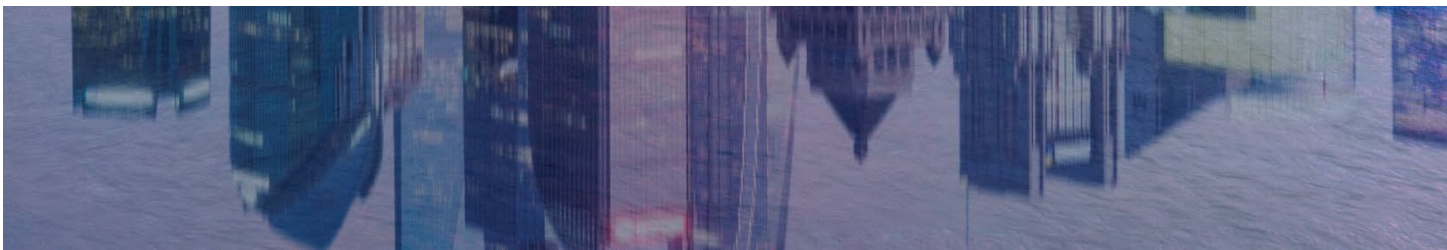


China Economic Quarterly Q3 2023

Highlights of the recent development of
China's digital economy



Highlights of the recent development of China's digital economy

Highlights:

- China's digital economy continued to grow robustly despite global turbulence over the past three years, with an average annual growth exceeding 10% from 2020 to 2022.
- By the end of 2022, there were 1.273 million valid patents registered in the core industries of the digital economy.
- Emerging telecom segments such as cloud computing, big data, and IoT exhibited rapid growth.
- The electronic information manufacturing industry experienced a slowdown in 2023, with a 3.4% decline in revenue compared to 2022.
- China has become a global leader in computing power infrastructure, driven by rapid development in digital infrastructure and data resources.
- Future development is focused on enhancing digital infrastructure, data resources, and security along with fostering deeper integration of digital technology across various sectors of the economy.

As of 2023, China's overall economy may not have fully recovered to where it stood three years ago, and the development of the digital economy has been affected by a slowdown in macroeconomic growth. However, the rapid rise of artificial intelligence (AI), exemplified by ChatGPT, signifies the dawn of a new era in the development of the digital economy, both globally and in China. The advent of the AI era is poised to expedite the disruption of various industries and domains, heralding a new phase of human development. This represents a unique and pivotal opportunity for China to cultivate an "innovative economy" that holds immense significance.

The rapid advancement of the digital economy is often described as the "Fourth Industrial Revolution", with AI technologies like ChatGPT playing a significant role in its development. At the core and foundation of the digital economy is data, an essential resource enabling AI to perform. The "Fourth Industrial Revolution" earns its name because its development is disruptive. The tremendous advancements in digital technology it brings forth has the potential to reshape many industry landscapes, in a similar way that the widespread adoption of mobile payments has propelled China's transition into a cashless society, simultaneously driving the growth of multiple industries.

Looking back in history, the introduction of ChatGPT can be likened to the significant technological advancements such as steam engine, the computer, and the internet, marking the entry of the digital economy into the era of intelligence. The widespread adoption of AI is expected to significantly enhance human labour productivity just as the invention of the steam engine by Watt marked the beginning of industrialisation in the West.

One of the main reasons behind China's lagging development in modern history can be attributed to it missing out on the previous industrial revolutions, particularly the First Industrial Revolution. In 1776, at a historical time when Watt invented the steam engine, Adam Smith, the father of classical economics, published "The Wealth of Nations", and the United States achieved independence, China was under the rule of Emperor Qianlong who was in his forty-first year of reign. To an effort to stabilise his regime, the Qing government revoked a policy of "extensive destruction of books". Due to the vast developmental gap between China and the West, the Chinese population at that time likely had little or no opportunity to access knowledge about the steam engine, "The Wealth of Nations", or the American "Declaration of Independence".

Today, after the emergence of generative AI in the United States, the impact it had in China is no less remarkable compared to any other developed country. This has laid a solid foundation for the rapid application of artificial intelligence as the digital economy has swiftly developed in recent years.

Whether it is ChatGPT or other landmark innovations in the future digital economy, developed countries are still likely to be the birthplaces of these inventions. Therefore, China's innovative economy would benefit greatly from close international connections. China's innovative economy should be built on the solid foundation of global and human scientific and technological progress, benefiting from and contributing to the enrichment of human civilisation.

So, after three years impacted by multiple global challenges, how has the digital economy progressed in China? This article provides a brief overview.

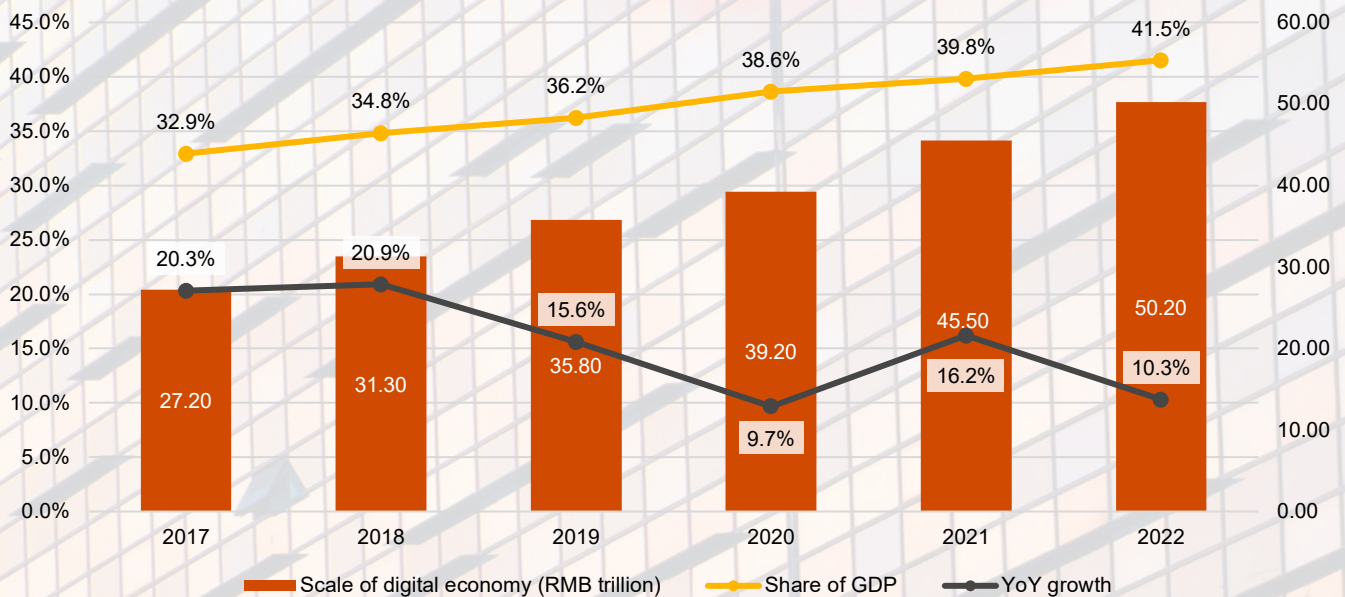
■ The digital economy reaches 50 trillion yuan, exceeding 40% of GDP

Despite the significant impact that the challenges of the last three years had on China's economic outlook, the digital economy has sustained robust growth, with an average annual increase exceeding 10% from 2020 to 2022. In 2019, China's GDP reached 99 trillion yuan, with the digital economy accounting for approximately 35.8

trillion yuan, representing about 36.2% of the total GDP, according to China Academy of Information and Communications Technology. During that time, the growth rate of the digital economy was 15.6%, significantly higher than the GDP growth rate of 6.1% for that year. By 2022, the scale of China's digital economy had grown to

50.2 trillion yuan, ranking second in the world in terms of size and accounting for 41.5% of the country's GDP. In 2023, while many sectors of China's economy might not have fully recovered to 2019 levels, the digital economy is expected to maintain its strong growth momentum.

