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Trends in the development of digital economy in China

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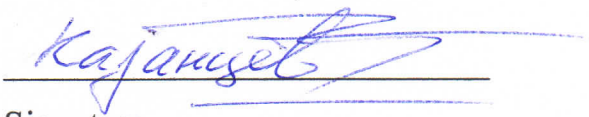
I hereby certify
that this is entirely my own work
unless otherwise stated

By Anton A. Kazantsev



Signature

Supervisor
PhD in Economics, Associate Professor
Liudmila V. Popova

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Introduction

The rapid technology advancement and general changes in the world economy are undoubtedly changing the global market. The global financial crisis of 2008 hastened a number of trends that have emerged as a result of the growing importance of the Internet, including consumer behavior shifts, globalization processes, and industry transformation. It has also raised risk and uncertainty. Speaking of the Internet, it is important to remember that it offers the fundamental framework for the growth of the digital economy. New markets are developing as a result of the Internet, allowing businesses and entrepreneurs worldwide to collaborate, participate in the development of goods and services, and create and use cutting-edge technologies. All of this was previously impossible, but now businesses and individuals from all over the world can engage in innovation, wealth creation, and social engagement in new ways. The essential link between economic growth and technological advancement is particularly evident nowadays.

Regarding developed nations, it can be said that technological advancement is partially fueled by the fact that investors are more actively funding innovative projects because traditional industries cannot provide them with high returns. We may observe that the demand for high technology has been shaped in developing nations like China by industrial development, the quick rise in population affluence, and the expansion of these populations as a whole. Therefore, businesses must focus on innovation and actively integrate into the new digital reality in every nation.

In developing nations that have participated in the manufacturing sector, the digitalization issue is particularly severe. For instance, China's economy has recently faced new difficulties in the form of slower economic development and higher salaries. As a result, labour-intensive production has shifted from China to other countries, leading to capital flight from the country. The PRC is working to develop high value-added items and to establish value chains domestically. The digitalization of the economy may serve as China's new engine for growth. The economy's digitalization is crucial in the context of the coronavirus pandemic because the COVID-19 epidemic, which forced many processes online, gave us a chance to observe the efficiency of using digital technologies.

Technology and digital solutions were among the most critical in the fight against the pandemic, and allowed many processes to be adapted. Many technologies developed during the pandemic, including artificial intelligence, digital payments and currencies, digital learning and health technologies, and finally digital economy components such as e-commerce made it easier for underdeveloped regions to survive the impact of lockdowns. This paper will focus specifically on these sectors of the digital economy.

Additionally, China's underdeveloped rural areas could benefit from the development of the digital economy. For the PRC, which has experienced labor migration to cities for decades, differences in economic, technological, and income levels are a societal challenge. Perhaps the advent of digitalization will open up new, desirable job opportunities and give people the chance to launch their own businesses. Through access to high-quality healthcare and education, digitalization can also qualitatively improve life in rural areas. This will then have a positive effect on the economic growth of the areas and the caliber of the human capital. In the state development plans for the upcoming few years, all these suggestions for raising rural incomes, enhancing and extending health care, and expanding education have been made.

China's experience is important to study because it represents, firstly, the experience of responding to a new challenge, as the country was the first to meet the coronavirus pandemic. In addition, it is in China that successful experiences of interaction between authorities, IT companies, local companies and users can be analysed. China is the first major country to actively implement many key technologies for the digital economy, such as central banks' digital currencies. China's experience can be applied to other countries, such as Russia, which also plans to develop digital solutions and digital currency.

The purpose of this paper is to identify key trends in China's digital economy and its impact on economic transformation.

In order to achieve this goal, a number of objectives were set:

- To reveal the general characteristics, features of the current development of digital economy, e-commerce, digital education and health projects;
- To consider the methods of government participation and support for digitalization of rural areas in China;

- Highlight the key factors of the positive impact of digitalization in rural areas of the PRC;
- Analyse the experience of applying artificial intelligence technologies in the fight against the coronavirus pandemic;
- Detect key milestones in the development of the digital renminbi in the PRC
- Identify the main prospects for cross-border application of the digital renminbi, as well as opportunities for Russia.

The object of the study is the trends of digital economy in China.

The subjects of the study are IT companies, joint digitalisation projects, rural households, startups, government agencies, local authorities, financial institutions.

Applying a systems analysis method, this paper examines the relationships between rural households, local governments and large companies. In addition, the study uses a case study method to analyse successful digitalization projects in the PRC. The data used for the analysis represent information from industry research agencies, official information from government websites, analytical firms and news publications, as well as information from classical and current academic studies.

The topic of this paper is touched upon by various researchers and authors, among the main topics are: the stages of development of digital economy in China, the role of e-commerce in China's digital economy development, the features and prospects of digital yuan application, and the study of projects of major Chinese IT-companies. The current studies will be discussed in more detail in a special section of this paper.

The paper consists of an introduction, three chapters, a conclusion and a list of references. Chapter 1 'Theoretical approaches and current research on the digital economy' consists of two parts. The first part is called Defining the digital economy, e-commerce, digital health and education, and it focuses on the scientific approaches to the concepts that are discussed in this research paper. The second part "Review of current studies" is a review of scientific studies that deal with issues related to the subject of this research paper, this part of the chapter helps to identify trends that other scholars have noted and to highlight what they have not considered.

Chapter 2, Current trends (after COVID) in the development of the digital economy in the PRC, is divided into three parts. The first, 'Impact of the pandemic on the development of the

health and education sectors', looks at China's experience in adapting its education and health sectors to the coronavirus pandemic and the new trends it has brought about. Part two, 'Applying AI technology in a pandemic: key technologies and features', analyses the use of AI technology in pandemic response, highlighting key emerging technologies as well as new directions for the development of the industry. The third part, "The development of e-commerce in rural areas in the post-pandemic period", looks at China's experience in developing e-commerce in rural areas.

Chapter 3, "The development of the digital renminbi and its prospects", contains two parts. The first part, "Stages in the emergence of the digital renminbi and prospects for domestic use", focuses on the stages of development of the digital renminbi and its prospects for domestic use. The second part, "Prospects for cross-border use of the digital yuan and opportunities for Russia", defines the prospects for international application of the digital yuan, as well as notes opportunities for Russia.

1. THEORETICAL APPROACHES AND CURRENT RESEARCH ON DIGITAL ECONOMY

1.1. Defining the digital economy, e-commerce, digital health and education

The digital economy emerged in the process of technology development and its penetration into spheres of life. The initial stage in its development could be called the post-industrial society. The main theorists in this direction in the 1950s were Toffler[1] and Bell[2]. They began to talk about the transformation of society, its modernisation and the change in the economy due to the technological process. But the main difference of the new society was the rapidly increasing role of information. Thus, we can consider the digital economy as a certain stage in the development of the economy, which is very closely linked to the factor of production such as information. It is impossible not to agree with this, because the digital exchange of information between economic agents has replaced the analogue one and ensures economic development, production of higher quality or fundamentally new goods and services. It must be said that there is no established definition of the digital economy in the world, which proves the multifaceted nature of the phenomenon. The term "digital economy" was first coined by D. Tapscott[3]. The scholar described how the Internet changed many business processes forever. At the time, it was the Internet that was actively changing the economy; the economy could not keep up with the pace of change and people did not fully understand the meaning and essence of new technologies, which led to the famous dot-com crisis. Nevertheless, the rapid digitalisation has continued and over time new components have emerged. Returning to Tapscott's time, the changes were important: semiconductors were replaced by microprocessors, networks became more open and computing power developed. All of this played an important role in the development of the digital economy.

As for the domestic approach to the digital economy, Glazyev believes that the beginning of the digital economy can be called the emergence of the computer, and its development is primarily associated with the technology of artificial intelligence. His ideas echo those originally considered by Toffler and Bell, as he believes that the digital economy has changed the existing technological

[1] Toffler A. The third wave. N.Y.: Bantam Books, 1980. 560 p.
[2] Bell D. The Coming of post-industrial society: A venture in social forecasting. N.Y.: Basic Books Publ., 1999. 507p.
[3] Tapscott D. Growing up digital. Harvard Business Press, 1997.

patterns. According to Glazyev, the world is in a transitional stage between the fifth and sixth technological modes, and it is information technology that ensures the transformation of production and the structure of the economy.[4] In the socio-political side of digitalisation, Glazyev highlights information security and surveillance systems, and, of course, the legal regulation of technology as new challenges for society. In addition, he highlights current trends, such as the development of blockchain technologies and, as an example, cryptocurrencies, as well as the Internet of Things, which, in his view, takes many processes out of national jurisdiction. The relationship between unemployment and technological development is also a relevant topic for domestic experts. For example, experts at the Higher School of Economics say that digitalisation is causing some professions to disappear, linking this to the automation of production and the move of many business processes online.[5]

In addition to the demise of a number of old professions, the digital economy is creating demand for new professions, leading to changes in education. With digitalisation, the workforce must have new competences and skills. In addition, we can say that the form of education itself is changing, as is particularly evident in the case of distance learning during the coronavirus pandemic.

As a rule, in foreign practice, the definition of the digital economy is limited to listing its components or those areas in which it is most widespread. As for more specific definitions, we can refer to the World Bank's definition: the digital economy is a new way of life that is based on knowledge and digital technology, and which creates new digital skills and opportunities for society, business and government. The World Bank also notes that the digital economy improves productivity by reducing costs and also helps to reduce inequalities in society.[6]

For a more succinct definition, I think we can look to the Organisation for Economic Co-operation and Development. The emphasis here is on the fact that it is based on intangible assets, and the widespread use of data, and furthermore, the digital economy is characterised by the fact

[4] Glazev S. Informatsionno-tsifrovaya revolyutsiya. YEVRAZSKAYA INTEGRATSIYA: ekonomika, pravo, politika. 2018;(1):70-83.
[5] Chto takoye tsifrovaya ekonomika? Trendy, kvalifikatsiya, izmereniye. Dokl. k KHKH apr. mezhdunar. nauch. konf. po problemam razvitiya ekonomiki i obshchestva, Moskva, 9–12 apr. 2019 g. / G. Abdrakhmanova, K. Vishnevskiy, L. M. Gokhberg. HSE — M.: Izd. dom Vysshey shkoly ekonomiki, 2019. — 82, [2] p.
[6] "World Bank Group. 2016. World Development Report 2016 : Digital Dividends. Washington, DC: World Bank. World Bank. URL: https://openknowledge.worldbank.org/handle/10986/23347

that it is quite difficult to define value creation. [7] Looking at the current stage, the Oxford experts highlight the following key technologies in the digital economy: mobile technology, cloud computing, business intelligence and social media. [8] These technologies are extraordinarily important in today's business processes. However, I would like to point out that this is by no means a complete list of the key components of the digital economy, which in recent years have been particularly active in a wide range of areas of life.

Today's experts and academics largely agree that e-commerce, Big Data, artificial intelligence and digital currency are also key components. Together, these technologies are leading the global economy into a new industrial transformation called Industry 4.0. This transformation is designed to automate many production processes, reduce costs and improve production efficiency.

The topic of rural development is always relevant for China, and digitalization provides new tools for the implementation of national rural development plans. It is worth looking at the development plans to highlight the key technologies that promote rural development. China has published its agriculture and rural modernization plan for the 14th Five-Year Plan (2021-2025).[9] According to the plan, after five years of effort, further comprehensive progress is expected in rural livelihoods and significant progress in agriculture and rural modernization. The authorities plan to coordinate rural development in an integrated manner, including land use, industrial development, residential development, improvement of the living environment, environmental conservation, disaster prevention and mitigation, and preservation of cultural heritage. The government notes the importance of a case-by-case approach in special cases, protecting traditional villages, ethnic villages, and limiting the merging of villages to create large settlements.

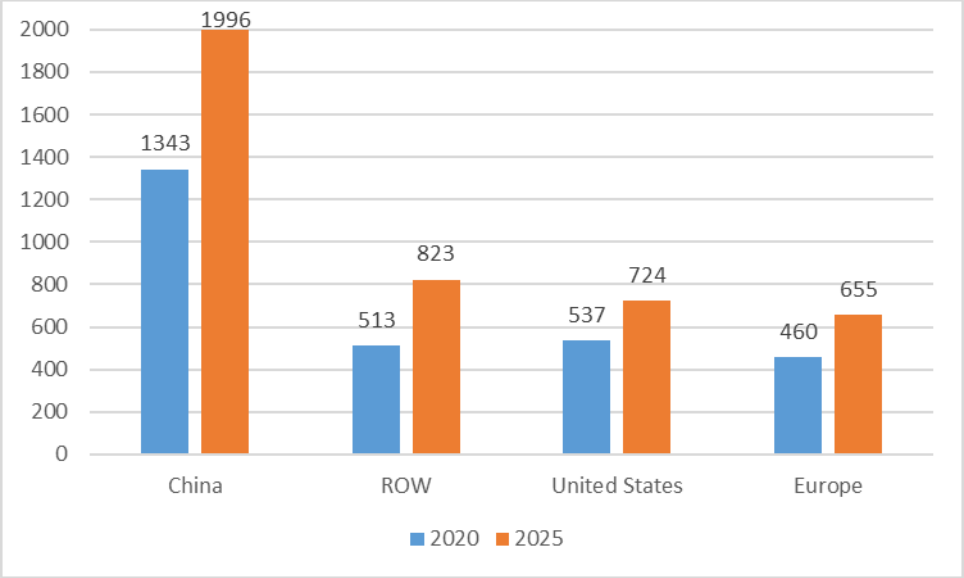
In addition, the Chinese authorities will promote the adoption of the same standards for basic public services and the same systems in urban and rural areas. It plans to improve service delivery in education, healthcare, elderly care, culture and other fields in rural areas. The authorities also want to promote exchange and rotation of teachers and doctors in the counties and encourage non-

[7] Addressing the Tax Challenges of the Digital Economy, Action 1 – 2015 Final Report. Paris: OECD Publishing, 2015.
[8] Oxford Economics (2011) The New Digital Economy: How it will transform business. Oxford Economics, A research whitepaper.
[9] China has published its agriculture and rural modernization plan for the 14th Five-Year Plan / The State Council of the People's Republic of China, 2022. URL: https://english.www.gov.cn/policies/latestreleases/202202/11/content_WS620654d4c6d09c94e48a4f38.html

governmental organizations to take charitable initiatives in rural areas. Finally, the plans include a drive to increase literacy in science and technology among the peasants.

One of the main conditions for the development of villages is to increase the income of local people as well as their standard of living. The rapid expansion of cross-border e-commerce has opened up opportunities for small and medium-sized enterprises to participate in global trade. In addition, e-commerce platforms themselves can be a tool to overcome the disparities in rural and urban development in China. Taobao villages, discussed in the next chapter, could be one such tool. The OECD provides a comprehensive definition of e-commerce: The focus of this definition is on transactions made through computer networks, which today mainly include the Internet. It also follows from the definition that the delivery of goods and services does not necessarily have to take place online.

E-commerce can thus be said to be based on the use of electronic media and the Internet to trade in goods and services. E-commerce refers to a company's recourse to the internet as well as to information technology such as electronic data interchange. E-commerce refers to an internet seller's website selling goods or services to a user directly from a platform. The gateway uses a wireless shopping cart or shopping cart to pay by credit card, debit card or electronic funds transfer. A further description is as follows: Electronic communications and digital information processes in business transactions are used to create, modify and redefine value relationships between organisations and individuals. With the spread of ICT, particularly the Internet, the global corporate world is rapidly evolving towards e-commerce. This is a global trend that suggests further growth in this sector; it is worth noting that China leads the world in terms of e-commerce revenue, far surpassing other countries. (Graph 1)



Graph 1. Total eCommerce revenue forecast (in billion USD)

Source: Statista Digital Market Outlook 2021[Graph]. In Statista. Retrieved May 29, 2022, from https://www.statista.com/outlook/digital-markets

As the Internet allows consumers to enter the global economy, they can compare prices in different regions, find out how they vary by demand, and learn about substitution. Consumers gain an undeniable advantage. Thanks to the openness of the marketplace, consumers can conveniently compare e-commerce offers on different websites. Competitors will immediately be one click away from the buyer if the company is e-commerce.

Some of the main benefits of e-commerce for consumers include the following:

- The ability to shop at a convenient time and place without having to physically visit retail premises.
- Access to a wide range of products, goods and services online.
- Opportunity to use a convenient way of payment.
- Wide range of companies to choose from.
- Ability to purchase foreign goods using cross-border e-commerce platforms.

From a business point of view, there are also a number of advantages of e-commerce:

- Reduces some of the costs associated with purchasing, storage and logistics.

- It speeds up the process of selling goods, thereby increasing the turnover of funds in the business.
- Allows companies to reach consumers in a larger territory, depending on delivery.
- Simplifies and speeds up communication with customers.

The government's plans include the improvement of the living conditions of rural residents, with the improvement of the healthcare system as one of its goals. It seems possible that digital health care can effectively help to improve the quality of services and increase the coverage of the population. Digital health has been described as a new stage and advancement on the evolutionary path of information and communication technology in health care, which represents a great leap forward and transcendent technology, rather than just the next technological step. Digital health as a new stage fits into what is widely referred to as the fourth industrial revolution - the use of big data, analytics and artificial intelligence, which are evolving in virtually every business sector.[10] The FDA considers digital health to include:

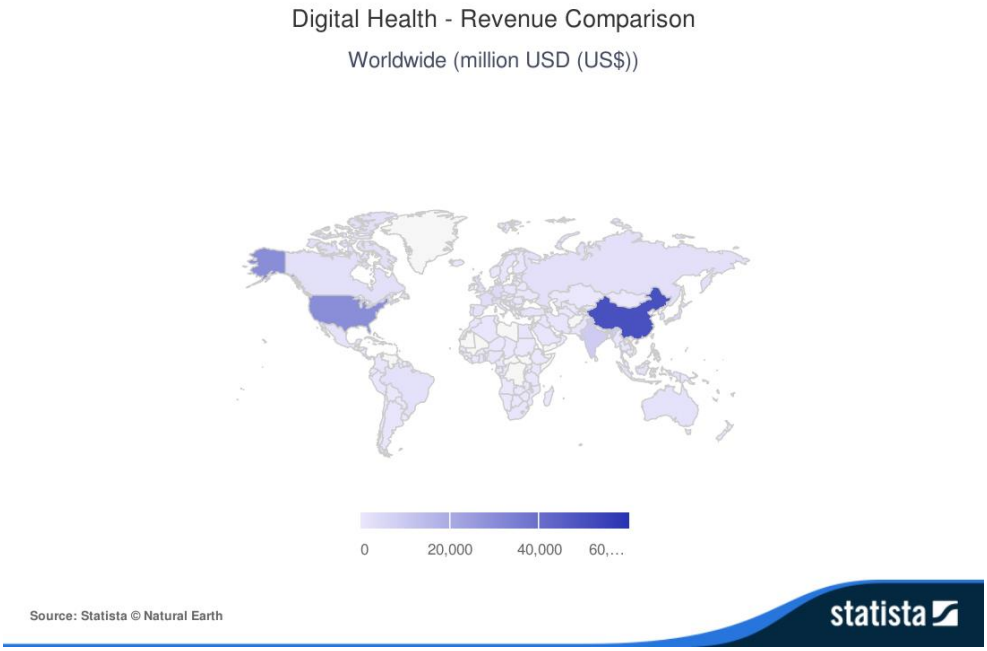
- mobile health (mHealth),
- health information technology (IT),
- wearable devices, telehealth and telemedicine, and personalised medicine.[11]

From mobile medical apps and software that support the clinical decisions doctors make every day, to artificial intelligence and machine learning, digital technology has become a driving force behind the healthcare revolution. Digital health tools have enormous potential to improve our ability to accurately diagnose and treat disease, and to improve the delivery of care to everyone.

