Development Status of Digital Economy in Northeast Asian Countries and China's Opportunities

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Abstract: *With the vigorous development of digital technology, the development of the digital economy has become an important component of the global economy. Against the background of negative growth of major global economies hit hard by the COVID-19 epidemic, the steadily rising digital economy has become a key force to boost the global economy and an important engine to promote global economic development. Northeast Asian countries should use the dividends released by the digital economy to promote the coordinated development of digital technology innovation within the region, respond to technological revolution and industrial transformation, and build new international competitive advantages. This article provides a detailed overview of the current development status of digital economy in various countries in Northeast Asia, analyzes the challenges faced by countries in the region in developing cross-border digital economic and trade cooperation from three aspects: political mutual trust, digital divide, and network security. It further proposes to build a cross-border digital service trade platform in Northeast Asia, establish a China North Russia Far East digital free trade zone, so as to promote the deepening of cooperation and common development in digital trade within the region.*
Keywords: *Northeast Asian countries; digital economy; Chinese opportunities*

Introduction

In 2020, the COVID-19 swept the world, and the total global GDP declined, but the scale of the global digital economy rose steadily, with the added value reaching 32.6 trillion US dollars, and the contribution to GDP was 43.7%, up 2.5% year on year. In 2021, the added value of the global digital economy continued to rise, contributing 45.0% to GDP, a year-on-year increase of 14.4% (see Figure 1). The scale of added value in 2021 has increased by 66.15% compared to 2017, accounting for nearly three times the proportion of global GDP. Against the backdrop of negative growth in major global economies, the steadily rising digital economy has become a key force in boosting the global economy and an important engine for promoting global economic development

Fig. 1. Global GDP, Scale of added value in the digital economy, and Proportion to GDP in 2016-2021[1,2] *(unit: trillion US dollars, %)*

[1] ZHANG Guocheng. A*nalysis of the Global Digital Economy Market Size and Competitive Pattern in 2022: Developed Countries Leading the Digital Economy*, Dec.16, 2021, https://www.qianzhan.com/analyst/detail/220/211206-04807d2c.html.
[2] CAICT: *White Paper on the Development of China's Digital Economy(2021)*, http://www.caict.ac.cn/kxyj/qwfb/bps/202104/P020210424737615413306.pdf.

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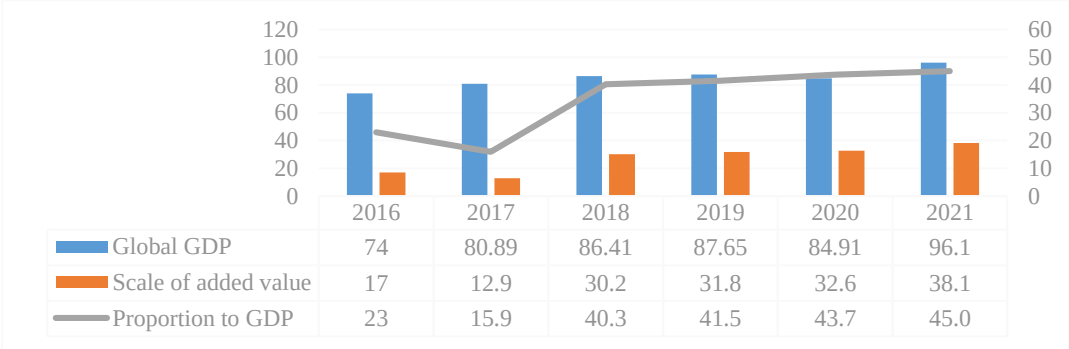


	2016	2017	2018	2019	2020	2021
Global GDP	74	80.89	86.41	87.65	84.91	96.1
Scale of added value	17	12.9	30.2	31.8	32.6	38.1
Proportion to GDP	23	15.9	40.3	41.5	43.7	45.0