Digital economy growth in China from 2017 to 2022



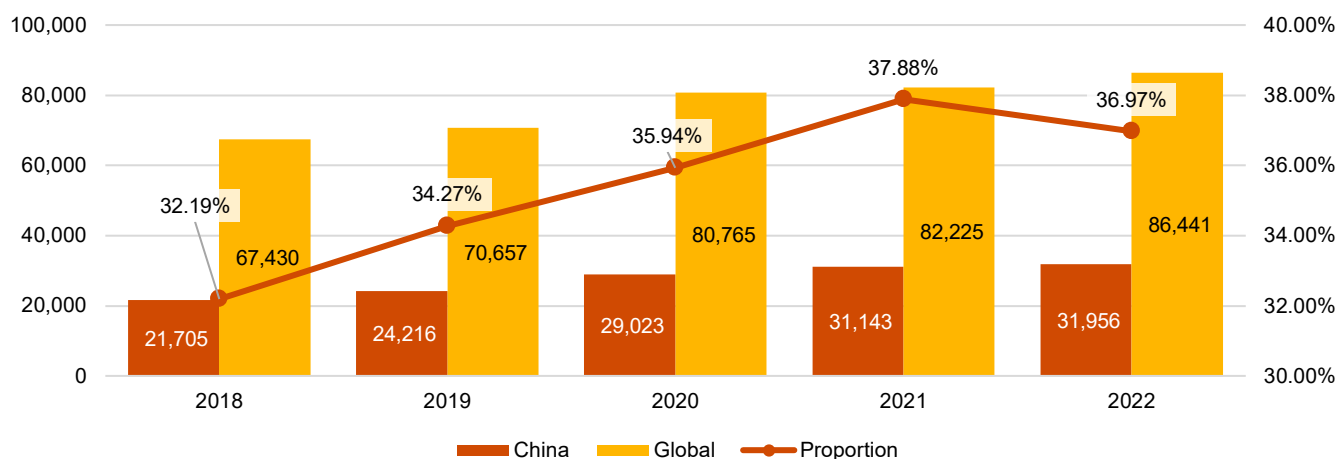
Source: China Academy of Information and Communications Technology

For instance, according to statistics from the National Intellectual Property Administration, as of the end of 2022, there were 1.273 million valid invention patents registered in the core industries of China's digital economy. The growth in registration of invention patents in the

core digital economy industries has been nothing but rapid. In 2022, there was 296,000 invention patent grants in these core industries, accounting for 42.6% of the total domestic invention patent grants. In the period after 2016, the average annual growth rate of

patent grants in core digital economy industries was 22.6%, or 1.5 times the average annual growth rate of all domestic invention patent grants during the same period.

Growth of PCT* patent applications related to information technology in China from 2018 to 2022 (Unit: by pieces)



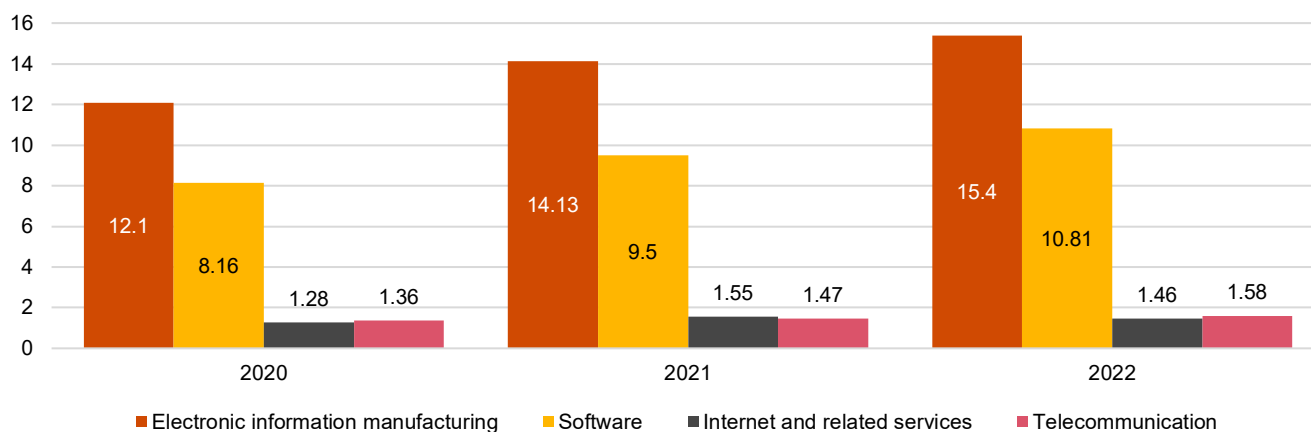
Source: Office of the Central Cyberspace Affairs Commission
*PCT: Patent Cooperation Treaty

Looking at the sectoral breakdown, it is observed that China's digital economy, amounting to the 50.2 trillion-yuan in 2022, mainly comprised the electronic information manufacturing industry (15.4 trillion yuan, up 5.5% year-on-year), software services (10.81 trillion yuan, up 11.2% year-on-year), and the core industry of the industrial internet (1.2

trillion yuan, up 15.5% year-on-year). National online retail sales reached 13.79 trillion yuan, of which the online retail sales of physical goods accounted for 27.2% of the total retail sales of consumer goods. Enterprises in the internet and related services industry above a designated size (the scope of which was adjusted from the previous

year's internet and related services revenue of 5 million yuan to 20 million yuan and above) recorded revenues of 1.46 trillion yuan, down 1.1% year-on-year. Telecommunications business revenue totalled 1.58 trillion yuan, representing an 8% year-on-year increase.

Revenue growth of China's digital industry from 2020 to 2022 (Unit: RMB trillion)



Source: Ministry of Industry and Information Technology of the People's Republic of China

■ Data centres, cloud computing, big data, and the Internet of Things (IoT) are experiencing rapid growth

According to statistics from the Ministry of Industry and Information Technology, in the first three quarters of 2023, the cumulative revenue from telecommunications services reached 1,281 billion yuan, mainly generated by three main telecommunications companies. This represents a year-on-year increase of 6.8%. When calculated at constant prices from the previous

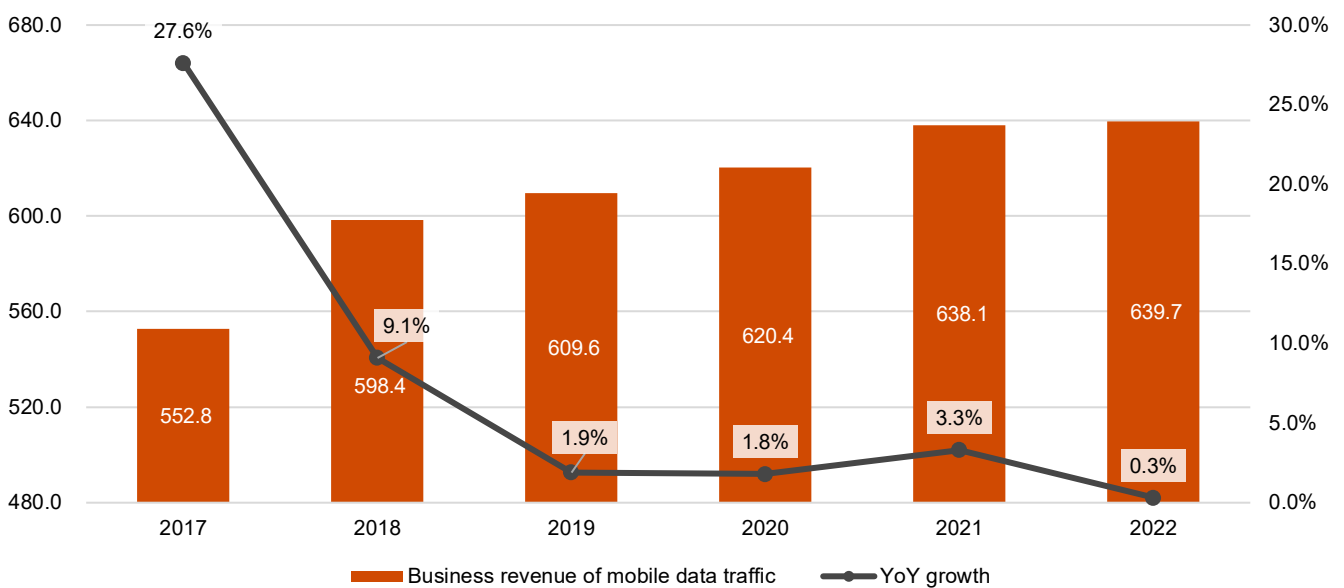
year, the total volume of telecommunications services grew by 16.5% year-on-year.