Digital health technologies use computing platforms, communications, software and sensors for health and related purposes. These technologies have a wide range of applications, from general wellness to use as medical devices. They include technologies intended for use as a medical product, as part of a medical product, as a companion diagnostic tool, or as a complement to other medical products (devices, drugs and biologics). They may also be used for the development or research of medical products.

[10] Snowdon A. Digital Health: A Framework for Healthcare Transformation / HIMSS, 2020. 69pp. 5p.
[11] What is Digital Health? / US Food and Drugs Administration, 2020. URL: https://www.fda.gov/medical-devices/digital-health-center-excellence/what-digital-health

It is worth noting that it is China that is the top digital health market in the world, with total industry revenues of almost $50 billion, followed by the US with almost $30 billion. (Graph 2)



Graph 2. Revenue comparison on Digital Health by country (million USD)

Source: Statista Digital Market Outlook 2021[Graph]. In Statista. Retrieved June 10, 2022, from https://www.statista.com/outlook/dmo/digital-health/worldwide

The government also plans to actively develop education in rural areas, but due to many difficulties, including transport accessibility, not all children are fully included in education. The introduction of digital education could enable people in remote areas to receive knowledge, including from experts in big cities, through online lessons. The University of Edinburgh formulates its definition as follows. Digital education is the innovative use of digital tools and technologies during teaching and learning, and is often referred to as Technology Enhanced Learning (TEL) or e-Learning. Exploring the use of digital technologies gives educators the opportunity to design engaging learning opportunities in the courses they teach, and these can take the form of blended or fully online courses and programmes.[12]

[12] McLaughlin Сю What is digital education? / The University of Edinburgh, 2018. URL: https://www.ed.ac.uk/institute-academic-development/learning-teaching/staff/digital-ed/what-is-digital-education

The concept of digital learning is not new and has existed in various forms for many years, but the COVID-19 pandemic has had a significant impact by bringing education online. One of the key reasons for the development of online education is that the Internet has become much more accessible and affordable, and this has led to a greater fusion of digital and traditional learning methods.

1.2. Review of current studies

In order to determine the direction of research, and to use the findings of academics for their own research, it is necessary to examine the current state of research by other economists.

For example, Hong J. and Murmann J.P. in their article "The Rise of China's Digital Economy: An Overview" conduct a comparative analysis of China and the United States in one key area of the digital economy - e-commerce and Internet services.[13] Since the issue of definitions is traditionally acute for the digital economy, it is interesting to see that the authors consider it appropriate to limit the discussion in this paper to four types: (1) Internet access services, which are typically provided by telecommunications companies, (2) Internet platform services and value-added applications, which include business-to-business and customer-to-customer services (eBay and Taobao) (3) Internet search services (e.g. Google, Baidu), and (4) Internet content services including audio, video, online games and news.

In the article, the authors note that China is rapidly gaining momentum and leading online retail sales by a wide margin, accounting for more than half of global online retail sales in the past three years. In addition to e-commerce, China is also emerging as a global force in social media, digital finance, cloud computing and other Internet platform services, according to the authors.

However, the authors show that the US is further along in the field of general-purpose technologies that have the potential to change the digital economy landscape at the root level. General-purpose technologies are technologies that can be used in a wide range of industries and create strong spin-offs. While several Chinese players are leaders in several general-purpose areas such as 5G, the US giants, along with their European and Japanese allies, retain advantages in various important areas. The article points to a promising area for Chinese companies: artificial intelligence, where China could contribute more in some areas, such as facial recognition.

Speaking of the findings, Hong J. and Murmann J.P. write that China still lags behind the US in Internet penetration, but it is different in that it is building a mobile, fibre-optic and inclusive digital infrastructure. Favourable infrastructure, innovation tailored to the large Chinese market and the rapid commercialisation of products and services by local companies have turned the

[13] Hong Jiang and Johann Peter Murmann (2022). "The Rise of China's Digital Economy: An Overview ". Management and Organization Review 18:4, August 2022, 790–802

world's largest domestic population into active online consumers, making China by a wide margin ahead of the US in retail e-commerce and digital payments. From the perspective of the difference in successful technologies, the article concludes that while China has embodied digital technologies in leading customer-to-customer and customer-to-customer businesses, it has not been as successful in business-to-business services. The US is still ahead in general-purpose technology underpinning the digital economy. The authors thus provide a comparative analysis in the selected sectors, but do not reveal the specifics of the development of the US and Chinese digital economies.

A very important aspect of China's digital economy is its relationship to the concept of the circular economy. In their article "Circular economy and digital technologies: a review of the current research streams" Trevisan A., Zacharias I., Liu Q., Yang M. and Mascarenhas J. write that the concept of the circular economy has attracted the attention of academics, business and governments in recent years, and that the circular economy is a concept that involves "a regenerative system in which resource consumption and waste, emissions and energy leakage are minimised by slowing, closing and contracting material and energy loops.[14] It opposes the linear model of consumption and advocates a resource-based approach in which value creation is decoupled from raw material extraction by slowing down and closing loops. The authors note that this idea extends to both biological cycles and technical cycles at different levels of application, i.e. at the micro, meso and macro levels.

The article says that digital technologies have shown promise in accelerating the transition to a circular economy at all levels. At the micro level, which is limited to a single company, the Circular Economy is associated with business model innovation. Digital technologies are used to achieve and exploit the goals of the circular economy through linked capabilities such as monitoring, control, optimisation and automation.

Moreover, the authors suggest that digital technologies have demonstrated potential synergies for achieving circular economy objectives at the micro, meso and macro level. Although there are several studies in the literature on the relationship between digital technologies and the circular economy, they have not been identified by major research themes. Thus, this research

[14] Adriana Hofmann Trevisan, Isabela Simões Zacharias, Qinglan Liu, Miying Yang and Janaina Mascarenhas (2021). "Circular economy and digital technologies: a review of the current research streams". Proceedings of the Design Society , Volume 1: ICED21 , August 2021 , pp. 621 - 630

paper identifies the main research areas on the circular economy and digital technologies. Through a systematic literature review and content analysis, the authors reviewed 40 articles and classified three main research areas. (1) Industry 4.0 (I4.0) focuses on the relevance and role of I4.0 in the transition to CE. (2) The Business research stream assesses the relationship between digital transformation and business. (3) The Sustainability research stream discusses sustainability issues such as waste management and smart cities.

In addition to these areas of research, I find the use of AI technology, digital education and the imbalance in technology penetration between urban and rural areas extremely interesting.

This is how the authors Yan S. and Yang Y. take up the topic of digital education in their study 'Education Informatization 2.0 in China: Motivation, Framework, and Vision'. In the research, the authors begin by noting that the combination of modern educational technology and education first emerged in China in the form of 'audiovisual education'.[15] The authors point out that over the next 30 years, the informatization of education in China has made significant advances. The authors cite examples of these achievements, namely the initial formation of a nationwide education information infrastructure system, construction and connection of campus networks in schools of all levels and types in cities and economically developed areas, continuous enrichment of digital educational resources, effective expansion of information learning, initial improvement of education informatization management, sustainable development of online distance education.

Yan S. and Yang Y. point out that based on the comprehensive development of informatization of education in China over the past 30 years, the Chinese Ministry of Education published a Ten-Year Plan for Informatization of Education (2011-2020) in 2012. It establishes a "two-stage" strategy for the development of informatization of education in China. The first step focuses on creation and application. The second step involves achieving integration and innovation. By 2017, the first step has been completed, which according to the authors means the goal of China's education informatization 1.0 has been achieved.

The study provides evidence that, to accelerate education modernisation, promote education informatisation in a new era and create a new engine of innovation, the Ministry of Education

[15] Shouxuan Yan, Yun Yang (2021). "Education Informatization 2.0 in China: Motivation, Framework, and Vision". ECNU Review of Education 2021, Vol. 4(2) 410–428

published an Education Informatisation 2.0 Action Plan in 2018, combined with targets related to key strategies for the national Internet+, big data and a new generation of artificial intelligence. It thus proposed a framework for action, leading the authors to conclude that China has entered the era of informatization of education 2.0. It is noted that the Action Plan for Informatization of Education 2.0 proclaims the goal that by 2022, teaching will be applied by all teachers, learning will be applied by all school-age students, digital campus construction by all schools, the application of informatization and information literacy by teachers and students in general will increase, and an "internet+education" platform will be established.

The authors point out that although the informatization of education in China has developed rapidly and achieved significant results, in general, information technology remains largely a mere tool-level application. The study points out that the revolutionary impact of information technology on education modernization has not been fully demonstrated. According to the authors, the low level of informatization of education makes it difficult to implement education modernization by 2035. One of the conclusions is that in the next 15 years, informatization of education 2.0 in China will certainly be a new national initiative to achieve education modernization by 2035.

Speaking about the development prospects, the authors point out that the informatization of education 2.0 in China is driven by innovative ideas to further coordinate the relationship between artificial intelligence technology and education. Based on a comparative analysis with the informatization of education 1.0 in China, the informatization of education 2.0 in China is clearly not a technology upgrade but a concept upgrade. According to the authors, the main reason is that the scientific and technological revolution has triggered profound reforms in politics, economy and culture. Such changes have created new requirements for nurturing talent, which can only be met if educational development is driven by innovation rather than the application of technology, the article notes.

This research paper will look at the international dimension of China's digital economy, but it does not look at major integration projects. Authors Su C. and Flew T. in their article "The rise of Baidu, Alibaba and Tencent (BAT) and their role in China's Belt and Road Initiative (BRI)"

examines the relationship between China's largest IT companies and the government.[16] In addition, the article analyses the role of these companies in the One Belt, One Road project, which is Xi Jinping's most important foreign economic and foreign policy project. The author notes the significant interest of the PRC authorities in using the potential of these companies to develop digital infrastructure as part of the Digital Silk Road project.

Su C. and Flew T. point out that while the Chinese authorities are interested in the development of these companies, their successes often give rise to apprehension and a desire to control and regulate their activities. However, the author stresses that such tensions between digital giants and national governments are not unique to China. As digital companies operate on a transnational scale, the tension between capital and state power is a dynamic interaction that occurs all over the world.

The authors write that China's internet giants have collectively contributed to BRI in the areas of cloud and payment services as part of the internet infrastructure of the digital Silk Road. While Chinese authorities hope to improve BRI's development with Baidu, Alibaba and Tencent, the growing combined power of these companies remains a source of concern. Regardless, the article writes, the companies' promotion of the Belt and Road has accelerated China's rejuvenation.

In economic terms, e-commerce and mobile payment services are BRI's backbone technologies and contribute to economic growth in the region. An interesting point of the article can be found in the findings on the impact on China's soft power promotion. The authors find that culturally, the advanced companies Baidu and Tencent, which digitize traditional culture, are contributing to BRI's cultural sector, echoing the national plan to revitalise Chinese culture. The combination of companies and authorities has also accelerated development in regional regions.

The article refers to a certain system of mutual interests that binds China's big IT giants and the government, as the state relies on companies to build digital infrastructure, and companies rely on the state to allow them to operate as loosely regulated national oligopolies. From this perspective, according to the authors, the BRI represents an opportunity for companies to increase their influence abroad in tandem with government policy. BRI provides an opportunity for

[16] Chunmeizi Su and Terry Flew (2021). " The rise of Baidu, Alibaba and Tencent (BAT) and their role in China's Belt and Road Initiative (BRI)". Global Media and Communication, 2021. Vol. 17(1) 67–86

cooperation between government and corporations, but also the potential for circumventing government demands for greater control.

One of the most extensive topics for research on the digital economy in China is the digital yuan. Duggal M. in the article "The Dawn of the Digital Yuan: China's Central Bank Digital Currency and Its Implications» focuses on the ongoing development of China's central bank digital currency, the digital yuan. The author notes that the COVID-19 pandemic stimulated digital innovation and proved to be a boon to the technology industry. Even before the pandemic, however, central banks were exploring digital currencies.[17] The author writes that while more than 80% of the world's central banks are engaged in CBDC research and 40% are working on pilot programmes, the People's Bank of China (PBoC) is leading the way.

The article discusses the digital currency launch test regimes, with the author writing that to realize the idea of introducing the digital yuan, China's Central Bank has conducted many large-scale tests with massive incentive package payments in major cities with major national and multinational retailers. A notable feature of the article is the great emphasis placed on the issue of overseas use of the digital RMB. The author notes that the digital renminbi is the next major milestone in achieving the goal of internationalising the Chinese renminbi, which has been the main objective since the 2009 financial crisis, increasing the global circulation of the renminbi; this will allow Beijing to hedge against the global hegemony of the US dollar.

The article also points to a specific digital currency promotion project. The Belt and Road Initiative (BRI) is central to this goal: the DCEP can be incorporated and promoted through transactions made within BRI corridors. This cross-border use of the digital renminbi could also critically enhance China's technological control and surveillance capabilities beyond its borders, posing a security challenge for BRI member states as well as other trading partners.

However, the author also draws attention to the domestic use of the digital renminbi, thereby underlining its consistency with the ideas of 'double circulation'. Internally, the DCEP is part of the efforts of the Chinese Communist Party (CCP) to "digitalise" and "intellectualise" public and private institutions, the economy and society. In practice, however, the DCEP can act as a means

[17] Mahima Duggal « The Dawn of the Digital Yuan: China's Central Bank Digital Currency and Its Implications», 2021. Institute for Security and Development Policy, ASIA PAPER June 2021

to monitor the Chinese population and allow the CCP to further consolidate its power by reinforcing its digital authoritarianism.

It is also interesting to consider articles that examine the impact of digitalization on different sectors of the economy. For example, the authors Cui C. and Yan Z. in their article "Does the Digital Economy Promote Domestic Non-Tradable Sectors?: Evidence from China" note that the literature on how the digital economy has changed domestic non-tradable sectors is limited, although the Chinese government is seeking to scale up the domestic market to match the digitalisation trend.[18] This paper examines this issue using a range of prefecture-level city data from 2010 to 2019 in China. Using fixed-effects panel data methods, synthetic difference-in-differences and time-space econometrics, the paper's hypothesis sheds light on the positive impact of the digital economy on domestic non-traded sectors.

The authors write that there is disagreement among scholars as to whether domestic non-traded sectors (DNS) benefit from the digital economy. Of course, domestic non-traded sectors, such as local suppliers of goods and services, investment or public infrastructure, are necessary to enhance a country's economic strength and quality of development. The authors ask the question: can domestic non-traded sectors benefit from the trend of digital transformation in the same way as the international trade sector? This paper attempts to find evidence to answer this question.

In this paper, the authors attempted to determine the impact of digital economy on DNS based on prefecture-level city data from 2010 to 2019. In the paper, the authors see this work as a first step in calculating the adoption of DEI from the main indicators of digital infrastructure in China to observe the level of digital economy development in 283 cities in China. The authors then chose DNS as an indicator to assess the scale of local market without international trade sector, and developed a methodology to investigate the impact of digital economy on DNS.

The main results of the paper show that the growth of DNS has been influenced by the deepening digital economy over the past decade in China. The results showed that the development of the digital economy plays a crucial role in the growth of the DNS in China. Policymakers who have proposed a new model of "dual circulation" development are paying attention to the implementation of digitalization strategy to create a new engine of economic activity.

[18] Chunying Cui and Ziwei Yan (2023). " Does the Digital Economy Promote Domestic Non-Tradable Sectors?: Evidence from China". Sustainability 2023, 15, 2617

In addition, the authors uncovered temporal and spatial correlations between neighbouring cities in developing the digital economy and other macroeconomic factors that can improve DNS. Municipalities should develop a comprehensive digital economy plan and help neighbouring cities to actively reinforce digital economy development to realize win-win interprovincial trade.

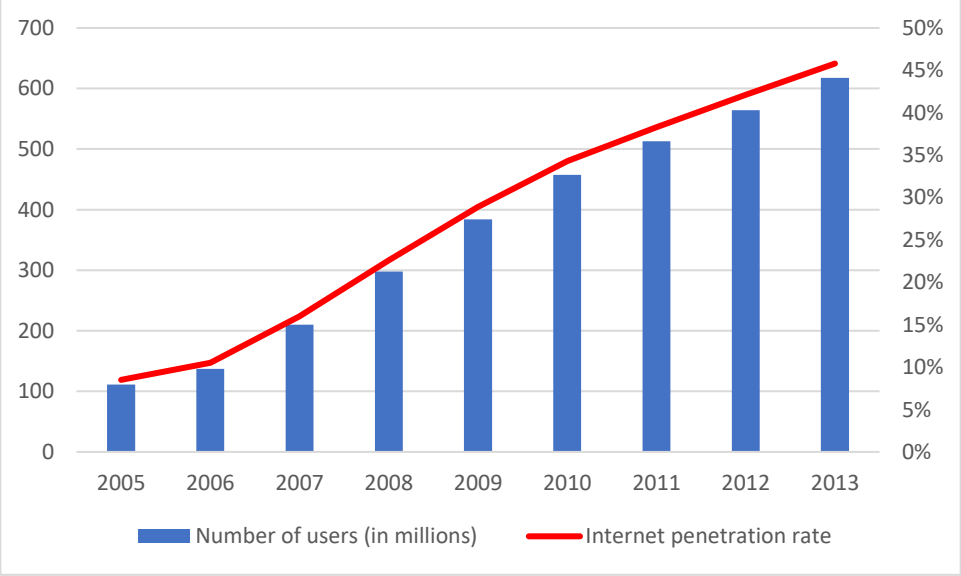
The regression results showed that the impact of the digital economy on the growth of domestic non-traded sectors improved by 14.84%. The policy effect increased the average treatment effect by 3.9%, accompanied by temporal and spatial correlations. Further analysis showed that a possible intermediate mechanism through which the digital economy contributes to the development of domestic non-traded sectors is the enhancement of the local product market. It was concluded that policymakers in developing countries should dedicate themselves to removing domestic trade barriers between different regions in order to enhance the benefits of digitalization.

