteristics of the digital economy, and continuously tap the new momentum of China's digital economy development. The world is undergoing a new round of technological and industrial changes, and the digital economy has become an important direction of world economic development. It should be noted that the digital economy shows obvious technology-driven characteristics in terms of production factors, development momentum, and production service modes. However, in the field of digital economy, China is a leader in business model innovation and a follower of technological innovation. The development lag of core technology will certainly restrict the high-quality development of China's digital economy. Therefore, first, we need to focus on advancing key core technologies, keep up with the international frontier of digital technology, and break through core technologies in key areas such as integrated circuits, new displays, key software, artificial intelligence, big data, and cloud computing. Second, improve the basic system and supporting policies of data factors, coordinate and promote the national data factor market system, and accelerate the construction of digital economy with data as the key factor; Third, appropriately advance the deployment of digital infrastructure construction, such as improving the construction of information and communication networks, promoting the large-scale deployment of 5G networks and converged applications, and taking the improvement of digital infrastructure as a path to bridge the digital divide between regions and between urban and rural areas as soon as possible.

Second, deepen digital transformation and build an internationally competitive industrial system. At the micro-subject level, it is necessary to support and guide the healthy and sustainable development of platform economic norms, strengthen, improve and expand digital platforms, give full play to their positive role in leading development, creating employment, and international competition, and deepen the digital transformation of traditional enterprises, such as deepening the integrated development of 5G + industrial Internet. We will accelerate the cultivation of specialized and innovative enterprises and individual champion enterprises

in manufacturing, and enhance the digitalization level of agriculture. At the industrial level, it is necessary to continue to promote the deep integration of the digital economy and the real economy, strengthen the technology integration and product innovation for diversified application scenarios, and finally form an internationally competitive industrial system to promote the digital economy to better serve and integrate into the new development pattern; At the same time, it is necessary to grasp the development relationship between digital industrialization and industrial digitalization, promote the development of digital industry clusters, build high-quality software cities and famous parks in China, improve the degree of software industry clustering, build world-class digital economy industrial clusters, and actively integrate into the global industrial chain of digital economy.

Finally, strengthen the basic theory of digital economy research, I digital economy development law trend. Systematically deepen the theoretical system of digital economy, on the one hand, digital economy research should be fully integrated with the Chinese context. First, to target the spillover effect of the digital economy in China's economic and social development; On the other hand, the research of digital economy should be more diversified on the basis of integrating with traditional theories. It is not only necessary to understand the digital economy from the perspective of the key dimensions of traditional theory, such as supply, demand, industrial organization, growth, etc., but also to analyze the impact of various emerging digital technologies on economic forms with The Times. On this basis, a market-theory-system dynamic development system of digital economy is established. To achieve the standardized and rapid development of the digital economy, not only needs the guidance of the market and the system, but also needs to correct the dislocation of the market and the system through theoretical research. As the theoretical research connecting the market and the system, if the evolution direction is correct and the response is rapid, it can dynamically guide the digital economy to develop rapidly along the correct path.

Notes

1. Solow's economic growth model, expressed as $Y = AF(K, L)$, states that economic growth is determined by three factors: factor accumulation, efficiency improvement, and technological innovation. These factors correspond to the increase in capital (K) and labor (L) inputs, changes in the form of the function $F(\cdot)$, and variations in parameter A respectively.

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Further reading

- Wang, Z. and Zhang, X. (2021), "Institutional dimension of platform governance: based on the comparison of Chinese, American and British models", *Studies on International Relations*, No. 6, pp. 97-124+155-156.

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