The revenue from telecommunications services is mainly derived from three sectors: fixed internet broadband, mobile data traffic, and emerging businesses such as Internet Protocol Television (IPTV), Internet data centres,

big data, cloud computing, and IoT. Among these, mobile data traffic accounted for the highest revenue, reaching 492 billion yuan and contributing to about 38.4% of the overall revenue, with a year-on-year increase of 0.4%. In 2022, the revenue from this sector was 640 billion yuan, only edging up 0.3% compared to the previous year.



Business revenue growth of mobile data traffic from 2017 to 2022 (Unit: RMB billion)



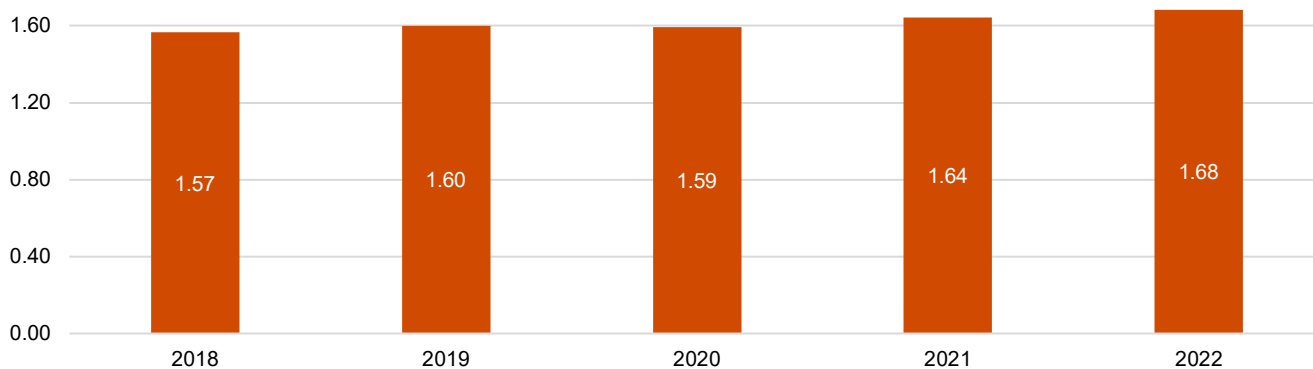
Source: Ministry of Industry and Information Technology of the People's Republic of China

The slowdown in the growth of the mobile data traffic industry since 2019 can be attributed to two main reasons. Firstly, the domestic mobile phone market has reached maturity, resulting in slower pace of growth. With a population of approximately 1.4 billion,

while in 2019, China has already exceeded 1.6 billion mobile subscriptions by 2019. Secondly, the deceleration in macroeconomic growth has impacted the demand for 5G phones. Taking 2022 as an example, 272 million mobile phone units were

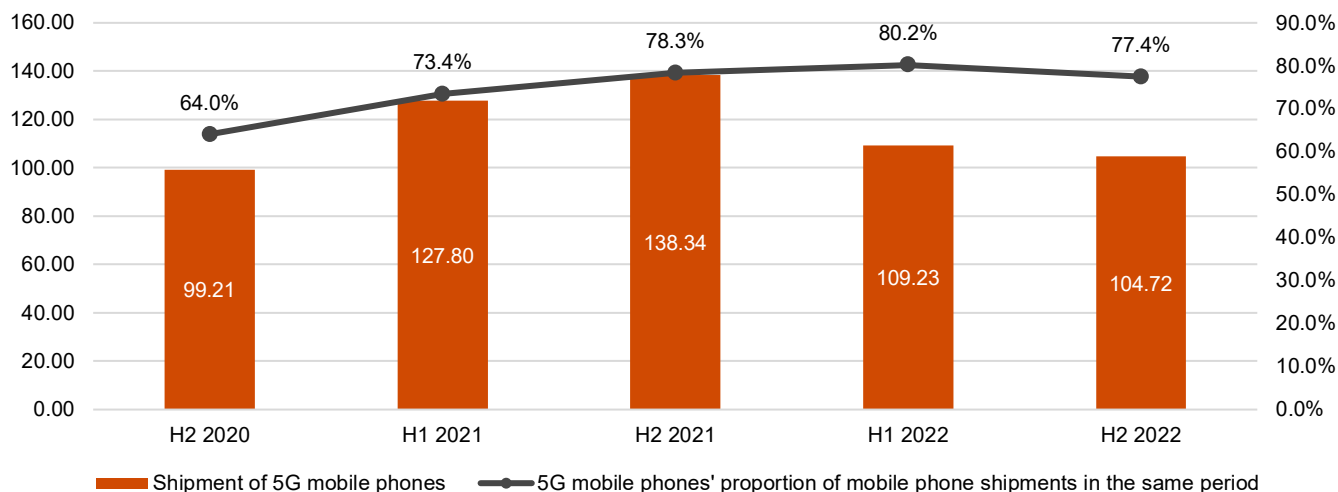
shipped, a year-on-year decrease of 22.6%. Out of these, 5G phones accounted for 214 million units, down 19.6% year-on-year, representing 78.8% of the total mobile phone shipments during the same period.

Size of mobile phone users (Unit: billion)



Source: Ministry of Industry and Information Technology of the People's Republic of China

Shipment of 5G mobile phones from H1 2020 to H2 2022 (Unit: by million pieces)



Source: China Academy of Information and Communications Technology

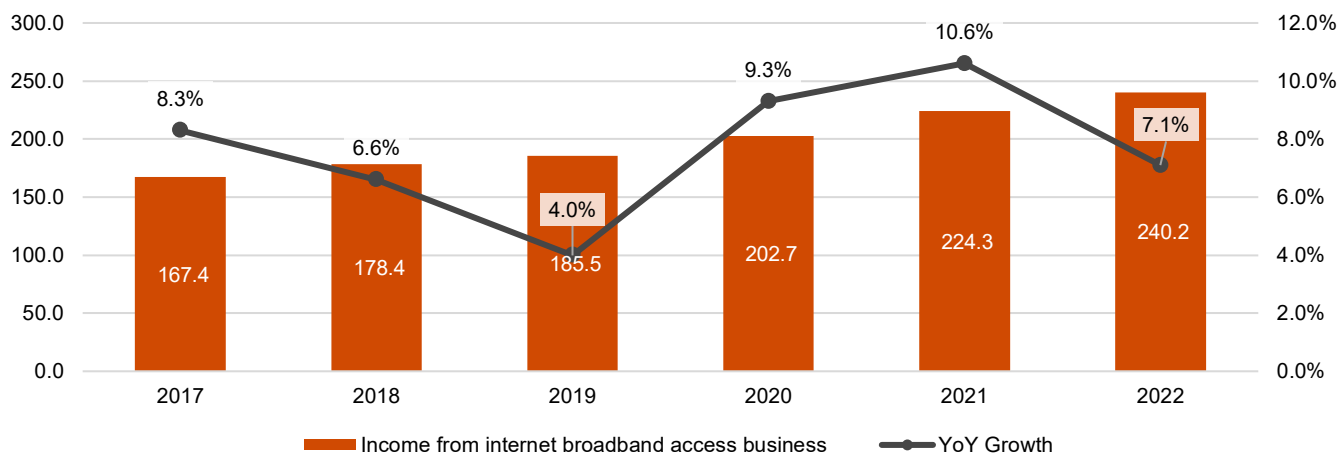


Among the three major telecommunications services, apart from mobile data traffic, fixed internet broadband and emerging services continue to maintain a steady growth

rate, with the latter showing particularly strong growth. In the first three quarters of 2023, the revenue from fixed internet broadband services reached 196 billion yuan, a year-on-year increase of 8%,

accounting for 15.3% of the total revenue from telecommunications services. Over the past six years, the average growth rate has been approximately 7.5%.