2. CURRENT TRENDS IN THE DEVELOPMENT OF THE DIGITAL ECONOMY IN THE PRC

2.1. China's digital economy development: stages, factors, features and challenges

Among the development phases of the past 20 years, the period 2000-2015 can be distinguished as the nascent Internet technology and development prerequisites in China.

In the first period, key policy documents include: "Opinions on Accelerating E-Commerce" issued in 2005,[19] and "Guidelines on Internet Promotion" from the State Council. These initiatives were primarily aimed at developing the internet and nascent platforms that encouraged online commerce. Already in these documents, the need for appropriate legislation, investment incentives, tax breaks, and direct state support through state-owned companies was enshrined. The gradual development of the internet and its penetration in China has been rapid, and the Graph 3 shows that by 2013 the number of internet users in the country exceeded 615 million.

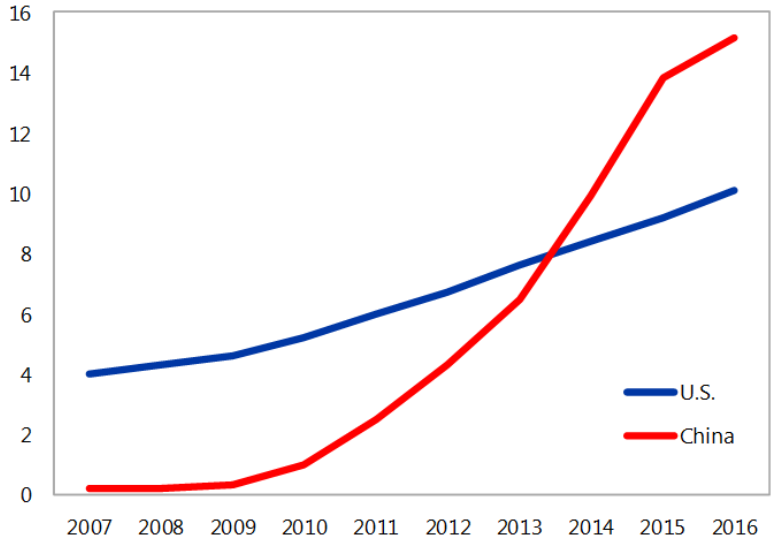


Graph 3. Chinese internet population in millions (blue bars, left scale) and Internet penetration rate (red line, right scale)

[19] 国务院办公厅关于加快电子商务发展的若干意见 / The State Council of People's Republic of China, 2005. URL: http://www.gov.cn/zhengce/content/2008-03/28/content_3862.htm

Source: China Internet Network Information Center (CNNIC), 2013 [Graph]. In Econsultancy. Retrieved May 3, 2023, from https://econsultancy.com/ecommerce-in-china-25-stats-that-highlight-one-big-opportunity/

E-commerce penetration has also grown rapidly in China. As early as 2013, it began to exceed that level in the US, as Graph 4 shows. China has thus overtaken the US in this aspect, significantly increasing the share of e-commerce sales.



Graph 4. Share of e-commerce in total retail sales (in %)

Source: Alibaba, 2019 [Graph]. In VoxChina. Retrieved May 3, 2023, from https://voxchina.org/show-52-139.html

The current stage of the digital economy dates from 2015, when China started to hasten the growth of its own innovation. China advanced the "Digital China" initiative after 2015, entering the third stage of the digital economy. China's policy at the time, known as the "Internet Plus initiative," aimed to connect traditional industries to the Internet. This encouraged the use of information technology (cloud computing, big data, and the Internet of Things) in more sectors, including manufacturing, banking, agriculture, health care, and government, among others.

The Internet Plus initiative aimed to connect Chinese business to the rest of the world as well as promote economic growth. The policy documents state that the promotion of "governance via Internet Plus" is important for transforming government functions, enhancing the efficiency and

transparency of public services, further stimulating market vitality, and fostering social creativity in addition to being essential for streamlining governance reform, strengthening supervision, and streamlining services.

According to papers from the PRC State Council, the relevant State Council departments and provincial governments will set up an integrated online public service platform by the end of 2017 that will thoroughly highlight public service difficulties and considerably raise service quality. A national "Internet plus governance" system will also be put in place by the end of 2020 to make public services "smarter" and to offer more convenience and efficiency for both enterprises and individuals. The central government's 2017 report for the first time included the digital economy, which is seen to have laid the groundwork for China's digital economy policy.[20]

In his government work report from March 2015, Chinese Premier Li Keqiang put forth the idea and strategy of applying the internet and other information technologies, like cloud computing and big data, to traditional industries like manufacturing, energy, and agriculture. In order to maintain strong growth rates, China had to find a new economic engine to replace cheap local labor and capital investment. Given that China's economic prognosis was gloomier than it had been in the preceding two decades, it was believed that digital transformation in all industries was the key to China's economic transformation.

In addition, China used to be positioned in the international community as a catch-up country, but all that has changed, and now the Celestial Empire aspires to become a global technological leader. The Chinese authorities made this explicit in 2015, when they presented the country's innovative development plan "Made in China 2025" at a meeting of the Chinese State Council. Under the plan, 15 manufacturing innovation centres will be established by the end of 2020 and around 40 by 2025. The main focus is on developing the next-generation IT industry (aka Industry 4.0) that was discussed before.[21] And the field of digitally controlled equipment and robotics will also be actively developing. Obviously, not all countries are ready to cede their leadership to China without a fight, which has led to a confrontation between the US and China.

[20] China to step up efforts to promote internet-based governance / The State Council of People's Republic of China, 2016. URL: http://english.www.gov.cn/policies/latest_releases/2016/09/29/content_281475454498314.htm
[21] Made in China 2025 / The State Council of People's Republic of China, 2016. URL: https://english.www.gov.cn/2016special/madeinchina2025/

The central government of China has prioritized the digital economy as a crucial element of the nation's policy agenda because it has emerged as a significant driver of economic growth in the country. The digital economy was one of China's primary economic goals for the years 2021–2025 as well as one of its long-term objectives for 2035 in the 14th Five-Year Plan. The two primary economic types recognized by the Chinese government, the agricultural and industrial economies, were also emphasized as being crucial for the development of the digital economy.

Additionally, the State Council published plans for the digital economy in January 2022, which confirmed that China's digital economy should be in full expansion mode, with the added value of major digital economy industries reaching 10% of the nation's GDP by 2025, and significant progress will be made in integrating digital technology with the "real economy".[22] Similar province and city-level digital economy plans have also been launched to build the local digital economy at the provincial level, following the central government's Plan.

China's Belt and Road Initiative (BRI), which has a digital component called the Digital Silk Road, involves financial investments in nations that are part of the initiative's logistics routes as well as in telecommunications, science, and smart economies. China's most well-known global digital economy program, the Digital Silk Road, was introduced in 2015 with the purpose of fostering greater digital connectivity and collaboration.

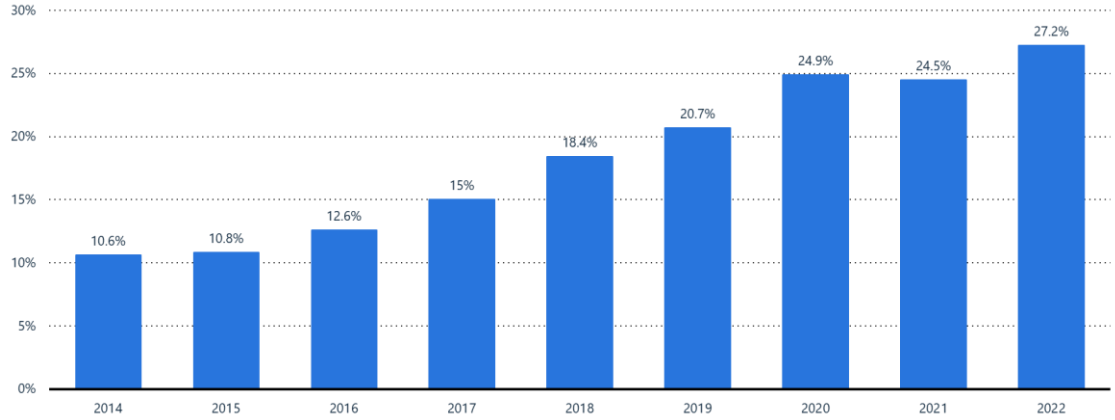
Among the factors of China's successful development of its digital economy are the effective use of technology borrowing in the pre-2015 period, as well as the active involvement of foreign specialists. This allowed China to obtain advanced Western technologies as quickly as possible, as well as to adapt them to its domestic needs.

A bigger state role in developing the digital economy strategy, supporting players in critical industries, and effective coordination between the national government, local governments, and businesses across the nation are all crucial. Prior to 2020, China's economic and industrial policies offered a welcoming and beneficial environment for businesses embracing innovation and digital technologies. The main goals of China's policies and initiatives were to promote and facilitate digital transformation. China's digitalization is based on an enterprise-driven model, in which

[22] Plan focuses on digital economy development during 14th Five-Year Plan period / The State Council of People's Republic of China, 2022. URL: https://english.www.gov.cn/policies/latestreleases/202201/12/content_WS61de9a35c6d09c94e48a385f.html

internet titans Baidu, Alibaba, and Tencent are constructing a vast digital ecosystem encompassing entertainment, retail, finance, transportation, and food delivery.

Of course, China also has an important success factor in the form of the country's large population that actively uses digital solutions in their daily lives. For example, we see a rapid increase in the share of e-commerce in sales in Graph 5. Moreover, in 2022 around 911 million people used mobile payments in China.[23]



Graph 5. E-commerce share of total retail sales in consumer goods in China from 2014 to 2022 (in %)

Source: National Bureau of Statistics of China, 2023 [Graph]. In Statista. Retrieved May 3, 2023, from https://www.statista.com/statistics/1129915/china-ecommerce-share-of-retail-sales/

China's digital economy does face certain difficulties, though. Compared to wealthy nations, the digital economy is still under-penetrated. China's digitalization rate in the three sectors (primary, manufacturing, and tertiary) is expected to be 8.9%, 21.0%, and 40.7% accordingly in 2020, according to the Chinese Academy of Information and Communication Technology (CAICT), compared to 23.1%, 45.3%, and 60.4% in Germany in 2019.[24]

The digitalization of the Chinese economy is also unevenly spread across sectors, with the service sector experiencing a higher level of digitalization than the manufacturing and agricultural sectors. Additionally, impeding sector expansion, the geographical imbalance in China creates a

[23] 51st Statistical Report on China's Internet Development / China Internet Network Information Center, 2023. URL: https://www.cnnic.cn/NMediaFile/2023/0322/MAIN16794576367190GBA2HA1KQ.pdf
[24] 全球数字经济新图景 -大变局下的可持续发展新动能 / China Academy of Information and Communications Technology (CAICT), 2020. URL: http://www.caict.ac.cn/kxyj/qwfb/bps/202010/P020201014373499777701.pdf

digital divide across the country. In comparison to central and western provinces and rural areas, digital penetration has been high in eastern provinces and important cities like Beijing, Shanghai, Guangdong, Jiangsu, and Zhejiang.

For a long time, China's economic policy supported information technology and the internet economy, but concerns about monopoly power in this sector were raised as a result of the huge technology corporations' explosive expansion. The Chinese authorities have called attention to the issue of Chinese users' data protection in addition to issues with competition: Large volumes of personal data about Chinese residents have been gathered and held by IT businesses, which the authorities claim is not in keeping with national security.

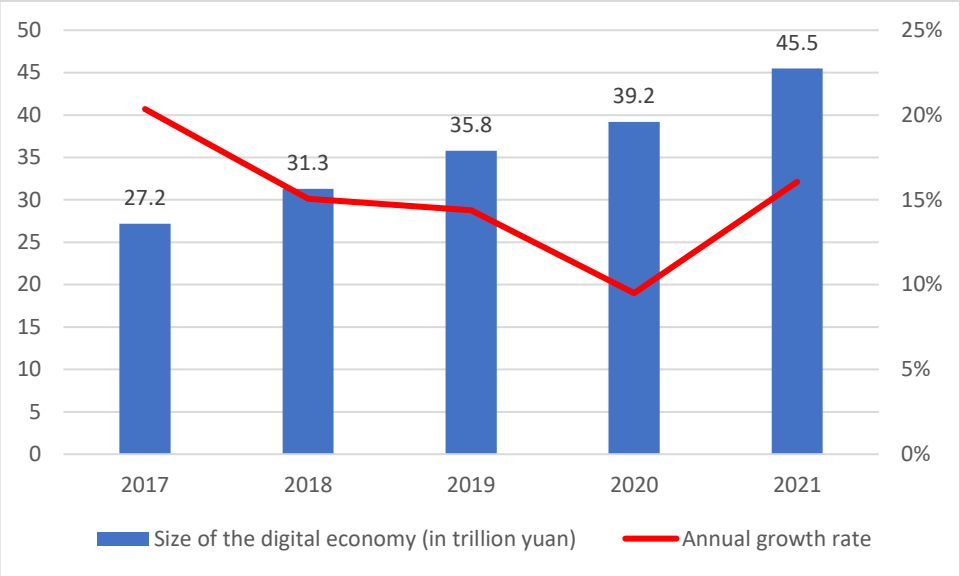
China's tightening and inspections of tech firms (such as Didi, Tencent, and Alibaba) point to a change in digital policy that will have a substantial impact on the sector of the digital economy. Increased government monitoring is anticipated during this period, particularly for foreign businesses, businesses with foreign money, and businesses listed on international stock exchanges.

Additionally, China and the US have been engaged in a technical arms race as a result of China's desire to expand its worldwide dominance in the digital economy and key technologies. As a result, businesses should be aware of the difficulties and possibly steer clear of high-risk sectors when traversing the Chinese digital economy environment, but they should also take advantage of some opportunities, such as those in cross-border e-commerce, fintech, artificial intelligence technology, and 5G applications. China is a global leader in several industries, and in some cases, Chinese businesses are setting the pace.

However, confrontation with the U.S. could play a crucial role in China's digital economy. In 2023, US President Joe Biden is talking about imposing restrictive measures on US investment in the Chinese technology sector, which should help contain the PRC. In addition to the potential loss of US investment in the sector, there are great risks of disrupting production chains due to the threat of a potential conflict in Taiwan due to the supply of microchips. China is trying to provide itself with microchips, but it cannot yet be on its own when it comes to supplying its high-tech companies with chips. All of this should encourage China to develop its own chip manufacturing and build an independent digital infrastructure.

China's digital economy is currently in a growth phase, and there is huge potential for the digitalisation of various industries. According to the Chinese Academy of Information and

Communications Technology, China's digital economy will exceed 45.5 trillion yuan in 2021, as shown in Graph 6, which is more than double what it was at the beginning of the 13th Five-Year Plan and will account for 39.8% of GDP, 1.2 percentage points higher than in 2020.[25]



Graph 6. Size of the digital economy in trillion yuan (blue bars, left scale) and Annual growth rate (red line, right scale) in 2017-2021 in China

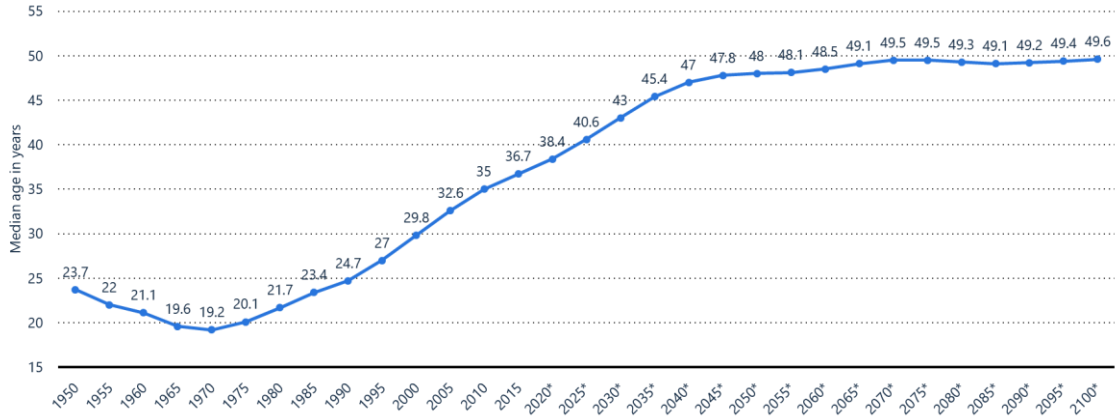
Source: 国内 B2B 电子商务龙头，紧跟数字化浪潮高速成长 / Ping An Securities Institute, 2023, p. 14. [Graph]. In Wind Financial Terminal.

Also in the graph above, you can see a downturn in the annual growth rate of the digital economy. However, the coronavirus pandemic has brought many changes to a number of sectors of the digital economy. Business processes have been changed, new technologies have been applied and new lines of business have proliferated, which will be discussed below.