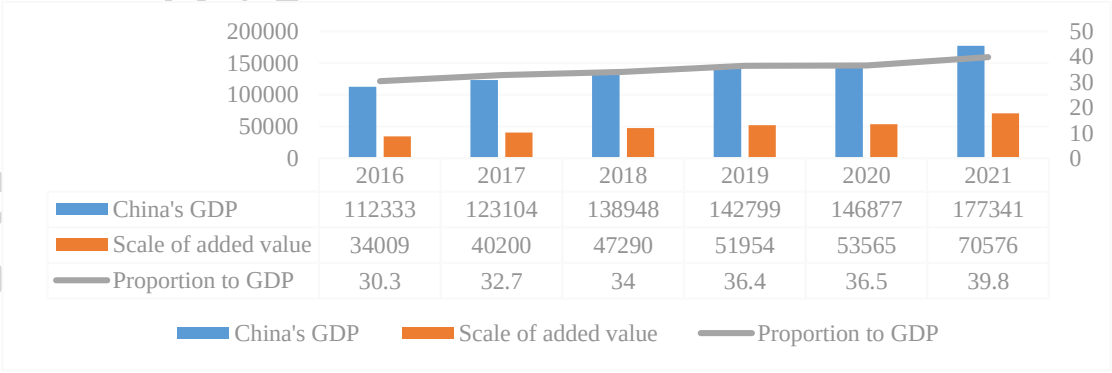
I. Development Status of Digital Economy in Northeast Asian Countries

1. The overall scale of digital economy in Northeast Asian Countries

1.1 The overall scale of digital economy of China

China has elevated the development of its digital economy to a national strategy, which has entered a fast lane of development and has steadily ranked second in the world for several years. As shown in Figure 2, the overall scale of China's digital economy has increased from $3400.9 billion in 2016 to $7057.6 billion in 2021, an increase of 51.8%. The overall scale of the digital economy has increased from 30.3% of GDP in 2016 to 39.8% in 2021. It can be seen that the development of the digital economy has become a key driving force for sustained and stable growth of the national economy. In January 2022, the State Council issued *The 14th Five Year Plan for the Development of the Digital Economy*, which clearly stated that by 2025, China's digital economy will enter a period of comprehensive expansion. Looking ahead to 2035, the digital economy will enter a period of prosperity and maturity. The report of the 20th National Congress of the Communist Party of China further emphasized the need to accelerate the construction of a digital China. China's continued focus on high-quality development of the digital economy, which will continue to play an accelerator role in reshaping the global economic structure and building a new pattern of global competition.

Fig. 2. China's GDP, Scale of added value in the digital economy, and Proportion to GDP in 2016-2021[3,4] *(Unit: USD100mn, %)*



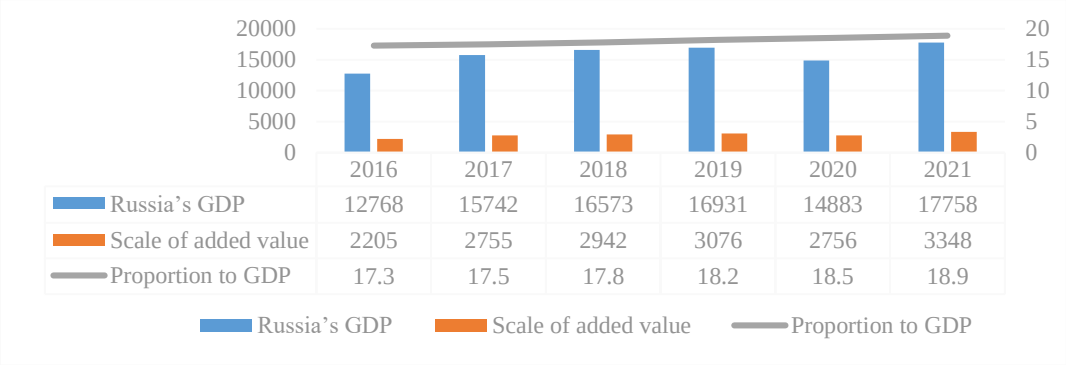
	2016	2017	2018	2019	2020	2021
China's GDP	112333	123104	138948	142799	146877	177341
Scale of added value	34009	40200	47290	51954	53565	70576
Proportion to GDP	30.3	32.7	34	36.4	36.5	39.8

1.2 The Overall Scale of Digital Economy of the Russian Federation

[3] CAICT: *White Paper on the Development of China's Digital Economy(2021)*, http://www.caict.ac.cn/kxyj/qwfb/bps/202104/P020210424737615413306.pdf.
[4] *GDP (current LCU) Japan*, https://data.worldbank.org.cn/indicator/NY.GDP.MKTP.CN?locations=JP.