Income from internet broadband access business from 2017 to 2022 (Unit: RMB billion)



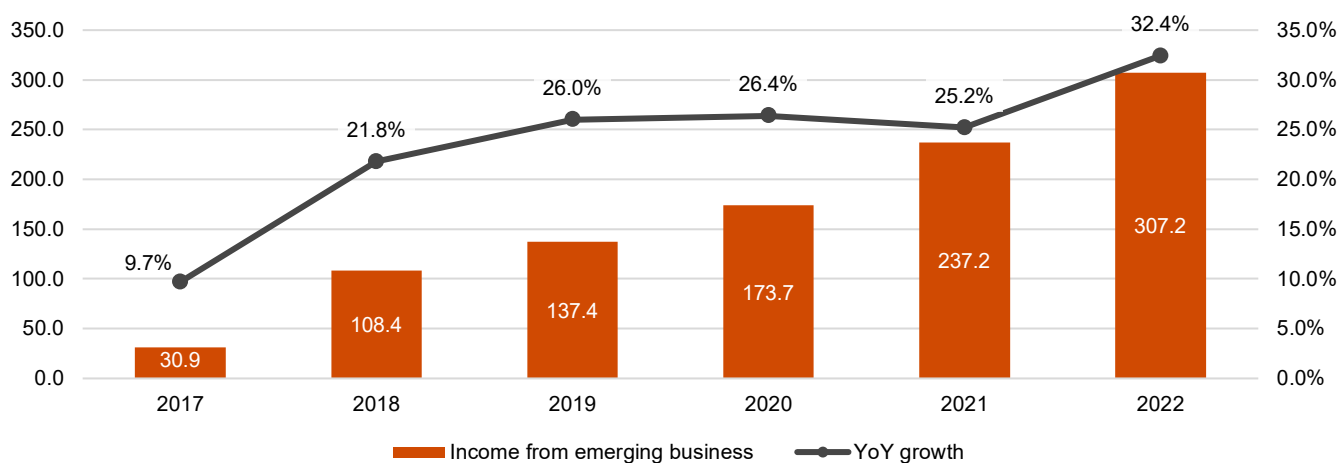
Source: Ministry of Industry and Information Technology of the People's Republic of China

Furthermore, emerging telecommunications services such as IPTV, Internet data centres, big data, cloud computing, and IoT have continued their strong growth trajectory in recent years. In the first three quarters of 2023, the revenue from these services reached 270 billion yuan,

representing a year-on-year increase of 19.8% and accounting for 21.1% of the total telecommunications service revenue. Among them, the year-on-year growth rates for cloud computing and big data were 35% and 37.1% respectively, while IoT business revenue grew by 24.1%. In 2022,

revenues from data centres, cloud computing, big data, and IoT services increased by 11.5%, 118.2%, 58%, and 24.7%, respectively compared to the previous year. From 2017 to 2022, the annual average growth rate of these emerging telecommunications services exceeded 20%.

Income from emerging business from 2017 to 2022 (Unit: RMB billion)



Source: Ministry of Industry and Information Technology of the People's Republic of China

*: Statistical system in 2018 was revised, with adjustments in relevant business scope.

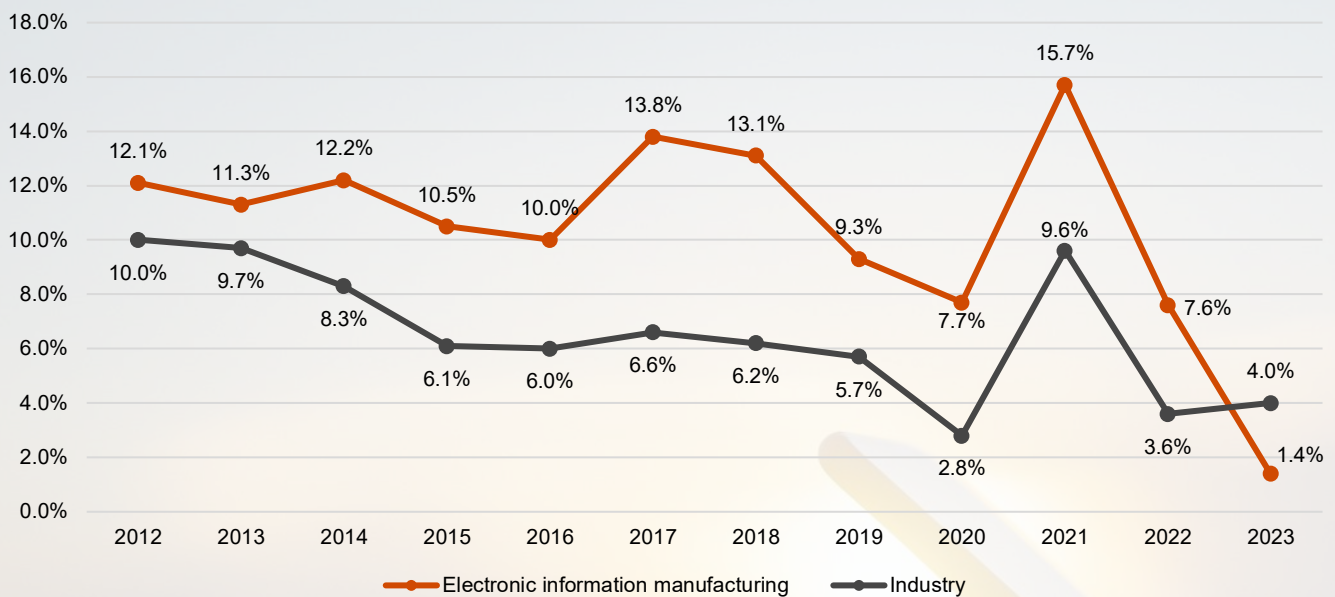
■ Negative growth in the electronic information manufacturing industry

According to the Ministry of Industry and Information Technology, in the first three quarters of 2023, companies in the electronic information manufacturing industry above a designated size achieved a business revenue of 10.7 trillion yuan, marking a year-on-year decrease of 3.4%. This contracts with the previous growth streak in business revenue. In 2022, the industry had realised a business revenue of 15.4 trillion yuan up 5.5% year-on-year, however, profits had declined

significantly, with a total profit of only 739 billion yuan, down 13.1% year-on-year. From 2012 to 2021, the growth rate of the electronic information manufacturing industry far exceeded the overall industrial added value growth rate. It was not until 2023 that its growth rate fell below the overall industrial added value growth rate. The slowdown of growth can be attributed to several factors, including:

- The global economic downturn, which has led to reduced demand in the electronic information manufacturing industry.
- Overcapacity in the industry, potentially leading to price declines and affecting the added value.
- Changes in domestic and international environments, such as policy adjustments and trade frictions, impacting production and sales.