[25] China's digital economy hits 45 trillion yuan / Xinhua, 2022. URL: http://english.scio.gov.cn/chinavoices/2022-11/10/content_78511347.htm

2.2. Impact of the COVID-19 on the development of the health and education sectors

The PRC faces new challenges, for example, China may soon face an unprecedented period of an ageing population and rising healthcare costs. By 2030, the country will have around 300 million people aged 65 and over, up from around 187 million in 2020. The population of people over 60 years old in China is projected to reach 28% by 2040, due to longer life expectancy and declining fertility rates.[26] Health care costs are rising rapidly with age, as seen in Japan, where patients aged 65 and over accounted for about 60% of such costs in 2014, according to WHO and the Japanese Ministry of Health. At the same time, the median age of China's population will rise, which will also require government attention. (Graph 7)



Graph 7. Median age of the population in China from 1950 to 2100 (in years)

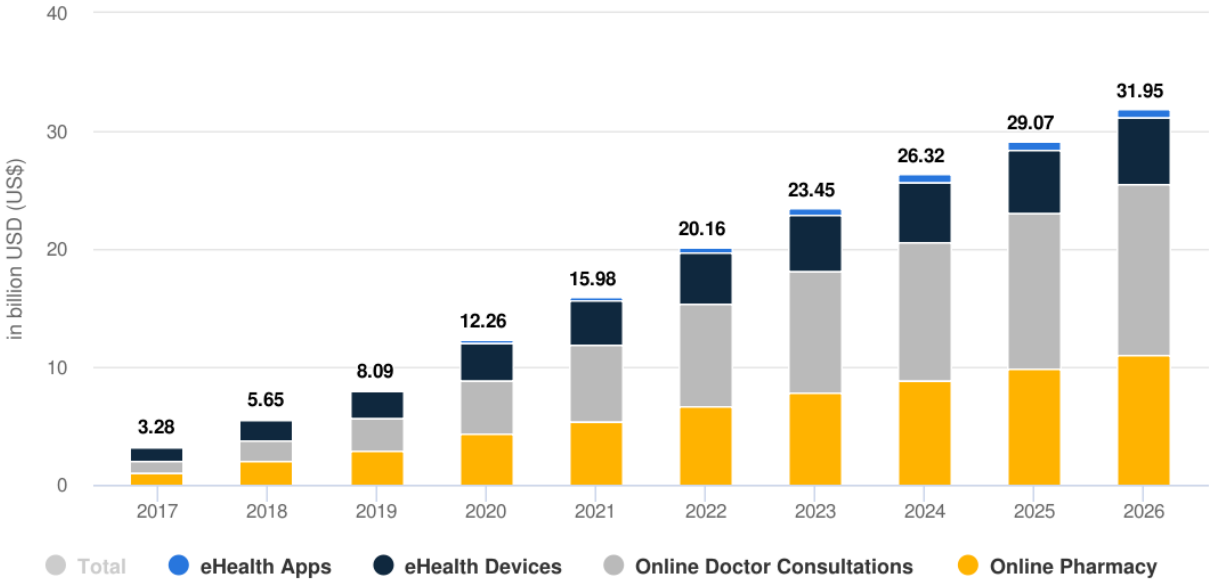
Source: United Nations, 2022 [Graph]. In Statista. Retrieved June 12, 2022, from https://www.statista.com/statistics/232265/mean-age-of-the-chinese-population/

High-end medical imaging and radiology equipment, where technology is still inferior in China, may be needed to address the challenges in healthcare, which may lead to greater reliance on imports. Although the government is unlikely to raise import tariffs significantly, it may continue to pursue policies that encourage public hospitals to choose domestic brands over imported ones in order to preserve profits and investment. Over the past decade, China has provided 509.8 million rural residents with access to basic healthcare services. By the end of 2021,

[26] Ageing and health / World Health Organization, 2021. URL: https://www.who.int/china/health-topics/ageing#:~:text=China%20has%20one%20of%20the,expectancy%20and%20declining%20fertility%20rates.

there were 23,000 county-level health units, 35,000 village-level health units, and 599,000 village-level health units.[27] However, telemedicine is also needed for rural areas, which will make it possible to provide care without the time spent on travelling.

China's telemedicine industry reached an inflection point in 2020 as a government push amid the pandemic reaffirms its longer term growth prospects. The market size is expected to reach 200 billion yuan in 2021. Some experts believe nearly a third of medical consultations could be shifted online by 2026, driven by common diseases and follow-up consultations for chronic illnesses management. There are more modest forecasts, however, which also underline the growth potential of online counselling. (Graph 8)



Graph 8. eHealth revenue by segment with forecast to 2026 (in billion USD)

Source: Statista Digital Health, 2022. [Graph]. Retrieved June 12, 2022, from https://www.statista.com/outlook/dmo/digital-health/ehealth/china#revenue

E-commerce giants including Alibaba, JD.com and Tencent are also pouring in money to create health-care ecosystems online, which helps grow the e-pharmacy industry. Alibaba Health

[27] China ensures healthcare access for all 510 mln rural residents / Xinhua, 2022. URL: https://english.news.cn/20220524/350c1a2c873b41fc9df013964b890fc2/c.html

could emerge as the dominant e-pharmacy, supported by its parent Alibaba's e-commerce platform and financial-services capabilities.

Online health-care service providers such as Tencent-backed WeDoctor could be China's solution to easing its congested hospital system. Patients tend to go to top-ranked tertiary hospitals irrespective of severity because such facilities tend to be better equipped and have the most reputable doctors. This gives rise to WeDoctor's online registration service, which allows users to research doctors and make appointments. The platform also enables the concept of primary care, which could take the load off hospital visitations and at the same time help doctors build reputations, eventually diverting patients to lower-tier hospitals.

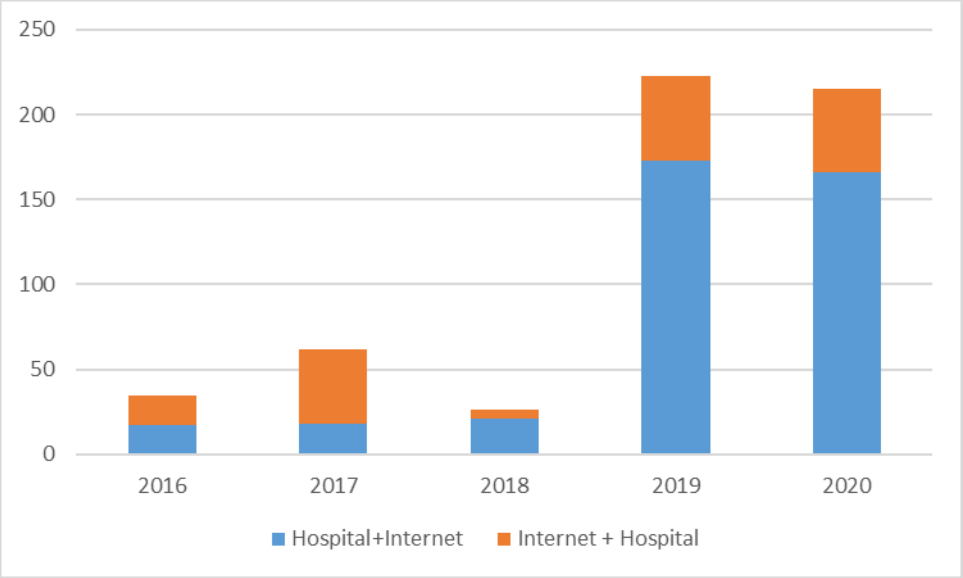
Chinese researchers point to the relationship between Internet+ and health care, which has been combined with the Internet to create the Internet + Health Care Project (IPHC).[28] The authors formulate IPHC as a new application of the Internet in health care, which includes medical education, health information requests, electronic health records or electronic medical records (EHR/EMR), disease risk assessment, online disease counselling, electronic prescriptions, remote consultations and various remote forms of health services such as treatment and rehabilitation.

Their key findings reflect that healthcare development will focus on technology and infrastructure, which make up a relatively high proportion (30%) of supply-driven policies; however, the importance of these policies in relation to new technologies needs to be improved. The authors note that healthcare organisations that provide patients with online health communities should pay more attention to developing tools that will make internet searches more efficient. Given the role of cloud computing, big data, artificial intelligence, 5G and other emerging technologies in facilitating the positive development of IPHC, future policies should closely monitor technology trends and provide forward-looking and innovative guidance for IPHC development.

As part of this initiative, online hospitals are being opened in China. (Graph 9) There are two types of hospitals:

- Hospital + Internet – associated online hospitals under the offline medical institution.
- Internet + Hospital – independent online hospitals affiliated to medical institutions.

[28] Yang F., Shu H., and Zhang X. Understanding "Internet Plus Healthcare" in China: Policy Text Analysis / Journal Medical Internet Res. 2021 Jul; 23(7): e23779. URL: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8367124/



Graph 9. The number of Internet hospitals opened

Source: Internet Hospitals in China / Deloitte, 2021. Retrieved June 12, 2022, from https://www2.deloitte.com/content/dam/Deloitte/cn/Documents/life-sciences-health-care/deloitte-cn-lshc-internet-hospitals-in-china-the-new-step-into-digital-healthcare-en-210315.pdf

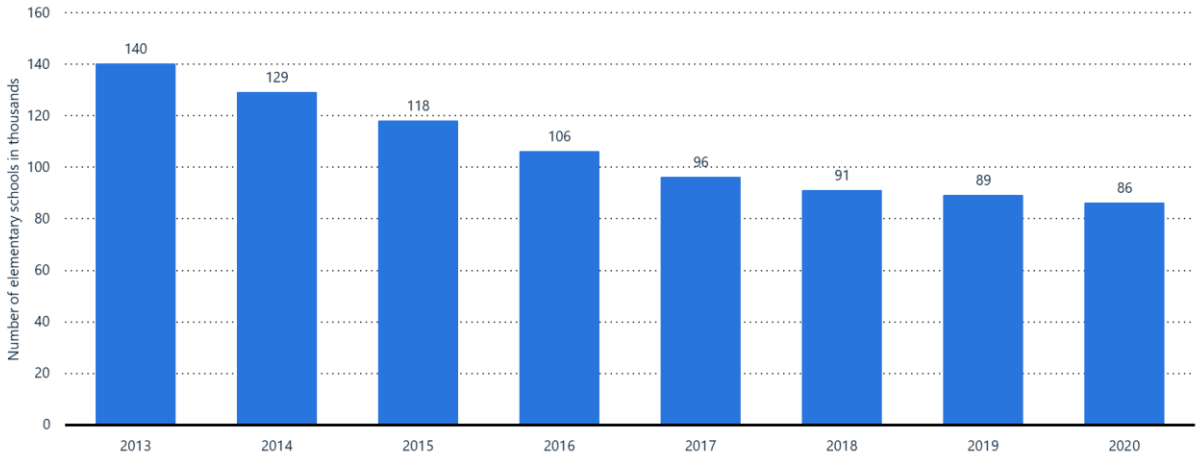
The government should increase the Internet literacy and learning capacity of older people in rural areas to use their gadgets for mobile applications and to search for information on the Internet. The government should promote and publicize the benefits and positive effects of telemedicine among these communities in rural areas, and expand the reach of telemedicine.

The positive effects on health are also reported by Chinese researchers.[29] From their work, they conclude that internet use has a significant positive impact on the health of rural adults. Using the Internet, rural adults can find a great deal of health information, increase social interaction and maintain physical activity to improve their health. Thus, it is important to encourage the use of the Internet for health purposes in rural areas. In addition, Internet use has a heterogeneous effect on the health of rural adults of different genders, ages and education levels: the higher the education, the greater the positive effect.

[29] Li L., Zeng Y. The Impact of Internet Use on Health Outcomes of Rural Adults: Evidence from China / Int J Environ Res Public Health. 2020 Sep; 17(18): 6502. URL: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7559417/

This thesis leads us to the next technology of this chapter, which should change the quality of life of rural people for the better - it is digital education.

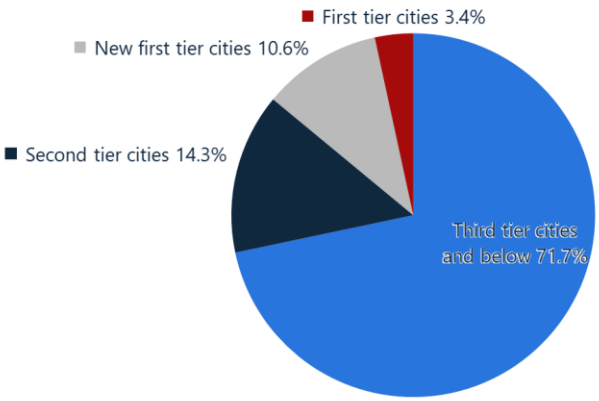
In its mission to eradicate extreme poverty, China has identified education as a key strategy. It was believed that improving schooling, especially in rural areas, would ensure that future generations would not fall into the same poverty traps as their parents. The need for it in rural areas is linked to the closure of schools for children due to school consolidation. (Graph 10) This causes a problem with transport accessibility to schools.



Graph 10. Number of elementary schools in rural areas in China from 2013 to 2020 (in thousands)

Source: National Bureau of Statistics of China, 2021. In Statista. Retrieved June 13, 2022, from https://www.statista.com/statistics/866768/number-of-elementary-schools-in-rural-china/

It is worth noting that it is the primary schools for children that are closing, the high schools continue to operate. This is generating an increased demand for online education. Through the use of online education, children in rural areas have the opportunity not only to learn the basics, but also to take specialised courses from teachers in major Chinese cities. However, the most acute problem is the lack of pre-school education in rural areas. This causes a specific distribution of demand for online education across cities, with rural areas and small towns accounting for the largest share. (Graph 11)



Graph 11. Regional distribution of children in preschool age in China in 2019, by city tier

Source: China's online education industry report 2020. In Statista. Retrieved June 13, 2022, from https://www.statista.com/statistics/1222421/china-preschool-children-regional-distribution-by-city-tier/

It is also important to note the problems highlighted by the COVID-19 pandemic, namely that, according to expert research, most urban schools switched relatively easily to online learning, while rural children faced a lack of access to devices and network connectivity, low technical literacy and insufficient family support. According to various estimates, up to 11% of rural schoolchildren did not participate in any learning activities during the school closure period.[30]

Notably, many online education programmes are provided to schools by non-profit organisations. For example, the Public Welfare Programme for Education for Children in Remote Rural Areas of China. In China's Qingcheng County in Gansu Province, there were no English, art or music classes in primary schools. The problem has been solved by using online lessons for both schoolchildren and teachers in rural areas. The programme, launched by the Shanghai U-light Public Welfare Foundation with the support of government agencies, companies and organisations,

[30] Tiwari P. COVID-19 and Online Learning in Rural China: Challenges, Impact, and Opportunities / Institute of Chinese studies, 2021. URL: https://www.icsin.org/uploads/2021/08/02/a15b1f897867bf8d0089925c9f40d685.pdf

began in 2012. In total, the programme has been rolled out in 16 provinces, with more than 40,000 students and more than 1,000 teachers participating.[31]

In addition to digital technology itself, education must also teach children about technology and instill an interest in scientific activities. That's why special projects in China are opening special centres where schoolchildren can develop their skills and learn about high-tech. In the Xinjiang Uygur Autonomous Region, for instance, 100 centres are to be built by 2025 to promote science among adolescents and youth in rural areas.[32]

The implementation of such joint initiatives can improve the quality of education in rural areas, which will enable the development of production there, the introduction of new technologies and thereby help to reduce disparities in rural and urban incomes.

[31] Min H. Rural school children access quality classes online / Shine, 2022. URL: https://www.shine.cn/news/metro/2201080550/

[32] Xinjiang to construct 100 science centers for youth / China Daily, 2021. URL: http://epaper.chinadaily.com.cn/a/202112/23/WS61c3beeaa31019b029ba2bd9.html

2.3. Applying AI technology in a pandemic: key technologies and features

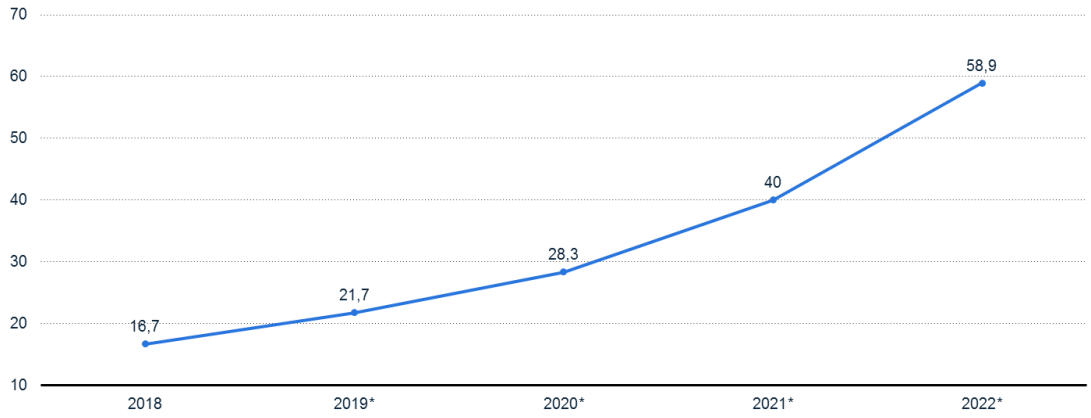
The pandemic is actively seeking new and expanding applications of AI technology as manufacturing processes change. A number of economic sectors can be identified in which AI has developed the most during the COVID-19 epidemic: (1) providing remote working for businesses (2) tracking systems, (3) technology (4) smart cities, (5) big data, (6) medicine and (7) unmanned cars.

Self-isolation, which indicates a distant working model, is one of 2020's key characteristics. Following the COVID-19 crisis, in which a company ordered its employees to stay at home, working from home has become more and more popular in China as well as the rest of the world. The number of people working remotely reached 200 million at the end of the Chinese New Year.[33] Such experiences have changed the way many business people think about how their companies should be organised. The trend towards remote working is likely to continue after the coronavirus. Artificial intelligence can help in this case by providing the necessary technological capabilities to employees who work from home. In addition, some of the business processes will seek automation, which is a good prospect for the development of various robots, chatbots and so on. We could say that this is more of a global trend, not just a Chinese one. So, the first area where AI is going to develop is in technological support of remote working mode for businesses.

The tracking of people's movements is the next isolation-related subject, and artificial intelligence is highly sought after in this field. How closely and productively Chinese IT behemoths and Chinese authorities may cooperate was demonstrated by the coronavirus pandemic. The necessity for a program that could aid in stopping the virus's spread was stated by the authorities on February 10 at a State Council press conference. A free smart mini-app was quickly made available by Aliyun in order to educate the public about the virus and stop its spread. The software tracked employee health and kept track of their entrances and exits from the workplace. At the same time, Tencent almost simultaneously released the Tencent e-pass, which detects people's movements, records body temperature, identifies a high-risk group and encourages people

[33] Bloomberg Business (2020), "HY Medical AI and You'an Hospital join forces in the battle against NCP". URL: https://www.bloomberg.com/press-releases/2020-02-28/hy-medical-ai-and-you-an-hospital-join-forces-in-the-battle-agai

to report their health information, while supporting offline use.[34] It seems possible that post-pandemic coronavirus applications of this kind will be in demand to control the spread of seasonal diseases, attracting additional investment as illustrated in Gragh 12



Graph 12. Investment value of China's traditional financial institutions in artificial intelligence from 2018 to 2022 (in billion yuan)

Source: China's AI Industry Report / iResearch. In Statista. Retrieved June 13, 2022, from https://www.statista.com/statistics/1054700/china-investment-of-traditional-financial-institutions-in-artificial-intelligence/

In addition, the QR Health Code system, which also tracked Chinese people's movements and contacts, was integrated with Wechat and Alipay apps to increase user reach. In this instance, the National Online Government Service Platform provides user data to QR Health Code. China Mobile, China Unicom, and China Telecom are just a few of the telecommunications firms that have suffered. They used cell phones to track the whereabouts of the populace and provided the government with this data. Together with increased public awareness among Chinese people, all of the aforementioned applications produced positive outcomes, helped to localize outbreaks, shorten isolation times, and lessen economic harm to businesses. The experience of managing the

[34] Yueliang, L. (李月亮) (2020), "深扒! 疫情中“失踪”的中国富豪，到底都干了些什么?". URL: https://mp.weixin.qq.com/s/LcRVxGDedx2YgucDg-5ojw

epidemiological situation in the nation is a "historic chance" for China to turn a crisis into an opportunity, according to Xi Jinping in April 2020. It is the coronavirus pandemic that can become a driver for a faster change in China's economic model, allowing it to increase the share of high-value-added exported goods precisely due to high technology, one of which is artificial intelligence.[35]

The idea of tracking the movements of citizens is not new to China, especially when you think of the social responsibility system. Cameras on the streets of cities that can identify a person in seconds are already commonplace in Chinese cities. But beyond surveillance, China's AI technology could be used to develop smart cities. A good example of such a smart city would be Hangzhou's City Brain, a smart city where AI is processing huge amounts of data on people's movements, traffic and the level of security in the city. Xi Jinping praised the City Brain experience during his visit to the city in March 2020. It is very likely that such a system of smart cities will be extended to other cities in the PRC. In addition, the development of smart cities is part of the so-called "Digital Silk Road" plan.