Russia vigorously promotes its national digital development strategy and achieves economic restructuring and upgrading. In May 2017, Russian President Putin signed a presidential decree approving *The 2017-2030 Information Society Development Strategy of the Russian Federation*, indicating the direction and planning path for future information society construction and development of the Russian Federation. On July 28 of the same year, the government of the Russian Federation officially approved *the Digital Economy Plan of the Russian Federation*, setting the development goals and tasks for the digital economy before 2024. As shown in Figure 3, the overall scale of digital economy of the Russian Federation and its proportion to GDP have maintained stable growth. The overall scale of digital economy accounted for about 1% of GDP in 2012. From a numerical perspective, the development trend of digital economy of the Russian Federation in the past decade has been good. In 2020, under the impact of the COVID-19, the total GDP and overall scale of the digital economy showed a slight decline, but the proportion of the scale of the digital economy in GDP rose slightly. In 2021, the overall trend of economic development rebounded, with the overall scale of the digital economy accounting for 18.9% of GDP, reaching a historical high and increasing by nearly 20 times compared to 2012. Based on the above data and the direction of the national economic development strategy layout, the Russian Federation has effectively promoted the development of the digital economy and created a new economic growth pole.

Fig. 3. Russia's GDP, Scale of added value in the digital economy, and Proportion to GDP in 2016-2021[5,6] *(unit: USD100mn, %)*



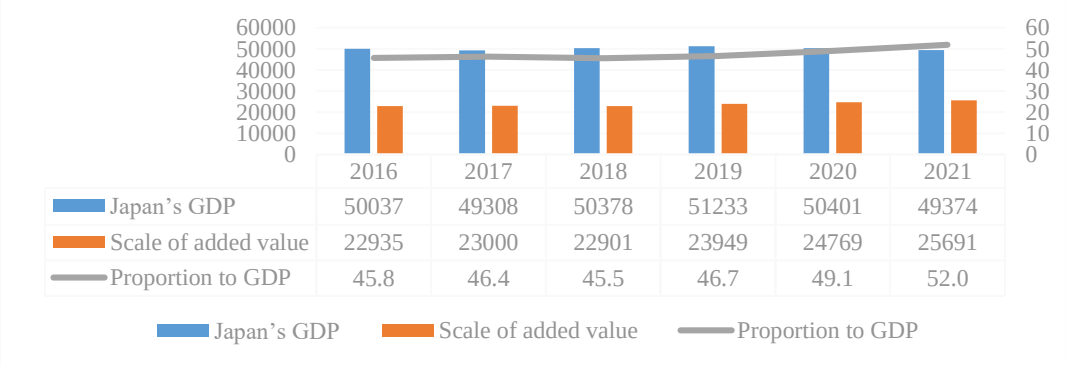
1.3 The Overall Scale of Digital Economy of Japan

The development of Japan's digital economy started early, with frequent top-level designs. In 1994, the Japanese government proposed "electronic government" with the aim of becoming a highly informationized country. Subsequently, a series of national strategies focusing on digital information technology to promote Japan's economic and social development, such as *e-Japan*(2001), *u-Japan*(2004), and *i-Japan*(2009), were successively introduced. In 2012, Japan proposed *Japan Revival Strategy*, which explicitly promoted the revitalization of the Japanese economy through the integration and development of digital information technology and industries.[7] In 2013, the Declaration on the Creation of the World's Most Advanced IT Countries and roadmap were introduced as symbols to promote the application of big data. With the strong promotion