Annual growth of electronic information manufacturing and industry form 2012 to Sep 2023

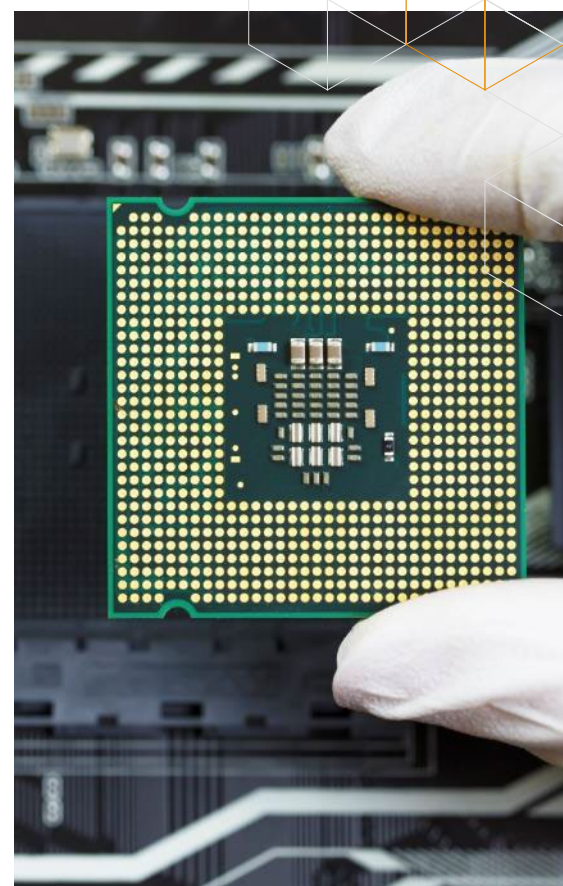


Source: Ministry of Industry and Information Technology of the People's Republic of China
 *: The 2023 data were calculated as of Sep 2023

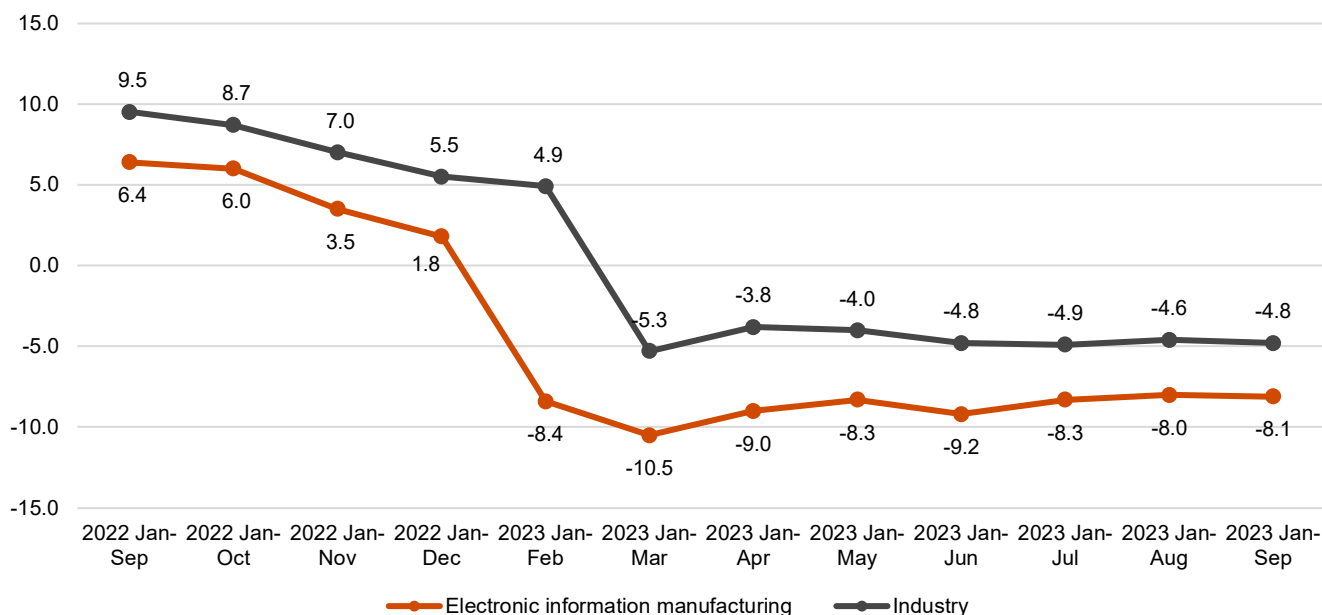
By examining the specific product performance in the electronic information manufacturing industry, we can observe the following trends in the first three quarters of 2023:

- The production of mobile phones was 1.094 billion units, showing a marginal year-on-year increase of 0.8%. Among which smart phones accounted for 792 million units, down 6.1% year-on-year.
- The production of microcomputer equipment amounted to 253 million units, down 21.1% year-on-year.
- The production of integrated circuits was 244.7 billion pieces, a decrease of 2.5% year-on-year.
- In 2022, the production of these categories all experienced varying degrees of decline: mobile phone production decreased by 6.2%, including an 8% decrease in smart phones; microcomputer equipment production fell by 8.3%; and integrated circuit production dropped by 11.6% year-on-year.

The electronic information manufacturing industry has been affected by weakened demand both domestically and internationally. Additionally, China holds a significant share in the export of electronic information products. According to customs statistics, in 2022, China exported 166 million laptops (out of a total domestic production of 434 million units), a year-on-year decrease of 25.3%; exported 822 million mobile phones (out of a total domestic production of 1.56 billion units), a decrease of 13.8% year-on-year; and exported 273.4 billion integrated circuits (out of a total domestic production of 324.2 billion pieces), a decrease of 12% year-on-year.



Cumulative YoY growth of electronic information manufacturing and industry exports (Unit: %)



Source: Ministry of Industry and Information Technology of the People's Republic of China



■ Rapid development of computing power infrastructure

The rise of AI, exemplified by the advent of large language model tools like ChatGPT, has also raised the bar for the infrastructure of the digital economy, particularly in terms of computing power infrastructure. This is a primary driver for computing power demand today and an important component of the new emerging information infrastructure.

By a narrow definition, computing power refers to the ability of a computer to perform specific computational functions and meet specific computational performance requirements. In a broader sense, as a new type of productivity in the digital economy era, computing power refers to the ability of clusters or centres of computing devices to process various types of information, often involving data storage, network transmission, information computation, and more.

According to the "High-Quality Development Action Plan for Computing Power Infrastructure" released by China's Ministry of Industry and Information Technology, computing power, integrating information computing power, network carrying capacity, and data storage capacity, all help to attain a new type of productivity that mainly serves society through computing power infrastructure.

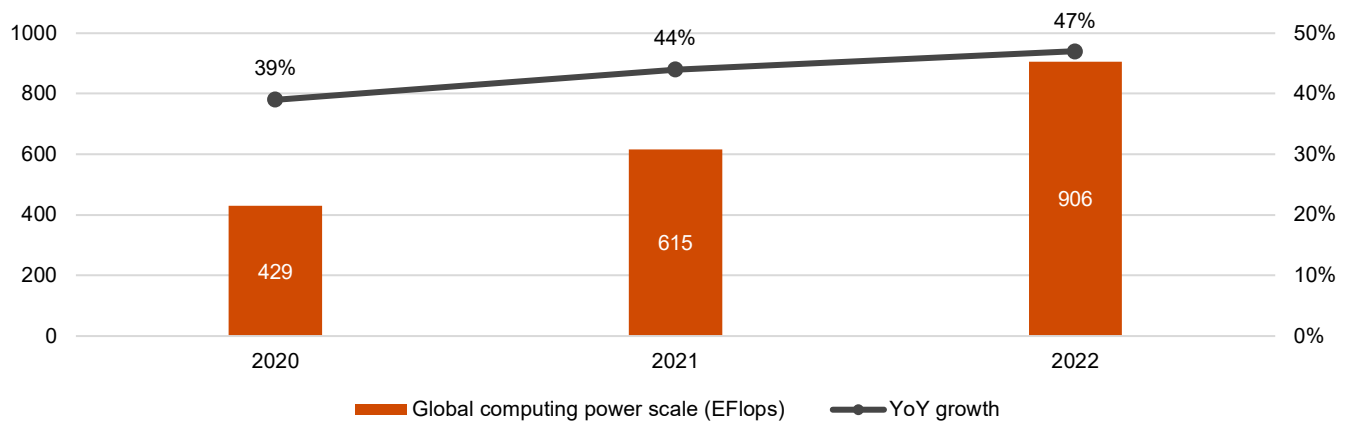
Computing power infrastructure is defined as the main carrier providing computing power services to society, an important part of the new type of information infrastructure. It is designed to enhance collaborative innovation in computing, networking, storage, and applications. The computing power industry encompasses upstream industries consisting of facilities, equipment, software suppliers, and network operators; midstream industries consisting of basic telecommunications companies, and third-party data centre service and cloud computing providers; and downstream industries including internet companies, industrial enterprises, and various industry users.