Looking deeper into technologies that will be in demand after the pandemic in the context of smart cities, China's SensCrowd Analytics Server passenger traffic management system is worth mentioning. It helps to regulate passenger traffic so that transport is not overcrowded. Parks or stadiums are examples of crowded areas where this technology can be actively used. The system monitors crowd behavior and can alert managers to potential risks so that precautions can be taken to avert them. During large-scale unrest and protests, this technology is especially helpful. With just one camera, the system can track and analyze the behavior of more than 100 people.[36] Such systems, which help to recognise faces, are not only in demand in China. At the moment, about 18 countries use intelligent monitoring systems which were produced in China. For example, the monitoring system for Ecuador (ECU-911) was developed by two Chinese companies, C.E.I.E.C. and Huawei.[37]

[35] Shevko, A. (2020), "A historic chance for China in the AI field". URL: https://russiancouncil.ru/analytics-and-comments/analytics/istoricheskiy-shans-dlya-kitaya-v-sfere-ii/
[36] SenceTime company (2019b), "SenseCrowd Passenger Traffic Analysis Server". URL: https://www.sensetime.com/me-en/product-detail?categoryId=21128
[37] Mozur, P., Kessel, J.M. and Chan, M., (2019), "Made in China, Exported to the World: The Surveillance State". The New York Times. URL: https://www.nytimes.com/2019/04/24/technology/ecuador-surveillance-cameras-police-government.html

Continuing the theme of pandemic change, the trend towards contactless delivery cannot be ignored. Driving drones can make delivery of goods as safe as possible for the customer. Grubhub, Uber Eats, DoorDash and other companies have introduced contactless food delivery to minimise contact between couriers and users.[38] This trend could be a great opportunity for China, as the country is actively pursuing the development of unmanned vehicles. According to experts, as of 2018, the size of the unmanned car market was estimated at more than RMB 89 trillion; by the end of 2020, there could be more than 15 million unmanned cars in the country. Deloitte experts predict that by 2030, annual sales of new unmanned cars in China will exceed 500,000 units, accounting for 24% of annual global sales.[39] Naturally, this market includes automobile companies and IT companies, and automobile companies are represented by a few participants, while the IT sphere is mostly represented by Baidu and Alibaba. For example, Alibaba is developing the AutoNavi project, which provides accurate maps of highways in the PRC.

In addition, start-ups such as Pony.ai, which are already collaborating with major car companies, are active players. For example, Toyota invested $400 million in the company in 2020.[40] The startup uses machine learning and deep learning to practice traffic situations in a variety of conditions. James Feng (head of Pony.ai) believes that transportation by unmanned vehicles can become not only safer but also truly contactless. Most importantly, however, Chinese companies can now build complete production chains without resorting to foreign companies. This, in turn, will enable China to produce more high value-added goods, which is what the country has been striving for in recent years. The centres of this industry are expected to be Beijing, Shanghai and Shenzhen.

During the pandemic, AI was most prevalent in medicine. The main challenge in the fight against the virus has been the development of a vaccine. The process of finding a cure is complex and long, with mass vaccination of the country not expected until 2021. The long term prospect is always associated with the need for clinical trials. TwoXAR CEO Andrew Radin believes that

[38] Cai K., (2020) 'A new image of robots: how the pandemic has changed attitudes towards artificial intelligence'. Forbes. URL: https://www.forbes.ru

[39] Hecker, M., Berdichevskiy, A. and Quan, Z. (2018), "Autonomous driving reshapes competition in the ecosystem". Deloitte China. URL: https://www2.deloitte.com/cn/en/pages/consumer-industrial-products/articles/autonomous-driving-reshapes-competition-in-ecosystem.html

[40] Pony.ai company (2020), "Pony.ai Raises $400 Million from Toyota to Accelerate Autonomous Driving Development". URL: https://www.globenewswire.com/news-release/2020/02/26/1990586/0/en/Pony-ai-Raises-400-Million-from-Toyota-to-Accelerate-Autonomous-Driving-Development.html

artificial intelligence technology can accelerate this process, primarily by matching patient groups and prediction.[41] The long lead time is always due to the need for clinical trials. Tom Siebel, owner of C3.ai, decided to use AI to fight the coronavirus. Within weeks, a "data lake" was created where information about the pandemic was collected. Using this application, health professionals could obtain valuable data, free of charge, from the World Health Organisation and the Institute for Health Metrics and Evaluation and other organisations that have collected patient data from COVID-19. Some 2,000 researchers are already using the C3.ai database.[42] In this way, AI can be developed in the processing and systematisation of medical data.

Chinese specialists have also developed their own solutions. For example, the startup SenceTime has created the SenseCare intelligent diagnostics and treatment platform. The platform uses AI and Big Data technologies to diagnose, treat and rehabilitate patients more effectively. The system provides technical support to medical staff with minimal time. The system automates certain processes for scientific and clinical trials. Naturally, great importance is attached to data protection.[43]

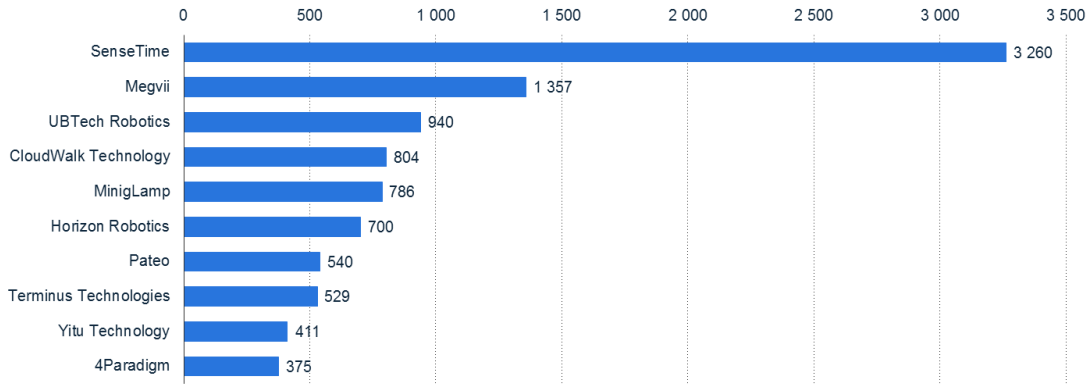
In addition, Chinese start-up Megvii Technology Limited has developed intelligent temperature measurement systems based on artificial intelligence, a system called MingJi. These have been widely used in China in places with large numbers of people. The technology itself has been used in other countries, which also indicates the demand for Chinese systems.[44] The two start-ups considered are the largest in terms of investment raised, as shown in Graph 13.

[41] Cai K., (2020) 'A new image of robots: how the pandemic has changed attitudes towards artificial intelligence'. Forbes. URL: https://www.forbes.ru

[42] Feldman, A. (2020) "Billionaire Tech Entrepreneur Tom Siebel Built A Massive Compendium Of Covid-19 Datasets. Some 2,000 Researchers Now Use It.". Forbes. URL: https://www.forbes.com/sites/amyfeldman/2020/07/23/billionaire-tech-entrepreneur-tom-siebel-built-a-massive-compendium-of-covid-19-datasets-some-2000-researchers-now-use-it.html

[43] SenceTime company (2019a), "SenseCare Smart Health Platform". URL: https://www.sensetime.com/me-en/product-detail?categoryId=21168

[44] Megvii Technology Limited (2020), "MEGVII's Ming Ji Mini Solution Deployed in global markets to Combat COVID-19". URL: https://en.megvii.com/news_detail/id/165



Graph 13. Total funding of the leading artificial intelligence (AI) startups in China in 2020 (in million U.S. dollars)

Source: China internet report 2020 / SCMP. In Statista. Retrieved June 13, 2022, from https://www.statista.com/statistics/1049379/china-most-funded-ai-startups/

To fight the virus, not only tests and a vaccine are needed, but also visual information about the condition of a person's lungs. This allows the progression of the disease in the body to be monitored, adjusting treatment and determining the patient's rehabilitation. Doctors are faced with the problem of analysing a huge number of images of the lungs, and Chinese companies have come to their aid. HY Medical has developed an algorithm that, based on the doctors' actions and machine learning technology, was able to analyse the images and make a diagnosis. HY Medical AI system automatically adapts to images from different locations and on different equipment. Disease detection and diagnosis accuracy was 96%. Most importantly, it is an efficient use of time and automates this routine operation. It is reported that it takes only 2-3 seconds to process 500 images.[45]

Thus, the pandemic was an opportunity to adapt the use of AI technology in medicine. Companies, including Huawei Cloud, established a free period of use of the technology with the prospect of further collaboration in the future.[46] In March 2020, Ecuador began using the coronavirus screening system developed by Huawei Cloud and HY Medical. Chinese experts were

[45] Bloomberg Business (2020), "HY Medical AI and You'an Hospital join forces in the battle against NCP". URL: https://www.bloomberg.com/press-releases/2020-02-28/hy-medical-ai-and-you-an-hospital-join-forces-in-the-battle-agai

[46] Huawei Cloud (2020a), "Ecuador Deploys Huawei Cloud-based AI-assisted COVID-19 screening system". URL: https://www.huaweicloud.com/intl/en-us/news/20200324170952750.html

able to carry out all the necessary work to install the system in a very short time, taking 14 hours. The screening system, using AI technology, was able to identify the affected areas of the body and the diagnosis was fully consistent with the actual infection.[47] Such a system accelerates the diagnosis of patients many times over and has great potential for development throughout the medical field. It can be seen that there is a demand for such technology, primarily in developing countries, and these are the markets that China will be counting on. There, it will have to compete with the US and European countries. However, there is no doubt that such technology will develop and improve, and that it will reduce the damage from possible epidemics in the future.

It is quite characteristic of China that local bodies and large companies work together. During the pandemic, the National Health Commission of China decided to include CT scans as the clinical diagnostic standard for COVID-19 in Hubei province. At the time, hospitals did not have the necessary equipment to automate diagnosis. Consequently, doctors had to analyse a huge number of images, cross-check them and make their own diagnoses. Given the number of infected people and the dynamics of coronavirus spread, it was clear that this was an inefficient way to detect COVID-19.

Huawei Cloud, together with Huazhong University of Science & Technology and Lanwon Technology, has just created a quantitative medical image analysis system based on artificial intelligence. The main tools used here are computer vision, machine learning and data analysis. The AI+CT medical image analysis system for COVID-19 is based on the EIHealth platform. In addition to AI Ascend, the platform is also powered by the ModelArts artificial intelligence management system. ModelArts allows to organise large amounts of medical data, train AI, create models and evaluate them. The system can analyse images and provide feedback to doctors in a short time. This facilitates the work of medical staff and increases efficiency, as the image analysis process is performed by a computer. A plus in Huawei's work are the chips of its own production (Ascend AI), so the company can provide them to itself and other companies, including international ones. By analysing patients' lung conditions based on clinical and laboratory data, the system assists doctors in determining the stage of the disease, which in turn helps in prescribing

[47] Huawei Cloud (2020b), "Fighting COVID-19 with Technology". URL: https://activity.huaweicloud.com/intl/en-us/fight-covid-19.html

the right treatment. AI technology has the potential not only to diagnose diseases, but also to treat them.

Continuing with the above system, it is worth noting that in confirmed cases AI-Assistance can perform 4D dynamic data analysis that monitors the patient's lung health. This helps doctors to monitor the patient's condition and see the results of the prescribed treatment or medication.[48] Doctors manually viewed up to 300 images. The large volume not only reduced the speed of getting a diagnosis, but also reduced the quality of the diagnosis, as there is always the fact of human error, especially when we talk about such a workload in doctors. Automating this process would be of great help to medical staff, allowing them to do things that cannot yet be done by a computer.

Artificial Intelligence can even automate the imaging process. It simply needs to reproduce instructions for the patient: where to position himself, what to do, and so on. This will eliminate physical contact with infected people, which significantly reduces the risk of illness for doctors. In addition, the hospital saves on personal protective equipment. If AI diagnoses a patient with coronavirus, the image is transmitted to the physician to confirm the diagnosis; for the physician, working with cases where no disease is present is eliminated. At the same time, the AI can distinguish between types of infection and give recommendations developed for that situation.[49] Thus, it can be said that, thanks to the pandemic, AI technology in medicine will be adopted much more actively, as it has proven successful.

The findings in this section of the chapter are supported by the research of other academics. For example, the findings of Chinese authors Ting Wang, Yi Zhang, Chun Liu and Zhongliang Zhou in their paper showed that AI had a significant impact on (1) screening and detection of the disease and (2) monitoring and evaluation of epidemic development. In particular, AI has been useful for screening and detection of COVID-19 in cities with high intercity mobility. In addition, AI has been important for reintroduction in cities with high risk of reintroduction. However, the

[48] Huawei Cloud (2020c), "HUAWEI CLOUD Launches AI-Assisted Diagnosis for COVID-19, Outputting CT Quantification Results in Seconds". URL: https://www.huaweicloud.com/intl/en-us/news/20200226142102281.html
[49] Liu, J. (2020), "Artificial Intelligence Assisted Radiology Technologies Aid COVID-19 Fight in China". URL: https://www.itnonline.com/article/artificial-intelligence-assisted-radiology-technologies-aid-covid-19-fight-china

authors note that there was limited evidence to support the effectiveness of AI in diagnosing and treating the disease.[50]

To better understand China's experience, it is worth paying attention to the conditions that exist for the development of artificial intelligence technology. Government programmes and development strategies, investment programmes and research centres form the basis of support for AI development in China. Already in 2018, the volume of Chinese investment in artificial intelligence reached 131.1 billion yuan, and that's 60% of global investment in the sector. It is estimated that the number of companies developing AI technology in China is already more than 400,000. In March 2020, the Chinese authorities announced a new development programme called "New infrastructure", which was necessitated in part by the coronavirus pandemic. This strategy is designed to mitigate the economic damage caused by the epidemic, as well as to promote sustainable development not only for the economy, but also for the country as a whole. Li Keqiang formulated the main components of this new infrastructure in May: 5G, AI, industrial internet, big data, smart energy and transport.[51] Chinese experts estimate that investment in the "new infrastructure" industries could reach RMB 17.5 trillion by 2025. Taking into account the fact that the idea of new infrastructure echoes the "Made in China 2025" plan, such investment volume seems quite acceptable, especially since these programmes will be implemented in parallel.

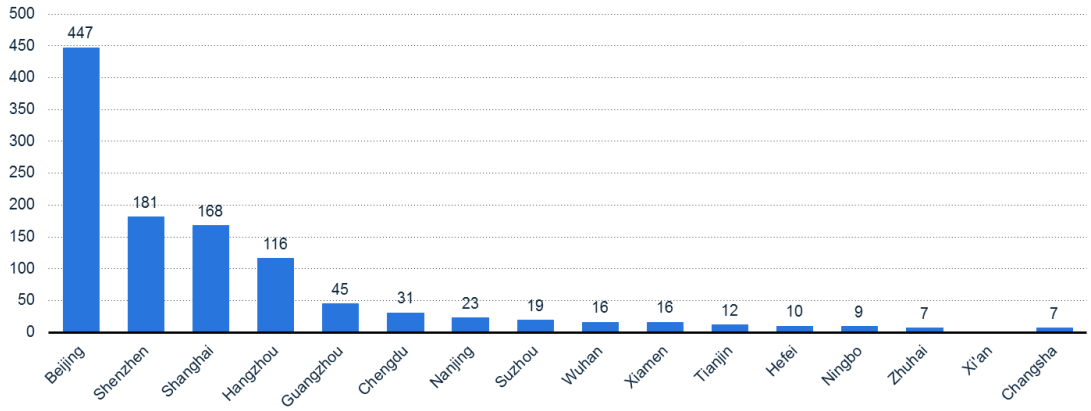
Artificial Intelligence in the new infrastructure is, in our view, the most important, as its development and active implementation will ensure growth in other sectors as well. China's AI development plan can be seen in the Notice of the State Council Issuing the New Generation of Artificial Intelligence Development Plan. According to the report, the scale of the AI industry in the PRC is expected to approach $30 billion in 2022. It is likely that investment in artificial intelligence will continue to grow beyond 2022, an assumption that can be confirmed by the state plan that was put forward back in 2017, which states that by 2030 China will become the centre of AI development.[52]

[50] Wang, T., Zhang, Y., Liu, C. et al. Artificial intelligence against the first wave of COVID-19: evidence from China. BMC Health Serv Res 22, 767 (2022). https://doi.org/10.1186/s12913-022-08146-4
[51] Xinhua (2020), "Economic Watch: China speeds up "new infrastructure" investment to combat economic pressure". URL: http://www.xinhuanet.com/english/2020-03/05/c_138846271.htm
[52] Shevko, A. (2020), 'A Historic Chance for China in AI'.URL: https://russiancouncil.ru/analytics-and-comments/analytics/istoricheskiy-shans-dlya-kitaya-v-sfere-ii/

One of the most important conditions for the development of AI in China is the active cooperation of the authorities at all levels. IoT is also developing in China, and here we can give an example of the active involvement of local authorities. During 2019, Jiangxi province saw the emergence of more IoT businesses (an average of 3.5 such businesses were registered). Since October 2018, the local government has started to provide comprehensive support to IoT companies. Thanks to this, 828 Internet of Things companies have been registered in Jiangxi province, an increase of 57.7% over 2018.[53] More than half of the companies are engaged in software development, information transmission and information technology services. Against the backdrop of the development of the internet of things, Jiangxi province wants to become the centre of this industry in the PRC. This is a really good example of how the authorities' interest helps businesses and, in this case, the digitalisation of the country and its economy.

To find new and unique AI solutions, Chinese companies are working closely with Chinese universities: joint research centres and laboratories are usually set up. For example, the Law and Artificial Intelligence Laboratory (at Peking University) and the Shenzhen Institute of Artificial Intelligence and Big Data. Thus, artificial intelligence is making business processes more efficient, reducing costs and creating entirely new jobs globally. These jobs are being created mainly in the developed eastern provinces and the traditional innovation hubs of Beijing, Shanghai and Shenzhen, but as part of a programme to reduce disparities in development between regions, western areas such as Sichuan could also become AI hubs, as illustrated in Graph 14. There is also a tentative regional specialisation: Beijing is a research centre where the search for new solutions takes place, while Shenzhen is more focused on practical applications, as there is a huge concentration of IT companies, including Huawei, Tencent and ZTE.