[5] CAICT: *White Paper on Global Digital Economy(2022)* , Dec. 2022, http://www.caict.ac.cn/kxyj/qwfb/bps/202212/t20221207_412453.htm.
[6] *GDP (current LCU) Japan*, https://data.worldbank.org.cn/indicator/NY.GDP.MKTP.CN?locations=JP.
[7] XIE Qian, YAO Bo, LIU Honghuai. *International Comparison, Development Trends, and Enlightenment of Digital Trade Policies*, [J]. Technology Economics, 2020(7): pp10-17.

of digital economy development by the Japanese government, Japan has achieved a high scale of digital economy growth and has been among the world's top for several years. The COVID-19 epidemic broke out in 2020, which led to a serious decline in the global economy. In 2020 and 2021, Japan's GDP showed a downward trend, but the overall scale of the digital economy grew steadily. In 2020, the overall scale of the digital economy and its proportion to GDP increased, with a proportion to GDP of 52.0% in 2021. (See Figure 4) It can be seen that the development of Japan's digital information industry has become the industry that contributes the most to Japan's GDP, and the development of Japan's digital industry has entered a period of steady maturity.

Fig. 4. Japan's GDP, Scale of added value in the digital economy, and Proportion to GDP in 2016-2021[8,9] *(Unit: USD100mn, %)*



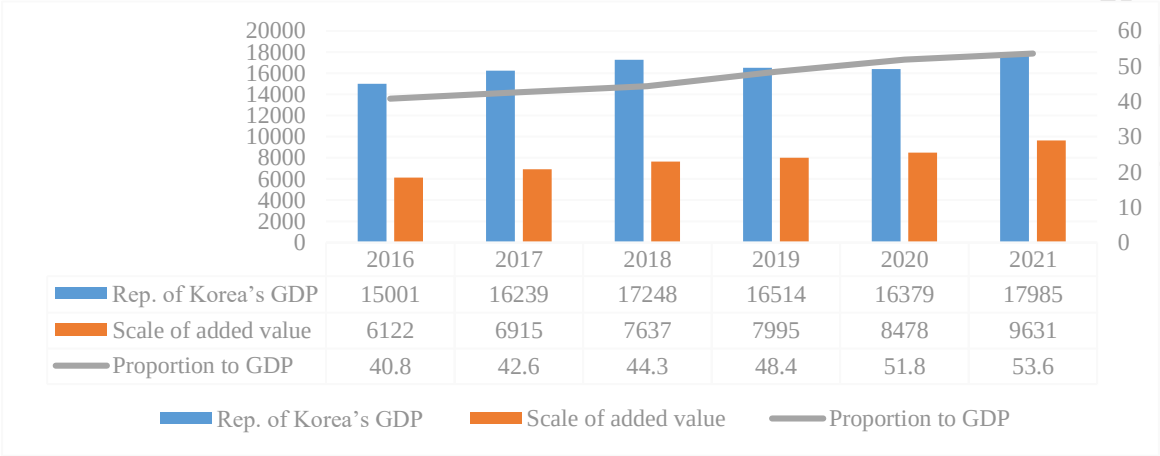
1.4 The Overall Scale of Digital Economy of Republic of Korea

Since the early 1990s, the government of Republic of Korea has been planning the development of the national information industry, and has since introduced multiple information technology strategic plans such as *the G-7 Plan (1992-2001)* (1992), *the Information Highway Construction Plan* (1994), *the Ultra High Speed National Information and Communication Network Infrastructure Plan* (1995), *the Cyber Korea 21 Plan* (1999), *the Information Village Plan* (2001), and *the e-Korea 21 Plan* (2002), *U-Korea Strategic Plan* (2004), *National Informatization Basic Plan* (2008), *IT Korea Future Plan* (2009), *Cloud Computing Diffusion and Enhancing Competitiveness Strategy* (2011), *ICT R&D Medium and Long Term Plan* (2013-2017) (2013), *K-ICT Strategy* (2015), *K-ICT Security 2020 Strategy* (2016), *Data Industry Revitalization Strategy* (2018), and Government's Medium and Long Term R&D Investment Strategy (2019).[10] The information industry has become a pillar industry of economy in Republic of Korea. In the fourth quarter of 2022, the ICT industry accounted for 13.0% of GDP and contributed 0.4% to economic growth[11]. Since the end of the 20th century, the information industry in Republic of Korea has entered a mature period, vigorously promoting the development of digital information technology and promoting the Digital transformation and upgrading of traditional industries. As shown in Figure 5, in recent years, the development trend of digital economy in Republic