Recent research by Inspur Group (or Langchao Group, an IT conglomerate in the Chinese mainland focusing on cloud computing, big data, key application hosts, servers, storage, artificial intelligence, and ERP) in collaboration with International Data Corporation (IDC) examined fifteen major economies across five continents. The research findings show that the level of computing power, as indicated by the computing power index, has a significant positive correlation with a country's GDP and the development level of its digital economy. The study

found that, on average, a 1% increase in the computing power index corresponds to a growth of 0.35% in the digital economy and 0.18% in GDP. This underscores the importance of computing power infrastructure in driving economic growth and digital transformation.

In the future, computing power infrastructure in China and globally will continue to develop rapidly. The China Academy of Information and Communications Technology estimates that by 2025, the scale of China's core computing power industry will exceed 4.4 trillion yuan, with the associated industry scale reaching 24 trillion yuan. As of the end of 2022, the total global computing power reached 650 EFLOPS, with general computing power at 498 EFLOPS, intelligent computing power at 142 EFLOPS, and supercomputing power at 10 EFLOPS. Intelligent computing power accounted for 21.9% of the total. The shares of the United States, China, Europe, and Japan in the global computing power scale were 34%, 33%, 17%, and 4%, respectively in 2022. Meanwhile, IDC predicts that the global AI computing market is expected to grow from \$19.5 billion in 2022 to \$34.7 billion in 2026.

Global computing power scale from 2020 to 2022



Source: China Academy of Information and Communications Technology



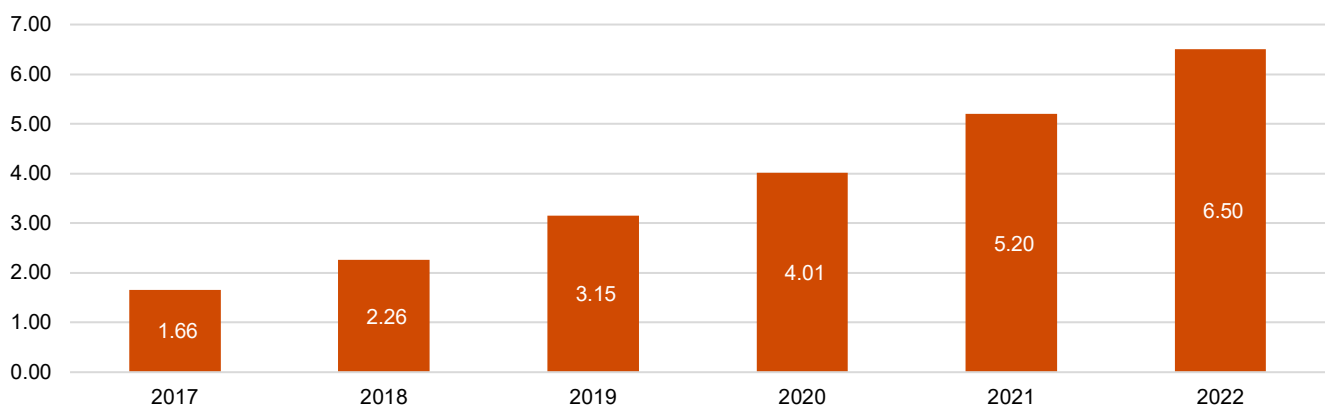
According to the "Digital China Development Report (2022)" published by the Central Cyberspace Administration, the construction of computing power infrastructure in China has entered a comprehensive phase, with the scale of infrastructure growing rapidly. China currently ranks second globally in terms of operational data centre computing power, which amounts to over 180 EFLOPS. Meanwhile, the construction of eight national computing power hubs is in an advanced

implementation phase, with over 60 new data centre projects underway.

China has emerged as one of the most advanced nations worldwide in terms of supercomputing development. In 2022, China was home to 162 of the top 500 supercomputers in the world, maintaining the top spot in total quantity. In 2022, the total scale of data centre racks in China exceeded 6.5 million standard racks, with an average annual growth of over 30% over five years. Data centre racks are

standardised frameworks used to install and arrange computer equipment in data centres, housing IT equipment including servers, storage devices, and network equipment. They are crucial for the operation of modern data centres, as they help in the efficient use of space, easy access to equipment, and effective cable management.

Total number of switchboards in the data centres in China from 2017 to 2022 (Unit: by million racks)



Source: China Academy of Information and Communications Technology

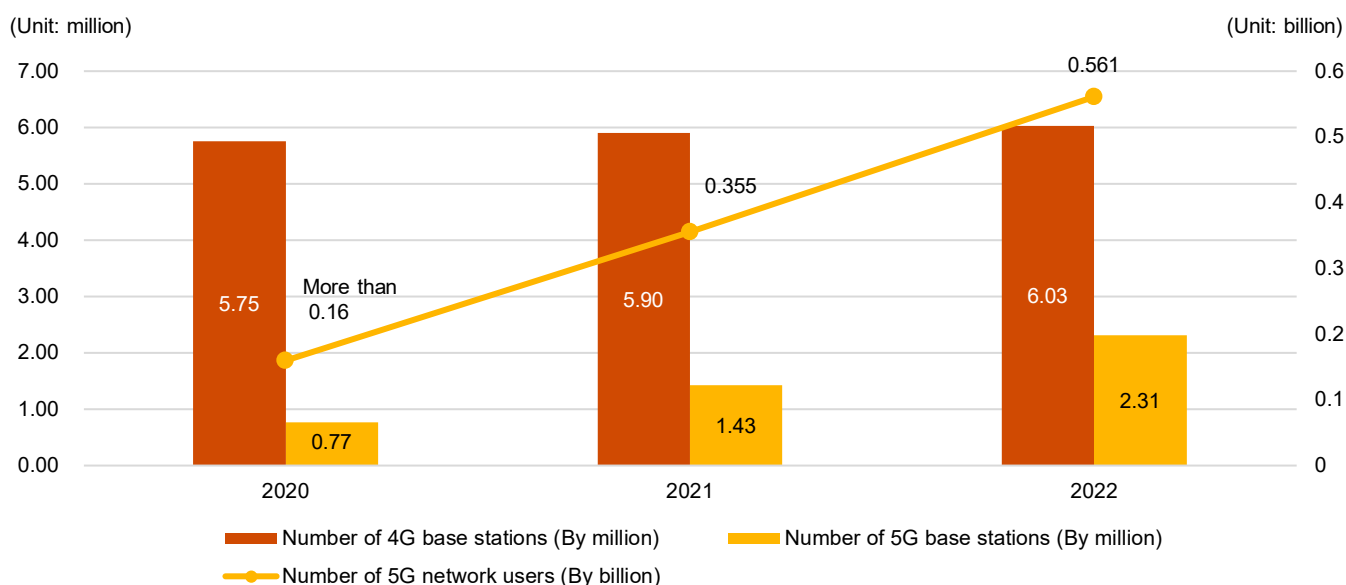


The remarkable development of China's computing power infrastructure has positioned the country as one of the major global leaders in this field. Several factors have attributed to this rapid progress. Firstly, there has been a significant improvement in the scale and capacity of the country's digital infrastructure in recent years. For example, rapid development in mobile communication networks, global leadership in the construction and

promotion of 5G networks, and fast-growing data resources have all contributed to the development of computing power infrastructure. According to statistics from the Central Cyberspace Administration, as of the end of 2022, China had cumulatively built and opened 2.312 million 5G base stations, serving 561 million 5G users and accounting for more than 60% of the global total. Furthermore, the scale of China's data resources has grown at