[53] People’s Government of Jiangxi Province (2019), "江西物联网形成新的经济增长点". URL: http://www.jiangxi.gov.cn/art/2019/10/24/art_398_810372.html



Graph 14. Number of artificial intelligence (AI) corporations in China as of May 2020, by leading region

Source: China's artificial intelligence investment research in 2020 / EqualOcean. In Statista. Retrieved June 13, 2022, from https://www.statista.com/statistics/1024666/china-number-of-artificial-intelligence-corporations-by-region/

As for the demand for AI specialists, it currently exceeds the supply. According to Chinese experts, China has a shortage of 30,000 AI specialists. The greatest demand is for specialists in the development of AI chips, machine learning technology, natural language processing, sound recognition, and computer vision.[54]

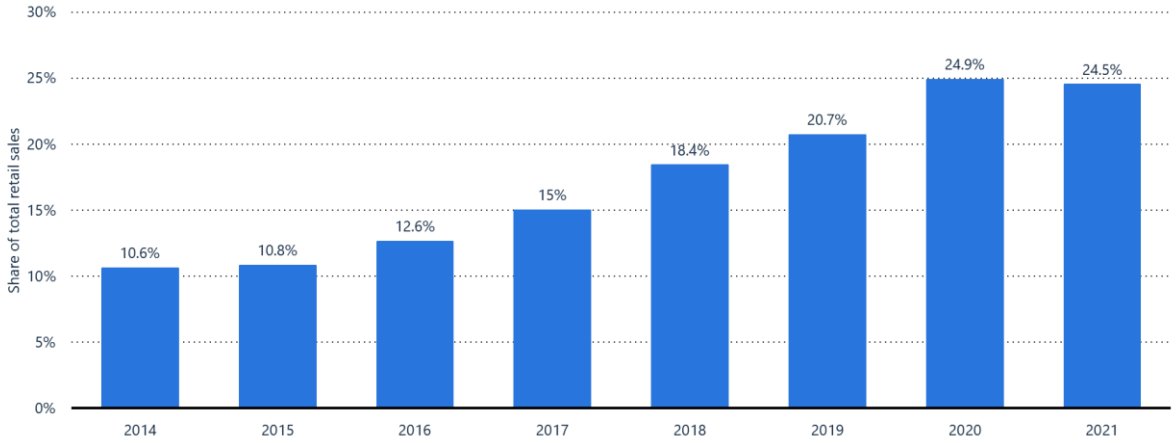
In the short term, the demand can be met by foreign specialists, but this is not in China's interest. China needs its own specialists. According to the AI Innovation Action Plan for Colleges and Universities, an AI-friendly technological and scientific environment must be in place by 2020. In terms of concrete results, 32 Chinese universities have opened colleges specialising in AI by 2019, while 19 universities have established separate research institutes. In addition, Chinese IT companies have also set up AI training colleges with universities. The training of new specialists has only just begun, but in the long run China will provide itself with highly qualified personnel. The mutual cooperation of universities and businesses looks very successful; students can get not only theoretical education, but also put it into practice to gain the necessary experience.[55]

[54] Liqin (力琴) (2020), "缺口高达 30 万，月入 30k 技术人才难觅，这份官方报告揭秘国内 AI 人才现状". URL: https://mp.weixin.qq.com

[55] Synced Review (2018), "China's AI Schools Are Accepting Applications: Here's a List". URL: https://medium.com/syncedreview/chinas-ai-schools-are-accepting-applications-here-s-a-list-5a568e1e31a1

2.4. The development of e-commerce in rural areas: features, success factors, impact of the pandemic

E-commerce in China has been booming for the last 10 years. The number of users, the volume of transactions, and the frequency of purchases have all increased. E-commerce now accounts for 24.5% of total retail trade, having more than doubled since 2014. (Graph 15)



Graph 15. E-commerce share of total retail sales in consumer goods in China from 2014 to 2021

Source: National Bureau of Statistics of China [Graph]. Retrieved June 10, 2022, from http://www.stats.gov.cn/

China currently has a 73% Internet penetration rate[56], which suggests that e-commerce still has potential to develop. The Chinese e-commerce market is constantly evolving. E-commerce sales in China are forecast to be over $1.4 trillion in 2022, and by 2025, China's e-commerce market is projected to have more than 1.2 billion users,[57] which demonstrates the enormous potential of Chinese e-commerce, given the massive consumer market.

Chinese key market players such as Alibaba Group, JD and Pinduoduo are jointly contributing to the comprehensive e-commerce ecosystem in China. The Chinese population is tech-savvy and mobile-oriented, so the Chinese e-commerce giants are constantly pushing

[56] 49th Statistical Report on Internet Development in China / CNNIC, 2022. p. 17. URL: http://www.cnnic.cn/hlwfzyj/hlwxzbg/hlwtjbg/202202/t20220225_71727.htm
[57] Statista Digital Market Outlook, 2022. URL: https://www.statista.com/outlook/dmo/ecommerce/china

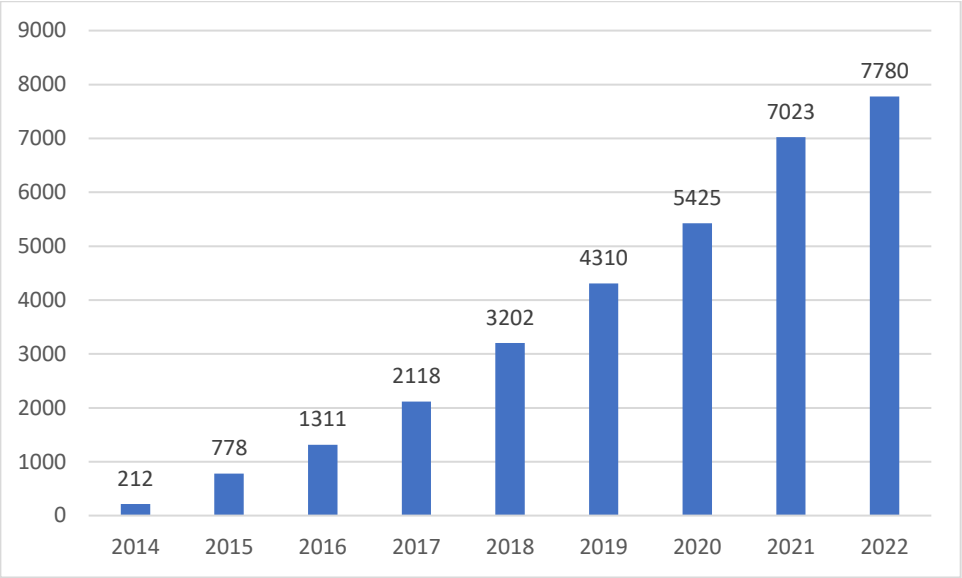
technology forward. They have diversified into literally every area that touches online retail, from payments to logistics.

At the same time, a new phenomenon has emerged in the last ten years as Taobao villages, which not only enable rural areas to be included in e-commerce, but also contribute to their digitalisation in general.

To begin with, consider the development period of Taobao villages up to the present. By 2022, the number of Taobao villages and Taobao cities in China has increased to 7780.[58] In nine years, such villages have become a trend and have emerged very actively as can be seen at Graph 16. A special feature of Taobao villages is clustering. Thus, there are more than 140 clusters comprising several villages of varying sizes and e-commerce volumes. As a rule, clusters are formed based on the similarity of products, as well as being located in the same city or county.

Because of the Covid-19 pandemic, the development of mobile Internet networks, including 5G networks, live e-commerce has become a new trend in the past two years. China has accelerated the pace of 5G network development, building 654,000 new base stations in 2021. 5G networks now cover all urban counties, more than 98% of urban areas in counties and 80% of urban areas in townships across China.[59] However, it is worth noting that geographically, the top 50 Taobao villages on Taobao Live are all located in the eastern parts of the country, with Zhejiang, Guangdong and Jiangsu provinces topping the ranking, which once again shows that Taobao villages are not yet able to cope with the disparities in regional development in China. However when it comes to rural areas, more than 97% of towns and 40% of villages have access to 5G networks. The provinces have developed plans to increase 5G network coverage in rural areas.[60]

[58] China Taobao Village Report 2020 / AliResearch, 2021. URL: http://www.aliresearch.com/en/Reports/Reportsdetails?articleCode=167153834769125376
[59] China adds 654,000 5G base stations in 2021 / Xinhua, 2022. URL: https://english.news.cn/20220120/ddcf65152664478ab13e12d60f142fb5/c.html
[60] China rolls out 1.6 million 5G base stations, all rural villages having access to broadband / Global Times, 2022. URL: https://www.globaltimes.cn/page/202205/1265842



Graph 16. The number of Taobao villages in China (2014-2022)

Source: Chu H. Placing the platform economy: the emerging, developing and upgrading of Taobao villages as a platform-based place making phenomenon in China / Cambridge Journal of Regions, Economy and Society, 2023. [Graph]. Retrieved April 10, 2023, from https://academic.oup.com/cjres/advance-article/doi/10.1093/cjres/rsad004/7078050

In addition, there is a definite potential for development for various service sites and offerings that will offer marketing data to vendors. Because by having access to the most up-to-date, complete and accurate information through information products, online businesses in rural areas can identify and address their weaknesses and adjust production in time to user demand, thus improving their sales figures.

It is clear from the name of the villages that locals mainly use the Taobao platform for e-commerce, however, this only applies to domestic sales. AliExpress is used to sell their products on the international market; in 2019, more than 400 Taobao villages traded goods abroad through this cross-border e-commerce platform. As for the domestic market, it is by far the main market and the annual transaction volume of online shops in Taobao villages and towns has exceeded 1 billion yuan.

In addition to the direct digitalization of rural areas, Taobao villages contribute to poverty alleviation in rural areas and allow migrant workers to return from cities to their home provinces, so far more than 800 Taobao villages have been dispersed in poor counties at the provincial level.

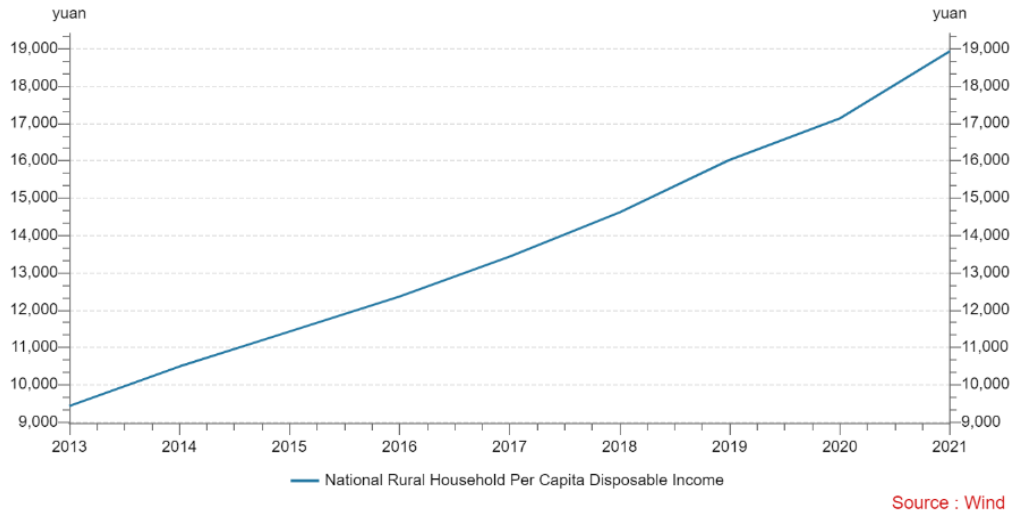
Taobao villages stimulate local entrepreneurship and even allow them to hire their own workers to help create and sell products: the total number of active online shops has reached almost 3 million, which has created more than 8.28 million jobs.

Various sources suggest that Taobao villages contribute to eliminating disparities in regional economic development. However, this is not entirely true: Zhejiang province has more than a third of all Taobao villages, followed by other eastern developed provinces in China. 97 of the top 100 Taobao villages are located in the eastern region, and only 3 in the central region.[61] However, in central areas, online retailers face less competition and can offer more unique products. In the western and central provinces, the following trends can be observed: greater clustering of local industries, which can most likely be attributed to more limited local infrastructure capacity, and the prevalence of Taobao cities, which are enlarged aggregations of several Taobao villages.

Taobao villages raise rural incomes in one way or another. Households in Taobao villages have income levels similar to those of urban households, and much higher than households in rural areas (not in Taobao villages). The average per capita income in Taobao villages (around RMB 35,000 per year in 2017) is almost three times higher than the rural average in China (RMB 13432 per year in 2017) and close to the urban average (RMB 36396 in 2017). Overall, business income accounts for about 50% of household income. Increased income, the opportunity to run their own business, the use of modern technology and the creation of the right conditions are starting to attract more and more young people to villages: at this stage, the proportion of people aged between 26 and 35 among online shop owners in rural areas is 72%, compared to 23% for rural areas as a whole.[62] Unfortunately, all the data is for 2017, and a similar one has not been conducted anymore. However, it can be seen that the disposable income of rural people in the country as a whole is increasing. The disposable income of rural residents has doubled in the past 8 years, reaching RM18931 in 2021. (Graph 17)

[61] China Taobao Village Report 2020 / AliResearch, 2021. URL: http://www.aliresearch.com/en/Reports/Reportsdetails?articleCode=167153834769125376

[62] Guseinova F., Kazantsev A. New Challenges in the Chinese Economy and Innovation Development Policy in China on the Example of Taobao Villages / SKIF Voprosy studencheskoy nauki Vypusk №7 (59), July 2021. pp. 65-69

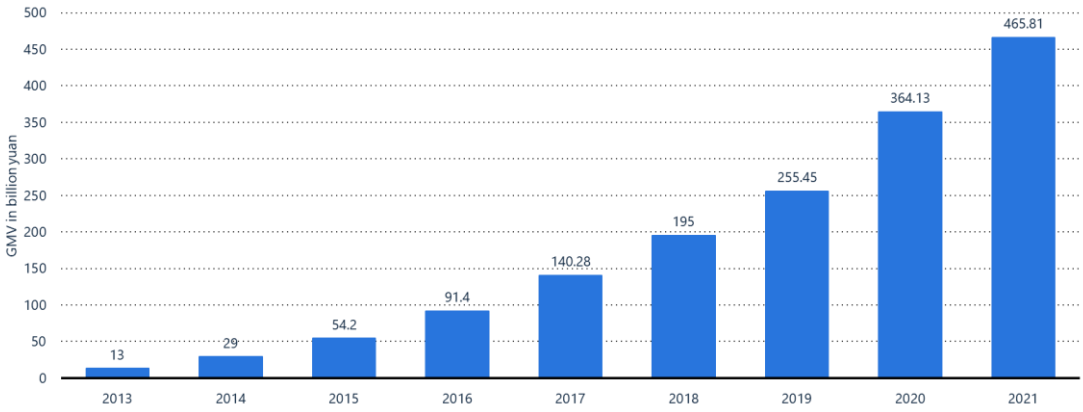


Graph 17. National Rural Household Per Capita Disposable Income 2013-2021 (in RMB)

Source: National Bureau of Statistics of China, 2022 [Graph]. In WIND Financial Terminal. Retrieved June 14, 2022.

To summarise the ten-year development of Taobao villages, they have made significant economic and social contributions that have increased workers' incomes, encouraged people to return home to start their own companies, promoted flexible employment for workers in rural areas, and helped to fight poverty and unemployment.

Next, we should look at the current situation and new trends in the development of Taobao villages. At the moment, households that engage in e-commerce have a higher income than households engaged in traditional rural activities, and income from business activities and the sale of their goods online is their main source of income. In addition, the demand for quality fresh produce is on the rise in China, with more than a fourfold increase since 2016. (Graph 18) All this makes it possible for young people to realize themselves in their home provinces: online shop owners are younger and more educated than the rest of the rural population, and there is also a high proportion of women among such entrepreneurs.



Graph 18. Gross merchandise volume of fresh food e-commerce in China from 2013 to 2021 (in billion yuan)

Source: 2021 年度中国生鲜电商市场数据报告 [Graph]. Retrieved June 11, 2022, from https://www.100ec.cn/zt/2021zgsxdsscsjbg/img/trz.pdf

The size of the industries is quite small, mostly 3-5 workers, who are often members of the same family.[63] Thus, Taobao villages, on the one hand, promote business development in rural China and, on the other hand, allow former labour migrants to spend more time with their loved ones, which, of course, has an impact on their quality of life.

Among the current problems that arise in the development of Taobao villages is the problem of understanding the mechanisms for promoting new mechanisms on e-commerce platforms, then as a consequence there is high competition due to the similarity and homogeneity of products, the next problem is the difficulty in obtaining credit to open a new shop, which is generally a traditional problem for Chinese small businesses. Finally, there is a lack of qualified workers who could improve the efficiency of production and online shops.

Next, we would like to point out that all the successes of Taobao villages would not have been possible without the cooperation of the authorities. It is this component of the success of the Taobao village phenomenon that we would like to analyse in order to identify the key factors for the development of digitalisation in rural areas. And China's experience can be a good example for countries that are struggling with poverty and aiming for economic development in rural areas.

[63] Luo X. In China's Taobao villages, e-commerce is one way to bring new jobs and business opportunities to rural areas / World Bank Group, 2018. URL: https://blogs.worldbank.org/eastasiapacific/china-s-taobao-villages-e-commerce-one-way-bring-new-jobs-and-business-opportunities-rural-areas

The challenge for the authorities was to develop and apply support measures that would modernise value chains and expand the e-commerce ecosystem in rural China.

First and foremost, we would like to consider the projects of the top-level authorities, which require the careful formulation of specific development plans and programmes. The 19th CPC Congress in 2017 put forward a strategy for rural revitalisation, agricultural development, and improving the welfare of the population, which are essential for completing the construction of a Chinese middle-income society. Firstly, the problem of lack of infrastructure was supposed to be solved by the Internet + programme, which envisaged the development of Internet networks in rural areas and full coverage for the country's entire population.

Developing the digital economy in rural areas is also in the national interest to modernise the entire country's economy: The Council of State has presented a plan to promote the digital economy during the 14th Five-Year Plan (2021-2025). The country aims to increase the share of the value added of the main sectors of the digital economy in its GDP to 10% in 2025, up from 7.8% in 2020.[64]

As shown above, the main successes of Taobao villages are related to overcoming rural poverty in China. This has been made possible by e-commerce. E-commerce was first included in the so-called 'Ten Major Projects' published by the State Council's Poverty Reduction Office to promote targeted poverty reduction.[65] Alibaba in turn set up the Alibaba Poverty Relief Fund in 2017, through which the company has accelerated efforts to revive rural areas during and after Covid-19 in some of China's poorest areas through e-commerce and digitalisation.