[8] CAICT: *White Paper on Global Digital Economy(2022)* , Dec. 2022, http://www.caict.ac.cn/kxyj/qwfb/bps/202212/t20221207_412453.htm.
[9] *GDP (current LCU) Japan*, https://databank.shihang.org/reports.aspx?source=2&type=metadata&series=NY.GDP.MKTP.CD#.
[10] LI Guyuan. *Research on Informationization and Smart Society Development in Republic of Korea*.[M]. Social Science Literature Press, 2020.4.1: pp.123-140.
[11] ITSTAT: *ICT 산업의 GDP 비중(실질)*，https://www.itstat.go.kr/itstat/kor/stat/StatList.html.

of Korea has been stable and improving. The overall scale of the digital economy accounts for a high proportion of GDP, with a proportion of over half in 2020 and 2021. It can be seen that the digital industry plays a crucial role in the development of the national economy.

Fig. 5. Rep. of Korea's GDP, Scale of added value in the digital economy, and Proportion to GDP in 2016-2021[12,13] (unit: USD100mn, %)



	2016	2017	2018	2019	2020	2021
Rep. of Korea's GDP	15001	16239	17248	16514	16379	17985
Scale of added value	6122	6915	7637	7995	8478	9631
Proportion to GDP	40.8	42.6	44.3	48.4	51.8	53.6

1.5 International Comparison of the Overall Scale of Digital Economy in Northeast Asian Countries

In recent years, the top-level design of the digital economy strategic planning of Northeast Asian countries has frequently boosted the sustained and rapid growth of the scale of digital economy development, and the overall scale of the digital economy has entered the forefront of the world. According to *the Global Digital Economy White Paper (2022)* released by the China Academy of Information and Communications Technology, the overall scale of China, Japan, Republic of Korea, and the Russian Federation's digital economy showed an upward trend in 2021. Among them, the significant increase in the scale of China's digital economy was 24.1%. In 2021, China, Japan, Republic of Korea, and the Russian Federation ranked 2, 4, 7, and 13 in terms of digital economy scale, respectively. The digital economy development of the four countries in Northeast Asia has entered the world's advanced ranks. From the comparison between the GDP growth rate and digital economy growth rate of Northeast Asian countries in Table 1, it can be seen that in recent years, the digital economy has performed better than the GDP growth rate, which has a significant supporting effect on economic stability and growth. Northeast Asian countries focus on the economic development dividends brought by the digital economy as an important driving force for driving their national economic growth.

Fig. 6. Comparison of the overall scale of digital economy in Northeast Asian countries in 2016-2021[14] (Unit: USD100mn)

[12] CAICT：*White Paper on Global Digital Economy (2022)*，Dec. 2022, http://www.caict.ac.cn/kxyj/qwfb/bps/202212/t20221207_412453.htm。
[13] *GDP (current LCU) Rep. of Korea*, https://databank.shihang.org/reports.aspx?source=2&type=metadata&series=NY.GDP.MKTP.CD#
[14] CAICT：*White Paper on Global Digital Economy (2022)*，Dec. 2022, http://www.caict.ac.cn/kxyj/qwfb/bps/202212/t20221207_412453.htm.