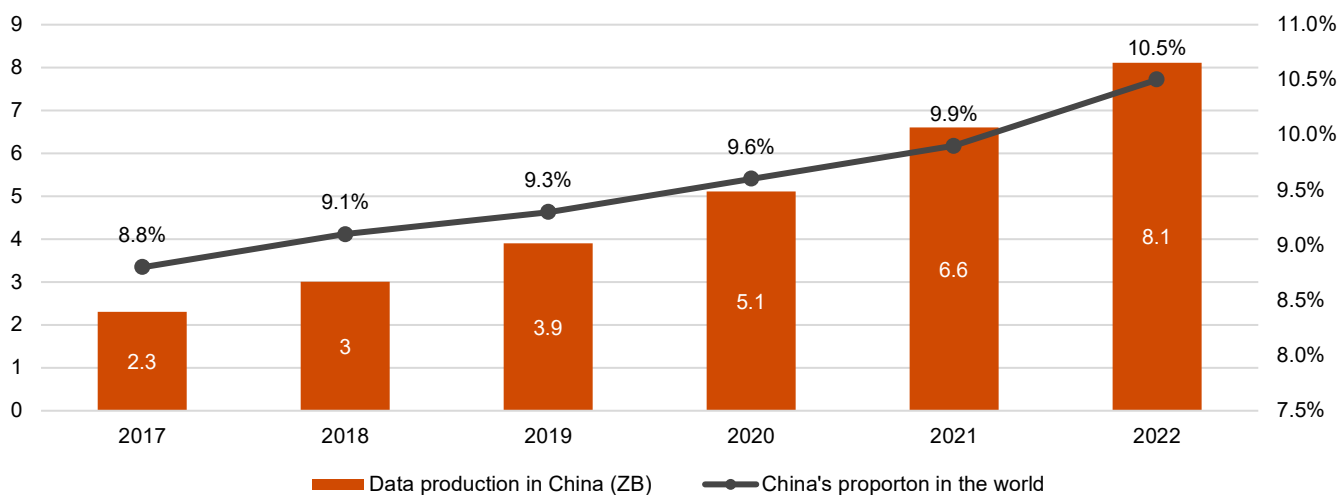
an accelerated pace. In 2022, the data output reached 8.1 ZB (zettabytes), a year-on-year increase of 22.7%, accounting for 10.5% of the worldwide data output and ranking second in the world. As of the end of 2022, data storage volume reached 724.5 EB (exabytes), with a year-on-year increase of 21.1%, accounting for 14.4% of the total global data storage volume.

Scale of mobile communication base stations and 5G users in China from 2020 to 2022



Source: Ministry of Industry and Information Technology of the People's Republic of China

Data production in China and its global proportion from 2017 to 2022



Source: China Academy of Information and Communications Technology, Chinese Academy of Cyberspace Studies

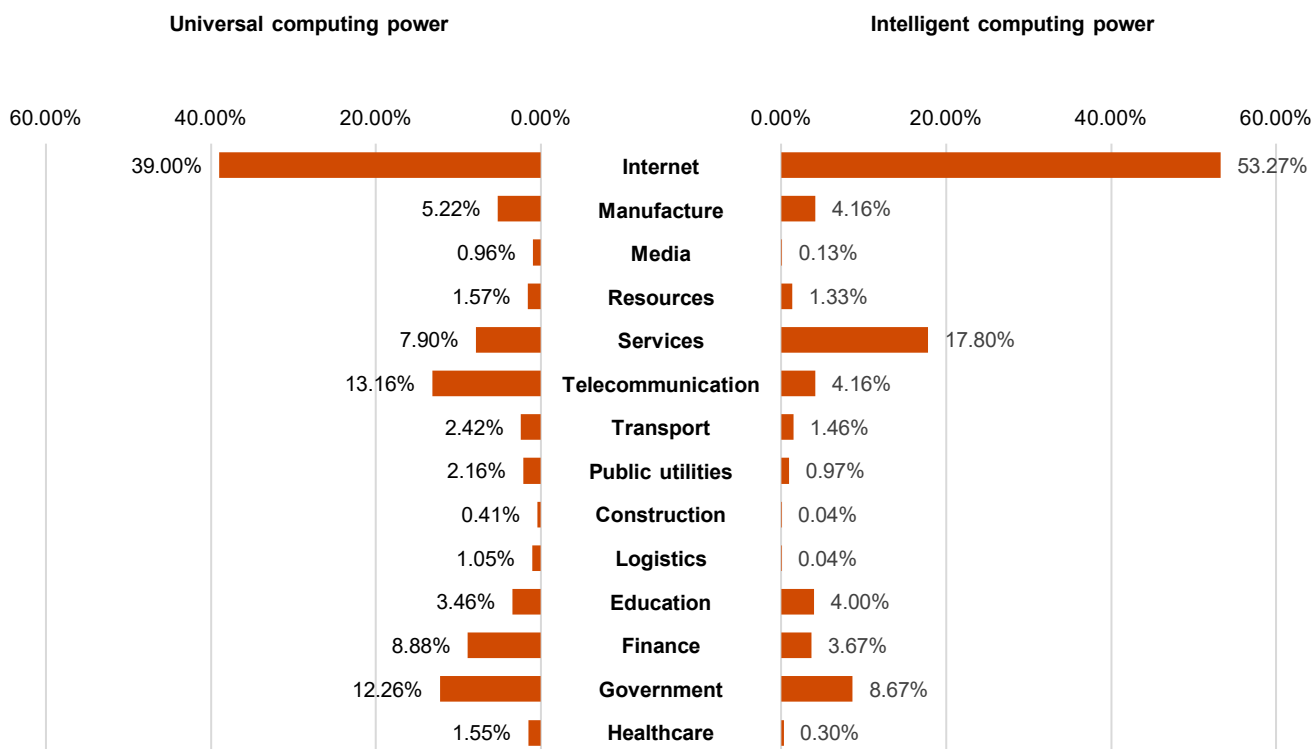
At the same time, Chinese telecommunications and technology companies are rapidly developing their service capabilities by offering cloud services and big data solutions. Additionally, the government places high importance on technological innovation and the development of the digital economy, leading to substantial investments in computing power infrastructure. For example, in October 2023, the Ministry of Industry and Information Technology, along with five other government departments, jointly issued the "High-Quality Development Action Plan for Computing Power Infrastructure" (hereinafter referred to as "the Plan"). The objective of the Plan is to strengthen the collaborative innovation in computing, network, storage, and applications, in order to promote the high-quality development of computing power infrastructure, and fully leverage computing power to drive the digital economy.

The "Plan" sets out the following targets for 2025:

- **In terms of computing power:** The computing power scale in China is expected to exceed 300 EFLOPS in 2025, compared to 180 EFLOPS in 2022; globally, this figure was around 906 EFLOPS in 2022, with a growth rate of 47%.
- **In terms of carrying capacity:** Direct network transmission between national hub node data centre clusters is expected to achieve no more than 1.5 times the theoretical latency. The coverage rate of the Optical Transport Network (OTN) in key application locations should reach 80%. Backbone networks and metropolitan area networks should fully support IPv6, and the use of innovative technologies like SRv6 should account for 40% in 2025.

- **In terms of storage capacity:** The total storage volume is projected to exceed 1800 EB, with advanced storage capacity accounting for more than 30%. The disaster recovery coverage rate for core and critical data in key industries should reach 100% by 2025.
- **In terms of application empowerment:** The scope of applications is on track to expand further in industries such as industrial, finance, health, transportation, energy, and education, significantly increasing the penetration rate of computing power. Currently, the application of computing power in China is mainly observed in the internet sector, while other sectors and industries are still in their early stages of development.

Distribution of computing power applications in various industries in China



Source: China Academy of Information and Communications Technology, IDC

■ The "2522" framework and the future development direction of China's digital economy.

The rapid development of China's digital economy is largely due to the emphasis and support of major national policies, in addition to market demand. The 20th National Congress held in mid-October 2022 proposed establishing a modern industrial system, with a continued focus on the real economy for economic development. It also seeks to promote new industrialisation efforts, and accelerate the building of a strong, quality manufacturing base for the country, including national aerospace industry, transportation, telecom, and "digital infrastructure," etc across the country.