For many poor countries where selling agricultural products is difficult due to logistical and information problems, China's experience in opening online agricultural sales channels can be very useful. However, the authorities note that each region in rural China is different, so local authorities should focus on the real situation in each region during poverty alleviation programmes and explore ways to alleviate poverty through e-commerce on a case-by-case basis.

Speaking more about such cases, at this stage the Chinese authorities are trying to eliminate the problems of Taobao villages mentioned above. For instance, in Xifeng County in Gansu

[64] Fan F. Stress on digital economy key to pursuing high-quality development, Fan Feifei / China Daily, 2022. URL: http://english.www.gov.cn/news/

[65] Zeng Z. The Assistance of Digital Economy to the Revitalization of Rural China / 4th International Conference on Social Sciences and Economic Development (ICSSED 2019, 2019. p. 702-704.

province (central China), there are plans to open an e-commerce operation centre that will provide advisory and educational services to entrepreneurs from rural areas.[66] This will help address the lack of qualified staff and the lack of marketing knowledge among entrepreneurs. The centre will offer seminar programmes that integrate all stages of the learning process on how to become an online entrepreneur.

In addition, there are plans to create a team of qualified internet marketers to help develop new shops. Local authorities and these training centres are expected to actively cooperate with representatives of the Taobao and JD.com platforms, on which entrepreneurs sell their goods. And such a centre is not an isolated case: the municipal authorities have built and run 13 e-commerce industrial parks, which are home to almost 400 businesses, requiring an investment of ¥500 million. Local authorities hope that a growing number of traditional agricultural producers, professional farming co-operatives and individual farmers will use the e-commerce channel as a new source of income.

Taobao villages could be further developed with the further integration of digital technologies into them. The CEO of Chinese technology giant Baidu said there are eight key technologies that will influence the development of the digital economy. These are autonomous vehicles, machine translation, bio-computing, deep learning systems, digital urban operations, knowledge management, artificial intelligence-based chips and personal intelligent assistants. These technologies will be designed to improve the efficiency of the entire value chain of goods produced by Taobao villages. A Tencent executive has similar ideas, saying that internet technology and smart agriculture should be put on "the same frequency" and accelerate the digitalisation of agricultural production.[67]

Speaking of the application of new technologies and ways of doing business, it is worth considering the successful case of online sales using streaming services. One option for such sales involves online retailers hosting live streaming sessions at a production site or where the owners live, often resulting in natural, realistic content that inspires confidence in the customer, which drives product sales. 2017 to 2020, more than 110,000 Taobao Live presenters hosted more than

[66] Chinese farmers in rural Guiyang leverage the cloud to sell their wares / Bloomberg, 2020. URL: https://www.bloomberg.com
[67] Fan F. Stress on digital economy key to pursuing high-quality development, Fan Feifei / China Daily, 2022. URL: http://english.www.gov.cn/news/

3.3 million live streaming sessions to promote agricultural products. The company's assistance is estimated to have helped increase sales of agricultural products by more than 15 billion yuan and boost revenues for more than 1 million villages.[68]

It should be noted, however, that there is also criticism from researchers. For example, Pan D. in his article «Storing data on the margins: making state and infrastructure in Southwest China» examines the infrastructure building processes that are being initiated for cloud infrastructure deployment, the processes themselves and their impact are examined in Guizhou. The author notes that the emerging data centre industry in Guizhou is part of a wider nation building process. However, the article points out that digital development and infrastructure building does not always contribute to overcoming economic inequalities and improving lives.

The author of the article confirms that the burgeoning data centre industry in Guizhou is causing a range of social, economic, environmental and spatial changes that have a profound impact on the region's residents. According to the author, the introduction of cloud infrastructure in Guizhou is both a process of building a regional identity - a Big Data hub in South China - and a process of government consolidation.

The article argues that the introduction of cloud infrastructure is a techno-political enterprise because it shows not only part of the regional processes in which Guizhou is trying to rebrand and reposition itself, but also part of the ongoing formation of the Chinese state. From this perspective, Guizhou's nascent data centre industry can be seen as part of a broader process of state consolidation. Revealing the techno-politics of cloud infrastructure in Guiyang, this article illustrates how infrastructures create connections while disrupting others, and highlights the tensions between centre and periphery, city and countryside.

Many Taobao villages retain traditional techniques for local and unique products, as well as being located in picturesque locations. This makes them attractive for domestic tourism, where tourists can buy an item and visit the village itself. To stimulate the flow of tourists, many Taobao villages are taking measures to improve living conditions, integrate agriculture with tourism and culture, and beautify the countryside, which is a crucial component of the Beautiful China Initiative (BCI), which aims to accelerate the country's sustainable development.

[68] Li C. Alibaba Ramps Up Digital Support to Revitalize China’s Rural Economy / AliResearch, 2021. URL: https://www.alizila.com/alibaba-ramps-up-digital-support-to-revitalize-chinas-rural-economy/

Thus, the final component of Taobao Villages' success is the parallel empowerment of health, education, social services and governance through the digitalisation of these areas. For example, in education, many schools in the PRC's rural areas will provide courses to improve literacy in science and technology in order to better prepare students in scientific disciplines. Topics will include artificial intelligence, smart manufacturing, aerospace and agricultural sciences, as well as life sciences.

In summary, there are three main components to the success of Taobao villages and their impact on economic development and digitalisation in rural areas:

1. The active involvement of local authorities, who provide the necessary infrastructure and contribute to addressing the current challenges of e-commerce development in rural areas.
2. Introduction of new technologies in the whole process of online shopping in Taobao villages.
3. Rural development in a broad sense through the digitalisation of tourism, education and health, which improves the quality of life and also contributes to a more skilled workforce in rural areas.

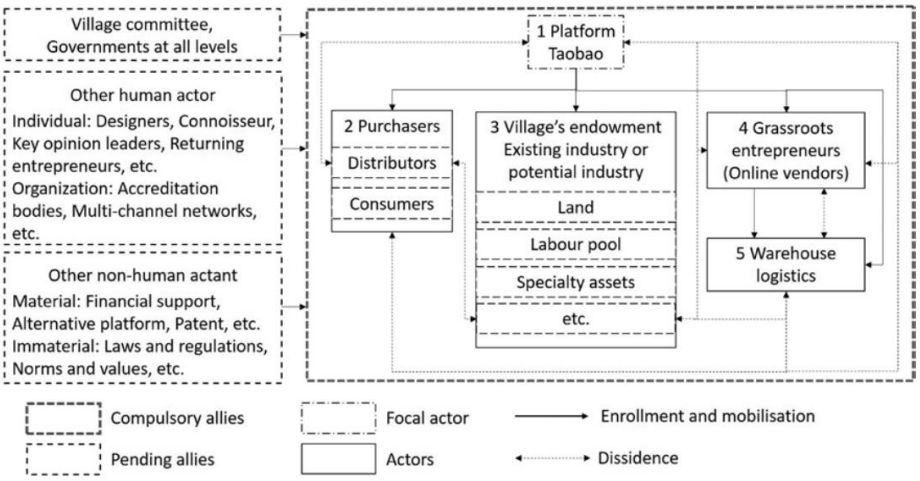
Taobao Villages and Taobao Towns achieved robust growth despite the adverse conditions brought by the Covid-19 pandemic, showcasing the important role that the digital economy plays during times of uncertainty. Overall, this is due to an increase in demand for e-commerce during the lockdown period. Demand for goods delivered through the Taobao platform has increased, as has demand and online commerce penetration in China increased in 2020 to 79.1%, and e-commerce in China has increased to 24.9%. [69]

China in 2020 has 5,425 and 1,756 Taobao Villages and Towns, respectively, an increase of 1,115 Villages and 638 Towns from the previous year. Taobao Villages and Taobao Towns, which make up around 1% and 5.8% of all administrative villages and towns in China, respectively, are dispersed throughout 28 and 27 provinces, autonomous areas, and municipalities. The Taobao Villages and Taobao Towns are growing more quickly in China's undeveloped areas. During the epidemic, marginalized people in isolated mountainous locations have had access to new

[69] National Bureau of Statistics of China, 2023. URL: http://www.stats.gov.cn/tjsj/zxfb/202301/t20230117_1892087.html

professions and business prospects thanks to the widespread use of internet infrastructure.Taobao Towns increased to 393 from 223 in 2019, nearly doubling from 172 in the central, western, and northeastern regions of China, while Taobao Villages nearly doubled from 172 to 341.

At present, the project is still developing, but the growth rate is declining. The number of Taobao villages is limited and the development of Taobao villages in the underdeveloped western provinces requires the active participation of authorities to build the necessary infrastructure as well as develop demand for Taobao village goods in these provinces. All this will take a long time and the right mechanism for interaction must be worked out. The Graph 19 shows a diagram of the current Taobao village operating model.



Graph 19. The translation of Taobao villages' emergence

Source: Chu H. Placing the platform economy: the emerging, developing and upgrading of Taobao villages as a platform-based place making phenomenon in China / Cambridge Journal of Regions, Economy and Society, 2023. [Graph]. Retrieved April 10, 2023, from https://academic.oup.com/cjres/advance-article/doi/10.1093/cjres/rsad004/7078050

From the diagram above, we can formulate the main issues in Taobao village development:

- Availability of demand - there needs to be demand for Taobao village goods, i.e. there is no point in developing Taobao villages in areas where there is weak customer demand, or there is no competitive advantage for Taobao villages.
- Availability of infrastructure - without a developed network of roads and railways, without affordable Internet it will be impossible to develop Taobao villages.

- Developed logistics system - this issue is directly related to the Taobao platform itself, as it is the company that provides delivery, storage in warehouses, receipt and inspection of goods.

In this way, Taobao villages will be able to develop further while at the same time developing the areas in which they appear. It has been shown how e-commerce can improve the lives of villagers, and as the Chinese authorities are interested in this, further interaction between the authorities, the Taobao platform and the villagers can be expected.

3. THE DEVELOPMENT OF THE DIGITAL RENMINBI AND ITS PROSPECTS

3.1. Stages in the emergence of the digital renminbi and prospects for domestic use

In previously unheard of ways, the COVID-19 pandemic and the 2020 catastrophe have accelerated electronic payments. With the launch of the digital yuan, China became the first major economy to actively create central bank digital currencies, a move that might potentially lead to a global chain reaction of central banks issuing their own digital currencies.

There are two uses for digital currency, it might be claimed. The first one entails the usage of CBDC within the nation, initially for people to make purchases and money transfers in their daily lives, as well as for legal companies to conduct transactions. The second trend already pertains to financial institutions, implying use in interbank lending, payments between banks, and the substitution of the new digital form for cash.

The introduction of digital currencies by central banks will contribute to the creation of novel payment instruments that combine the well-known functions of cash and non-cash and are practical for use in daily life and business as a result of the active digitalization of the financial sector around the world. Additionally, the use of blockchain technology will increase the security of financial transactions. At the same time, digital currencies can streamline and accelerate payments, which is crucial for the nation's business activity. Utilizing domestic payment systems based on digital currencies will also reduce a nation's reliance on external payment systems, enhancing its economic sovereignty. The ability of central banks' digital currencies to trace the chain of money flows will help to combat money laundering, illegal business, terrorist financing and corruption.

Blockchain technology is a prerequisite for digital currencies, hence it follows that cryptocurrencies are digital currencies created by mathematical algorithms. Data protection is offered via cryptographic methods and technologies. To carry out transactions, so-called distributed ledger technology is employed. Tokens, which stand in for the notional unit of cryptocurrency on the blockchain network, are used to deposit cryptocurrencies into users' digital wallets. With this technique, the history of cryptocurrency transactions is captured and recorded.

The People's Bank of China started creating the digital yuan in 2014. In China's National Technological Development Plan from 2016, blockchain was listed alongside AI, 5G, the Internet of Things, and cloud technologies. In collaboration with major banks and IT firms, the People's Bank of China outlawed initial public offerings of tokens in 2017, making cryptocurrency-based investments illegal as of that time.

Additionally, China forbids trading in cryptocurrencies. But in autumn 2019, Chinese President Xi Jinping declared blockchain to be the center of the nation's innovative development following a party study on the technology and digital currencies. He demanded that blockchain technology be developed more quickly and used in all spheres of the economy. Pilot programs for digital currencies were started in Shenzhen, Suzhou, Xiong'an, and Chengdu that same year.

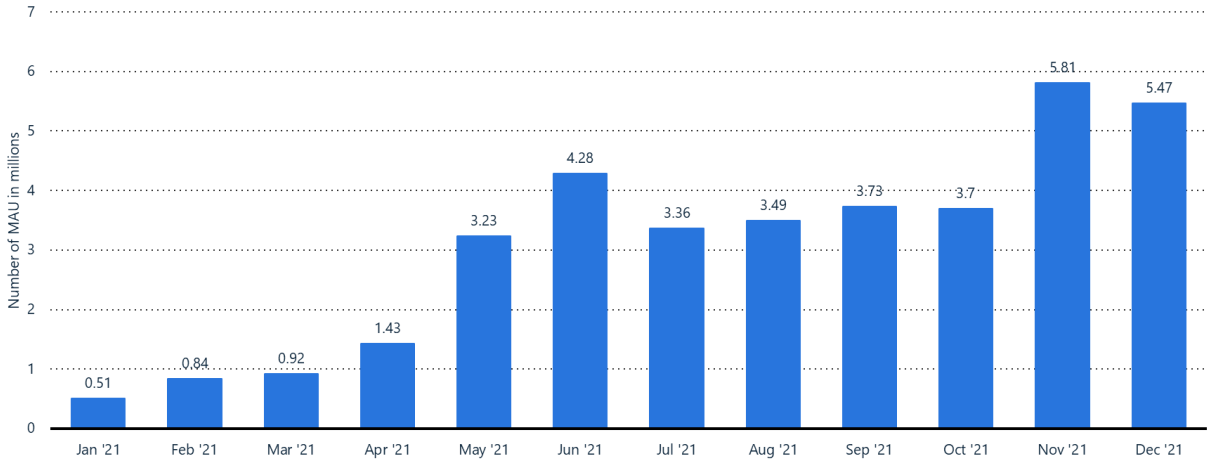
China's interest is dictated by a desire to control the movement of people's money. This desire is dictated by the extraordinary strength in the direction of mobile payments of Chinese digital companies. A large proportion of payments go through their systems, the companies control them and also have a large set of personal data on Chinese residents. Also, these companies were until recently listed in the US, making it unsafe for companies to have so much data. In addition, China is seeking to raise the importance of the renminbi as an international currency. This idea has particular potential in the Asian region.

The central bank conducted widespread tests of the digital yuan in 2019 along with seven significant state-owned businesses and institutions. Digital currency pilot programs have begun in Shenzhen, Suzhou, Xiong'an, and Chengdu. It should be emphasized that China is now a well-known pioneer in blockchain and cryptotechnology. 2020 will see the emergence of more than 10,000 blockchain businesses in China. UnionPay, Huawei, and Alibaba are three prominent Chinese firms that are working on their own blockchain initiatives.

In 2020, the first comparatively sizable experiments of the digital yuan commenced. The digital yuan is utilized in several places to pay for food, transportation, and retail items. Beijing is likewise paying its government employees with cryptocurrencies. Ten locations had pilot projects begun in 2021, and Beijing's Olympic Games will be the backdrop for a large-scale test of the digital yuan in 2022.

The digital RMB is the only central bank currency at the moment that has actually started to be used widely. More than 140 million wallets have already been opened in China, and within six

months of opening, 62 billion yuan have been credited, according to figures for 2021.[70] The digital yuan has already been used for payments in various cities in China, with transactions using it exceeding $8 billion in the second half of 2021. Graph 20 shows a gradual increase in the number of active users of digital RMB applications, with 5.5 million users at the end of the year.



Graph 20. Number of monthly active users of digital currency mobile applications in China from January 2021 to December 2021 (in millions)

Source: AskCI Consulting, 2022 / In Statista. Retrieved February 22, 2023, from https://www.statista.com/statistics/1368270/china-mau-of-digital-currency-apps/

Due to China's quick success, other nations are also considering creating their own digital currencies. From the creation of general concepts through the execution of significant pilot projects, we can see that it took 5 years, and 3 years if we talk about the active period. The central government is actively involved, which is a significant distinction from cryptocurrencies like Bitcoin and Ethereum, and thus guarantees very quick deployment.

The People's Bank of China defines the digital yuan as a digital form of fiat currency issued by the PRC Central Bank.[71] The terms Digital Currency Electronic Payment (DCEP) and e-CNY are most commonly used in international research to define the digital renminbi. It is noted that the digital renminbi has all the basic functions of money and is legal tender in China.

[70] 进展顺利！中国数字货币用户逾 1.4 亿 交易额达 620 亿元 URL: https://baijiahao.baidu.com/s?id=1717174098138462228&wfr=spider&for=pc

[71] Progress of Research & Development of E-CNY in China People's Bank of China, 2021. URL: http://www.pbc.gov.cn/en/3688110/3688172/4157443/4293696/2021071614584691871.pdf

Lack of privacy is one of the main differences between CNY and other cryptocurrencies because the People's Bank of China will issue the currency and be the one receiving information about all transactions. In other words, because the matter will be handled by the Central Bank, it breaches both the decentralization concept and the ideal of confidentiality of digital currency. The government will be able to better oversee citizen and corporate financial transactions thanks to the digital yuan.

Through meticulous design and top-level R&D, the People's Bank of China and participating institutions developed and improved e-CNY applications in three phases:

- development and testing;
- internal validation;
- pilot project.

PBOC has also developed three main e-CNY functions:

- exchange and circulation management;
- compatibility;
- wallet ecosystem.

The digital yuan will be distributed in what is known as a two-tier system.[72] It will be given by the central bank to commercial banks, who will then give it to customers of the bank's services. Although it is unclear how users will store and use the electronic yuan, it is known that they will need to download a government-owned app. It is well known that QR codes provide the foundation for the most widely used mobile payment method in China. Users display the code in their app during a transaction so the retailer may scan it. China has the potential for widespread adoption of the digital yuan, it might be argued.

Digital RMB will have a positive impact on e-commerce, as e-commerce companies can benefit from an increased number of electronic payments due to the introduction of digital RMB.