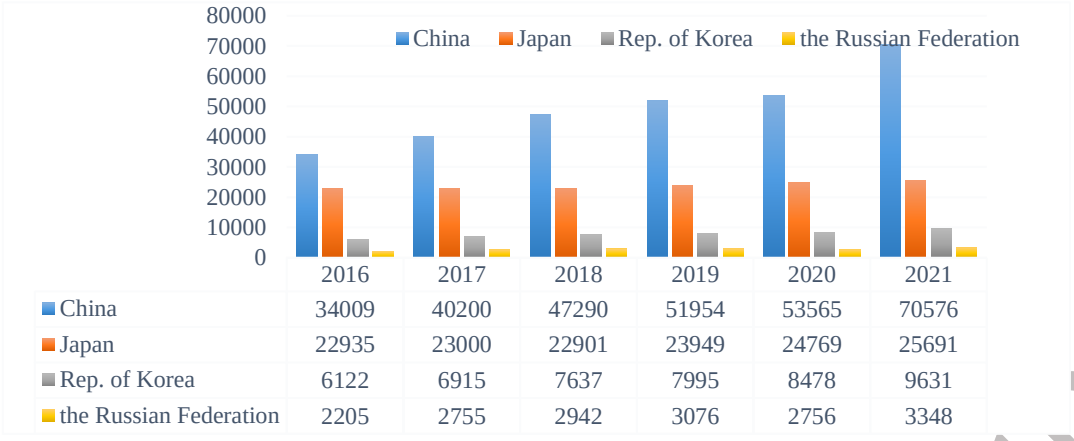


Table 1. Comparison growth rates of GDP and digital economy in Northeast Asian countries in 2017-2021 (%)

Year	2017		2018		2019		2020		2021	
Economy	GDP	Digital economy	GDP	Digital economy	GDP	Digital economy	GDP	Digital economy	GDP	Digital economy
China	8.75	15.4	11.40	14.99	2.70	8.98	2.78	3.01	17.18	24.10
Japan	-1.48	0.28	2.12	-0.43	1.67	4.38	-1.65	3.31	-2.08	3.59
Rep. of Korea	7.62	11.47	5.85	9.45	-4.44	4.48	0.82	5.70	8.93	11.97
The Russian Federation	18.89	19.96	5.01	6.36	2.11	4.36	-13.76	-11.61	16.19	17.68

2. Digital Infrastructure Construction in Northeast Asian Countries

Nowadays, digital development has become one of the important directions for countries around the world to plan economic growth. Northeast Asian countries have actively accelerated the construction of digital infrastructure in line with the trend of digital global development, with significant progress. According to *the Measuring Digital Development: Facts and Data (2022)* released by the International Telecommunication Union (ITU), in 2021 many key indicators related to digital development in Northeast Asian countries, including fixed and mobile phone signing rates, fixed and mobile broadband signing rates, LTE/WiMAX coverage, and the proportion of individuals using the Internet, were higher than the world average. As shown in Table 2, in recent years, Northeast Asian countries have continued to make efforts in the construction of internet facilities. Japan and Rep. of Korea have the most developed internet development, with a relatively stable scale of internet users. In 2021, the proportion of internet users in Rep. of Korea reached 97.6%, ranking first among countries in East and North Asia. The development of the internet in China and Mongolia is relatively lagging behind, but there has been a significant improvement in recent years. Between 2015 and 2021, the proportion of internet users in China increased from 50.3% to 73.1%; The proportion of internet users in Mongolia has increased from 22.5% to 84.3%, with a growth rate of 275 times, indicating rapid development. The Russian Federation's internet development indicators have maintained a steady growth trend

Table 2. Key indicators of Internet user data in Northeast Asian Countries in 2021[15,16,17,18,19]

Indicators	Mobile-cellular subscriptions per 100 inhabitants			Active mobile-broadband /fixed broadband subscriptions per 100 inhabitants			Percentage of population using the Internet（%）		
	2015	2018	2021	2015	2018	2021	2015	2018	2021
China	92.7	116.4	121.5	19.9 /55.8	28.8/94.2	37.6/104.8	50.3	59.2	73.1
Japan	126.2	142.5	160.9	30.6/127.9	32.9/194.7	36.1/223.6	91.1	88.8	90.2(2020)
Rep. of Korea	115.5	128.4	140.6	39.3/107.0	41.2/112.5	44.3/117.2	89.9	96.0	97.6
The Russian Federation	156.8	157.4	169.0	18.5/69.8	22.0/87.3	23.7/107.7	70.1	80.9	88.2
Mongolia	103.5	133.4	140.0	7.0/75.0	9.7/83.9	11.3/116.2	22.5	47.1	84.3