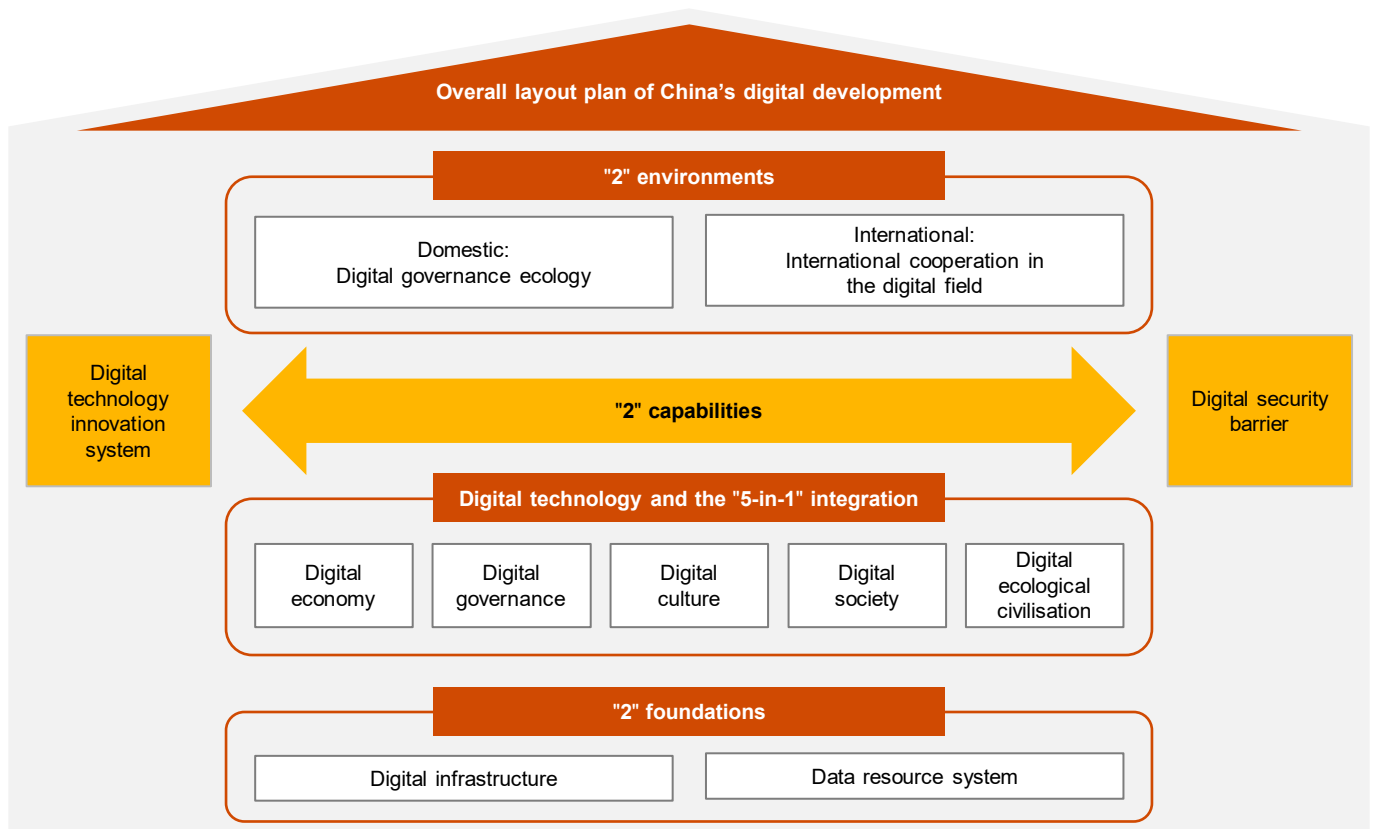
The importance of telecom and digital networks was elevated to the same level as manufacturing, aerospace, and transportation. The proposal also stated its goal to "accelerate the development of the digital economy, promote the deep integration of the digital economy within the real economy, and create internationally competitive digital industry clusters."

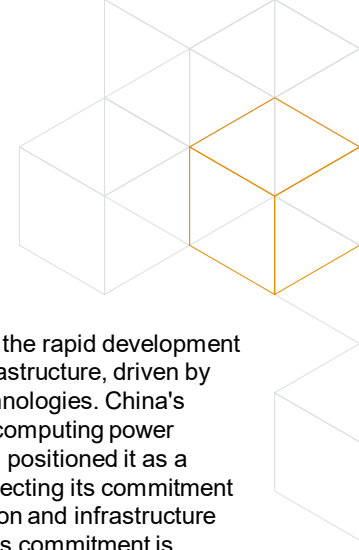
A few months later, in February 2023, the Central Committee and the State Council released the "Overall Layout Plan for the Construction of a Digital China" (hereinafter referred to as "the Plan"). The Plan proposes that by 2025, significant progress should be made in the construction of China's digital economy to attain a global leading position in terms of digital development. It adds that the systematic layout of the construction of China's digital economy should be more scientific and holistic, with more coordinated and comprehensive digital development efforts in the fields of economy, government, culture, society, and sustainability, strongly supporting the comprehensive construction of what the government defines as a modern socialist country. This specifically includes:

- Efficiently interconnecting the digital infrastructure;
- Accelerating the scale and quality of data resources;

- Effectively releasing the value of data elements;
- Significantly improving the level of digitalisation and intelligence of government services;
- Reaching a new level of digital cultural construction;
- Making significant achievements in precision, inclusiveness, and convenience of the digital society;
- Progressing in the construction of a digital ecological civilisation;
- Making major breakthroughs in digital technology innovation and leading in global application innovation;
- Comprehensively enhancing digital security assurance capabilities;
- Perfecting digital governance systems and opening new prospects in international cooperation in the digital field.

Overall layout of China's digital development ("2522")





The Plan outlines that the construction of China's digital economy based on the "2522" overall framework:

- The first "2" refers to the "two foundations" of digital infrastructure and data resource systems.
- The "5" refers to the promotion of deep integration of digital technology with the "five-in-one" approach in economy, politics (governance), culture, society, and the construction of an ecological civilisation.
- The second "2" refers to the strengthening of "two capabilities" of the digital technology innovation system and digital security barriers.
- The last "2" refers to the optimisation of the "two environments" of digital development, both domestically and internationally.

Accelerating the construction of China's data resource system includes establishing national data management systems and mechanisms, and data coordination management institutions at all levels. It involves the aggregation and utilisation of public data in important fields such as public health, science and technology, and education in national data resource repositories. It also encompasses unlocking the potential value of commercial data, establishing a data property rights system, conducting research on data asset valuation, and establishing a mechanism for data elements to participate in distribution based on their value contribution.

Finally, this article provides a comprehensive overview of the substantial progress made in China's digital economy, highlighting its resilience and dynamic growth despite global challenges. In 2022, China's digital economy reached a remarkable scale of 50.2 trillion yuan, accounting for 41.5% of the country's GDP. This growth is underpinned by innovation and a strong patent ecosystem, with 1.273 million valid patents registered in core digital economy industries by the end of 2022.

In addition, the article outlines the significant contributions of various sectors, including the electronic information manufacturing industry, software services, and the industrial internet core industry. However, it also acknowledges the challenges faced by the electronic information manufacturing industry, which saw a decline in 2023 due to reduced global demand and other macroeconomic factors.

A key highlight is the rapid development of computing infrastructure, driven by the rise of AI technologies. China's advancement in computing power infrastructure has positioned it as a global leader, reflecting its commitment to digital innovation and infrastructure development. This commitment is further evident in the government's proactive role in promoting the growth of the digital economy through significant national policies.

The article also delves into the "2522" framework, a strategic plan for the future development of China's digital economy emphasising the integration of digital technology with various sectors of the economy, enhancing the country's digital infrastructure, and optimising domestic and international environments for digital development.

In conclusion, China's digital economy showcases a robust and multifaceted growth trajectory, driven by technological innovation mostly conducted by enterprises, supportive government policies, and a forward-thinking approach to digital integration. China's journey towards a comprehensive and advanced digital economy, as outlined in this article, is a testament to its strategic foresight and adaptability in the face of global economic shifts.



In this context, the accelerated construction of China's **digital infrastructure** includes:

- The development of 5G networks
- Gigabit optical networks
- IPv6 scaling and application
- Mobile IoT
- Beidou scaling and application



Computing power infrastructure encompasses:

- General data centres
- Supercomputing centres
- Intelligent computing centres
- Edge data centres





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