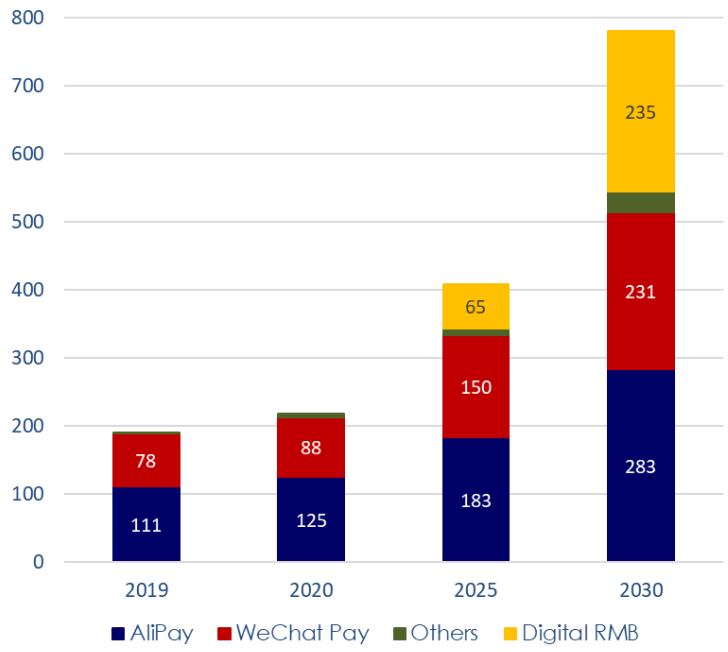
The consumer sector should also see a positive impact of the digital RMB because large enterprises will be able to create and implement profitable loyalty systems when using e-CNY, and for SMEs it is a chance to enter new foreign markets with the internationalisation of this digital currency, which we will discuss further.

[72] Raud M., MacKinnon E. «China's Digital Currency and Blockchain Network: Disparate Projects or Two Sides of the Same Coin?» / Stanford University, 2022. URL: https://digichina.stanford.edu/work/chinas-digital-currency-and-blockchain-network-disparate-projects-or-two-sides-of-the-same-coin/

The impact can also be described as positive for the commodity sector, but to a lesser extent than the above-mentioned sectors, as payments are likely to be made domestically, but globally less so for the time being.

For the banking sector, however, the impact will be negative and reduce the role of banks, as the digital RMB will lead to an outflow of funds from banks to the new digital wallets of the central bank. The People's Bank of China will also be involved in servicing business-to-business transactions within the country. The creation of "local" digital renminbi wallets for each bank would help to reduce the negative effect, but it is not known how feasible this would be.

Additionally, payment platforms like Alipay and WeChat Pay, which handle more than 90% of all payments in China, will suffer. The benefits of using digital RMB in this situation would be the lack of costs, government support, and possibly being required to do so for services and trade within the PRC. The Graph 21 below displays the volume of payments made through WeChat Pay and AliPay, as well as Bloomberg's predictions for RMB payment volume in 2025 and 2030.



Graph 21. Volume of payments by platform (trillion yuan)

Source: How a digital yuan threatens China banks, Alipay and WeChat Pay / Bloomberg Intelligence, 2021. Retrieved February 22, 2023, from

https://www.bloomberg.com/professional/blog/how-a-digital-yuan-threatens-china-banks-alipay-and-wechat-pay/

The majority of central banks should concentrate on improving their payment infrastructure during and after the COVID-19 crisis rather than establishing new blockchain-based forms of currency. Future trends are unlikely to favor either the extreme private or public models. Instead, we anticipate that the redesign of national monetary and payment systems will involve collaboration between state-owned central banks and (old and new) private entities, as these two groups will together be able to create better monetary and payment systems both domestically and internationally. For the first time in history, the financial and payment systems will be able to work together under this model thanks to technology.

3.2. Prospects for cross-border use of the digital yuan

Long-term, the adoption of digital renminbi by Hong Kong and China's trading partners may enhance the renminbi's position as the global reserve and settlement currency. That is the aim of its own digital currency's external development. Trading partners' progressive acceptance of the digital renminbi might further solidify the renminbi's position as a reserve currency for the world and the usage of the Chinese cross-border interbank payment system (CIPS) as a replacement for the US dollar SWIFT system in the face of possible US sanctions. But by 2022, the renminbi's share of global payments will only be about 3%.[73] The imposition of sanctions against Russia has accelerated the process of dedollarisation, but the renminbi does not yet hold a significant share of global payments.

Although CIPS facilitates cross-border settlements in renminbi, it still requires custodian banks, which hold the accounts of individuals and businesses.[74] These banks are still subject to sanctions, and the digital yuan does away with this necessity. In essence, it is a People's Bank of China money account that may be used to settle with another money account through a direct mechanism run by the central bank. This avoids the requirement for banks to be used in the transaction between sending and receiving clients, removing connections that could be affected by US or EU sanctions.

Hong Kong, however, is anticipated to serve as a test site for the deployment of digital renminbi offshore. To enable cross-border retail payments, authorities are integrating e-CNY wallets with Hong Kong's local Faster Payments System (FPS) network.[75] In addition to retail use, the city could be the first to try out the digital yuan for wholesale trade and cross-border transactions as China's offshore centre.

To encourage the internationalization of the renminbi and the use of China's Cross-border Interbank Payment System (CIPS), it is important to mention China's trading partners in the Regional Comprehensive Economic Partnership (RCEP) and the One Belt, One Road Initiative as potential users of the digital renminbi abroad. The Regional Comprehensive Economic Partnership

[73] RMB Tracker Monthly reporting and statistics on renminbi (RMB) progress towards becoming an international currency / SWIFT, 2022. URL: https://www.swift.com/ru/node/9501
[74] Cross-Border Interbank Payment System / CIPS. : https://www.cips.com.cn/
[75] Hong Kong Monetary Authority. URL: https://www.hkma.gov.hk/eng/key-functions/international-financial-centre/financial-market-infrastructure/faster-payment-system-fps/

(RCEP) is a free trade agreement among 15 nations in the Asia-Pacific region, including Australia, Brunei, Cambodia, China, Indonesia, Japan, Laos, Malaysia, Myanmar, New Zealand, the Philippines, Singapore, South Korea, Thailand, and Vietnam. It was relatively recently finalized in 2020 and will go into effect in early 2022.

Additionally, some nations (like China) are thinking about creating their own digital currencies as a tool for international trade in their own currencies (as well as using their own payment systems), which should give their economies more financial stability. A number of central banks from different nations have collaborated on projects as the concept of using digital currencies internationally has grown. For instance, one of the most well-known initiatives to enhance the financial system to handle several currencies for cross-border payments is the Multiple CBDC Bridge.[76]

mBridge is a pilot project of cross-border CBDC. This project involves China, Hong Kong, UAE and Thailand. The system uses distributed ledger technology (DLT) to exchange digital currencies between the countries' central banks. The testing took place from 15 August to 23 September шт 2023 and concerned foreign trade settlements and interbank transfers, with the participation of the 20 largest commercial banks of these countries. The use of this technology allows the adhering countries to convert mutual settlements into their national currencies, as well as to hide their data. This, on the one hand, continues the trend towards dedollarisation and, on the other hand, avoids economic sanctions. As can be seen from the Graph 22, the largest banks in the countries involved in the project participated in the test.

Graph 22. Participating commercial banks in the pilot

[76] Multiple CBDC (mCBDC) Bridge / Bank for International Settlements, 2021. URL: https://www.bis.org/about/bisih/topics/cbdc/mcbdc_bridge.htm

Source: Connecting economies through CBDC / Bank for International Settlements, 2022. Retrieved February 22, 2023, from https://www.bis.org/publ/othp59.pdf

China may deploy digital currency for domestic retail use to make history as the first big country to do so. The populace of the PRC might have easier access to financial services thanks to the digital yuan, which could also boost the effectiveness of economic government institutions. According to a 2021 Bank for International Settlements (BIS) poll, more than 86% of the world's central banks are considering using digital currencies.[77] For instance, it will be considerably simpler to track the flow of money in the shadow economy with the adoption of the digital renminbi. It is important to note that certain industrialized nations are concentrating their efforts on investigating the use of virtual currencies to increase the effectiveness of payments, especially cross-border payments. For instance, Canada and Singapore are investigating the use of cryptocurrencies in interbank payments, and Australia, Japan, Saudi Arabia, South Africa, and the UAE are investigating the usage of digital currencies across international borders.

Asia is the first continent where the digital yuan might displace the US currency. Trade between China and other Asian nations reflects their close relations, particularly in the years since the FTA came into effect (RCEP). The removal of constraints on the flow of products and services, as well as improved transportation connections (if we are not talking about COVID-19-related limitations) and reciprocal investment involvement, demonstrate China's significant influence on the nations of Southeast Asia. Therefore, it can be assumed that some payments and transactions will be conducted using the digital renminbi when it is launched, undermining the status of the US dollar in the region.

Additionally, China's One Belt, One Road initiative, a global infrastructure strategy, holds great promise for integrating Asia. More than 70 nations in Asia, Europe, and Africa are said to benefit from significant investment through the Belt and Road initiative. The Chinese government's efforts to encourage renminbi financing through unique financial organizations like the Asian Infrastructure Investment Bank or the Silk Road Fund have a significant impact on Asia, a key receiver of investments under this programme.

[77] BIS Innovation Hub work on central bank digital currency (CBDC) / Bank for International Settlements, 2021. URL: https://www.bis.org/about/bisih/topics/cbdc.htm

The quick and simple transactions offered by the digital renminbi, however, could be advantageous for many emerging nations, particularly those with relatively weak currencies. In various nations, rapid payments have been implemented as a result of the establishment of Ant Financial and Tencent throughout Asia as part of the Digital Silk Road project. In conclusion, once the Chinese government successfully establishes itself in the international financial system, the growth of the digital renminbi will have significant ramifications for Asian nations.

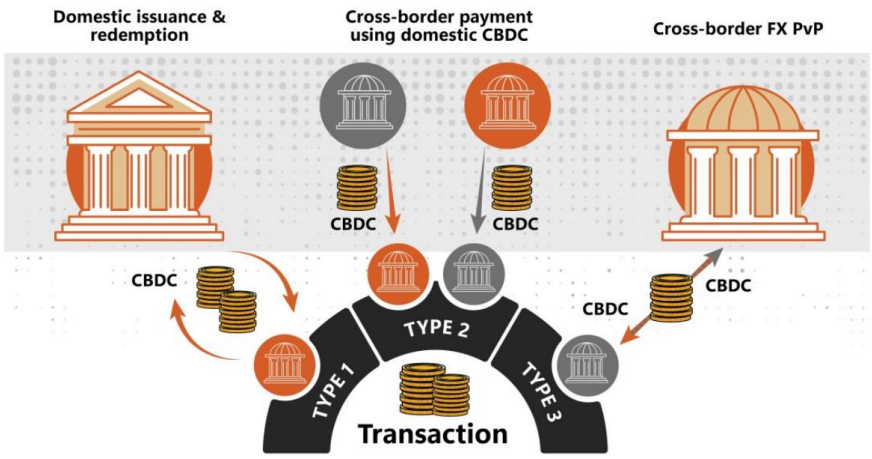
3.3. The digital yuan: experience and opportunity for Russia

First and foremost, Russia could be one of the countries that will use the digital yuan for trade payments. It has already been noted above that the use of digital renminbi at this stage directly affects banks. The distributed ledger system itself takes less time to set up than negotiating between countries and setting up the financial infrastructure: interfacing clearing houses, depositories, regulators, getting licences from banks in the two countries and so on.

Thus, it can be said that the use of the digital RMB will allow new banks and companies to be connected more quickly to mutual settlement systems. This is important for companies and mutual trade between the two countries. RMB trading volume in February 2023 exceeded RMB 1.48 trillion, with the Chinese currency's share of total spot market turnover approaching 40%. This indicates a continued trend away from unfriendly currencies and is a logical consequence of the sanctions imposed on Russia, which do not allow free use of currencies from Western countries. The increase in demand for renminbi is due to the shift to national currencies in bilateral trade between Russia and China. In addition, the trade turnover itself has increased by almost 30% and exceeded $190 billion (according to the General Administration of Customs of the People's Republic of China).[78] The Ministry of Finance's budget rule also contributes, as the Central Bank of Russia has started selling Chinese currency on the open market since the beginning of the year.

Russia could join the mBrigde project even using the digital rouble. The Graph 23 shows a schematic of how settlement works on the mBridge platform.

[78] Trade between Russia and China breaks a record / RIA, 2023. URL: https://ria.ru/20230113/kitay-1844528268.html



Graph 23. Transaction types tested on the platform

Source: Connecting economies through CBDC / Bank for International Settlements, 2022. Retrieved February 22, 2023, from https://www.bis.org/publ/othp59.pdf

Based on the chart above, 3 types of transactions can be distinguished:

- CBDC issuance and redemption between central banks and their domestic commercial banks commercial banks.
- Cross-border payments between commercial banks in local CBDCs (e.g. a UAE corporation pays a corporation from mainland China in electronic Chinese renminbi through their commercial banks participating in the platform).
- Cross-border PvP FX between commercial banks in local CBDCs (e.g. a Thai bank exchanges e-THB for e-HKD with a Hong Kong SAR bank on the platform).

The use of the digital RMB will not only help in the speed of setting up the infrastructure, but will also provide a way around sanctions for companies in the two countries. This is because the system itself has no external control, and all transaction data is available only to those involved in the transactions. This could stimulate economic activity between the countries, as a number of Chinese companies, including giants such as Huawei, have been forced to curtail their official activities in Russia due to the threat of secondary sanctions.

Second, Russia can draw on China's experience in developing its own central bank digital currency, the digital rouble. As defined by the Central Bank of the Russian Federation, the digital

rouble is a digital form of the Russian national currency that the Bank of Russia plans to issue in addition to existing forms of money.[79]

Russia, like China, envisages a two-tier operating model for the digital yuan. The central bank envisages using large banks to distribute the digital yuan to the population. Unlike China, Russia is just starting to develop this project. In December 2021, a prototype of the digital rouble platform was created. The following year, testing of the prototype of the digital rouble platform and development of an implementation roadmap based on the results of the testing began. An important aspect of 2022 was the development of legislation for the implementation of the digital rouble. Finally, in 2023 it is planned to pilot operations with real digital roubles, involving a narrow circle of clients of some banks from the pilot group.

At this stage of the pilot projects, it makes sense to refer to the experience of Chinese colleagues who have tested the digital RMB in different provinces, among different companies at different scales. China's experience will make it possible to predict the impact on economic sectors and determine the support measures of the authorities for companies and end-users of the digital RMB.

[79] The digital rouble: what it is and how to use it / Central Bank of Russia, 2023. URL: https://www.cbr.ru/faq/dr/

Conclusion

Although this study looks into a variety of areas of the digital economy, there is still much to learn about this subject. A review of current research has shown that the identified themes are addressed by different authors, but there is nevertheless the potential to explore new features of development and trends in China's digital economy.

China is actively developing its digital economy, with the most active development phase occurring in 2015, which this research paper examines. Key initiatives, such as Made in China 2025, Internet+, as well as policy documents of the Chinese authorities, set the country's development vector for the current period. The development of modern technology, one of which is artificial intelligence, is important for China. In addition, these documents formulate the areas of application of digital technology in life: education, medicine, as well as everyday retailing through e-commerce platforms. A special place is also given to rural areas, which need digital technology to improve their living conditions.

China has shown an unusually high rate of growth in the digital economy. An important component of successful digital development is a well-established mechanism of interaction between the authorities and business. In addition, the country is already aiming to address the shortage of skilled professionals in the industry. The most effective here is the format of interaction between business and universities, as well as the cluster system. In addition to training future specialists, this allows for scientific research jointly sponsored by governments and companies.

Key players in the sectors discussed in this paper are China's largest IT companies: Baidu, Alibaba, Tencent, start-ups such as SenceTime and Mengvi, infrastructure companies such as Huawei (5G technology). These companies are fully supported by the authorities, and companies and authorities are implementing joint projects. However, a number of companies (such as Didi, Tencent, and Alibaba) have recently been subjected to inspections and fines due to violations of antitrust laws. The Chinese authorities are also currently monitoring the security of citizens' personal data and access to it by foreign companies.

The pandemic has slowed the overall growth of China's digital economy in 2020, but it has spawned many new areas for development, as the pandemic has shown that artificial intelligence

technology can be successfully applied to (1) providing remote working for businesses (2) tracking systems, (3) technology (4) smart cities, (5) big data, (6) medicine and (7) unmanned cars.

In addition, the pandemic highlighted disparities in digital penetration in education and medicine between urban and rural areas. Urban dwellers have adapted more quickly to the move to an online format for education and treatment. An example of this is the use of an app to track the movements and contacts of city dwellers.

The paper identified the following benefits of Taobao villages: increased household income, new jobs, preservation of traditional ways of producing goods, development of related industries such as rural tourism. Villagers who use e-commerce platforms have a higher income than those who do not use them to sell goods and services. Moreover, in the last 8 years, which coincide with the spread of Taobao villages, the disposable income of villagers nationwide has doubled. Finally, Taobao villages have created nearly 8.3 million new jobs in rural areas by the end of 2021. Of course, challenges remain and arise for the development of e-commerce in rural areas. Challenges include: problems with product marketing, competition and monotony of some products, and lack of rural competencies. When considering technology deployment, the need to develop the accompanying infrastructure, such as 5G networks, was noted. And rural areas have a lot to develop, as only 40% of villages are equipped with 5G networks. However, local authorities have developed specific plans to increase coverage in rural areas.

The authorities' desire to control the flow of money within the country as well as cross-border payments, the new phase of confrontation between China and the US, the desire to strengthen the yuan, and now the banking sanctions imposed on Russia have prompted China to develop its own central bank digital currency, the digital yuan. The author notes the success of the pilot projects as well as the prospects of the use of digital renminbi under a two-tier system. In addition, the author notes the threat to the already existing payment systems AliPay and WeChat Pay.

The digital RMB is likely to be used for cross-border settlements, which would contribute to the internationalisation of the RMB and increase China's influence in the global financial system. This paper identifies potential partner countries: predominantly ASEAN countries. This paper points out the advantages of using the digital renminbi for cross-border payments: fast and

convenient infrastructure, the possibility of exemption from secondary sanctions for foreign companies.

Finally, China's experience can be used in the development of the digital ruble: different levels of sophistication of pilot projects can be used, local authorities can be engaged, and banks can be actively engaged to implement the central bank's own digital currency.

China is one of the world leaders in developing the digital economy, so learning from its experience is unusually important for developing countries that want to develop their own areas of the digital economy. Highlighting and analysing trends in China's digital economy can help shape its own development trajectories and roadmaps for implementing certain digital projects.

This research topic also has further potential for study. Many scholars and practitioners believe that the global economy has already entered a new industrial revolution that is transforming many business and manufacturing processes. China aims to become a global leader in digital technology in order to take a new place in the global economy and ensure sustainable economic growth. The defining date for many government development programmes is 2049, which will be the 100th anniversary of the founding of the People's Republic of China. The future will show whether China will be able to achieve its goals.

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