3. Transformation of digital government construction in Northeast Asian countries

At present, the global digital economy is in a rapid development stage, and the construction of digital infrastructure and related institutional supply are the cornerstone of digital global governance. Many countries and international organizations around the world have accelerated the construction of digital rules and good order, especially in promoting global governance in areas such as multilateral cross-border digital platform services. According to the Electronic Government Development Index (EGDI) and Electronic Participation Index (EPI) shown in the United Nations E-government Survey Report, China, the Russian Federation, and Mongolia should comprehensively promote the construction of a new type of government operation model - "digital government", actively enhance and build the willingness and ability of information exchange technology to provide public services, and narrow the gap with Japan and Rep. of Korea in the construction of "digital government". According to the report, in a survey of the current status of local online services (LOSI) in developed cities around the world, Moscow, Seoul, Shanghai, and Tokyo ranked 1, 7, 11, 19 in 2018[20], 6, 9, 9, 24 in 2020[21], 6, 30, 10, 14 in 2022[22]. The LOSI values of

[15] ITU: *Digital Development Dashboard-China*, https://www.itu.int/en/ITU-D/Statistics/Documents/DDD/ddd_CHN.pdf.
[16] ITU: *Digital Development Dashboard-Japan*, https://www.itu.int/en/ITU-D/Statistics/Documents/DDD/ddd_JPN.pdf.
[17] ITU: *Digital Development Dashboard-Rep. of Korea*, https://www.itu.int/en/ITU-D/Statistics/Documents/DDD/ddd_KOR.pdf.
[18] ITU: *Digital Development Dashboard-Mongolia*, https://www.itu.int/en/ITU-D/Statistics/Documents/DDD/ddd_MNG.pdf.
[19] ITU: *Digital Development Dashboard-the Russian Federation*, https://www.itu.int/en/ITU-D/Statistics/Documents/DDD/ddd_RUS.pdf.
[20] UNITED NATIONS: *E-GOVERNMENT SURVEY 2018*, https://publicadministration.un.org/egovkb/Portals/egovkb/Documents/un/2018-Survey/E-Government%20Survey%202018_FINAL%20for%20web.pdf.
[21] UNITED NATIONS: *2020 E-Government Survey (Full Report)*, https://publicadministration.un.org/egovkb/Portals/egovkb/Documents/un/2020-Survey/2020%20UN%20E-Government%20Survey%20(Full%20Report).pdf.
[22] UNITED NATIONS: *Local E-Government Development*, https://desapublications.un.org/sites/default/files/publications/2022-09/Chapter%203.pdf.

developed cities in the four countries of Northeast Asia are all higher than the world average. Among them, Moscow ranks in the top ten in the three-year version, and its local online services are relatively well-developed.

Table 3. Comparison of Global Rankings of EGDI and EPI in Northeast Asian Countries in 2010-2022[23,24,25,26,27]

Economy	China		The Russian Federation		Japan		Rep. of Korea		Mongolia	
	EGDI	EPI	EGDI	EPI	EGDI	EPI	EGDI	EPI	EGDI	EPI
2010	72	32	59	86	17	6	1	1	53	28
2012	78	66	27	19	18	11	1	1	76	24
2014	70	33	27	30	6	4	1	1	65	30
2016	63	22	35	32	11	2	3	4	84	39
2018	65	29	32	23	10	5	3	1	92	65
2020	45	9	36	28	14	4	2	1	92	87
2022	43	13	42	57	14	1	3	9	74	57

4. Digital Competitiveness in Northeast Asian Countries

4.1 Global Digital Competitiveness

The development of the digital economy, represented by digital industrialization and industrial digitization, has not only comprehensively improved national productivity and transformed the country's economic infrastructure, but also become the most important arena for political, technological dominance, and discourse power in new international competition.[28] The development of the digital economy has become a key force in restructuring global factor resources, reshaping the global economic structure, and changing the global competitive landscape. According to *the Global Digital Competitiveness Ranking* released by the International Institute for Management and Development (IMD), the digital technology application capabilities of the Russian Federation and Mongolia are limited, and the acceptance and transformation capabilities of digital technology need to be improved.(table 4) In the increasingly fierce competition in the field of digital economy, there is still an uneven pattern in the development of digital economy in Northeast Asian countries.

Table 4. IMD Global digital competitiveness index rankings in Northeast Asian countries

[23] UNITED NATIONS: *E-Government Knowledgebase(China)*, https://publicadministration.un.org/egovkb/en-us/Data/Country-Information/id/36-China.

[24] UNITED NATIONS: *E-Government Knowledgebase(the Russian Federation)*, https://publicadministration.un.org/egovkb/en-us/Data/Country-Information/id/141-Russian-Federation.

[25] UNITED NATIONS: *E-Government Knowledgebase(Japan)*, https://publicadministration.un.org/egovkb/en-us/Data/Country-Information/id/85-Japan.

[26] UNITED NATIONS: *E-Government Knowledgebase(Rep. of Korea)*, https://publicadministration.un.org/egovkb/en-us/Data/Country-Information/id/138-Republic-of-Korea.

[27] UNITED NATIONS: *E-Government Knowledgebase(Mongolia)*, https://publicadministration.un.org/egovkb/en-us/Data/Country-Information/id/113-Mongolia.

[28] YU Nanping，FENGJunfeng. *New International Competition in the Digital Economy Era* [J]. Contemporary International Relations, 2022(1): pp.35-43.

in 2018-2022

Economy	2018	2019	2020	2021	2022
China	30	22	16	15	17
the Russian Federation	45	45	50	42	NA
Japan	22	23	27	28	29
Rep. of Korea	14	10	8	12	8
Mongolia	61	62	62	62	62

4.2 Competitiveness of Digital Economy in Major Global Cities

According to Global Digital Economy City Competitiveness Development Report in Blue Book on Digital Economy published by China Social Science Literature Publishing House, this study focuses on the segmented dimensions of digital economy competitiveness in major cities around the world, focusing on areas such as economic and infrastructure competitiveness, digital talent competitiveness, and digital innovation competitiveness, and analyzes the digital economy city competitiveness of major cities in Northeast Asia. As shown in Table 5, in the past three years, Tokyo, Japan has been a global leader and has become the most competitive city in the digital economy of Northeast Asian countries. Seoul, Rep. of Korea, has significantly improved its ranking compared to 2020 but has not yet reached the ranking position of 2019. However, its digital talent competitiveness ranks first in the world in terms of individual values, and its overall ranking lags slightly, mainly due to its economic and infrastructure competitiveness. China is a Northeast Asian country with two cities ranking in the top 30 globally, while Beijing and Shanghai are both in the middle and upper reaches of the list, whose economic and infrastructure competitiveness and digital talent competitiveness, however, need to be urgently improved. Moscow, the Russian Federation, will become one of the top 30 cities in the world in 2021, which focuses on the development of digital talents, and has a large space to improve the competitiveness of digital economy in global city.

Table 5. Overall ranking of digital economy competitiveness in major global cities in 2021[29]

Rank	Cities	Economic and infrastructure competitiveness	Digital talent competiti-veness	Digital innovation competitiveness	Total score	Ranking in 2020	Ranking in 2019	Economies
4	Tokyo	64.5	69.8	78.6	70.9	5	6	Japan
5	Seoul	60.6	81.3	69.1	70.3	17	no	Rep. of Korea
12	Beijing	57.7	50.3	74.7	60.9	8	9	China
14	Shanghai	53.8	46.4	69.4	56.5	12	14	China
21	Moscow	45.6	63.8	50.1	53.2	no	no	the Russian Federation

[29] ZHAO Fuchun. *Global Digital Economy City Competitiveness Development Report* [M]. Blue Book on Digital Economy, China Social Science Literature Publishing House,2022.1: pp. 20-40.

4.3 Competitiveness of Global Digital Economy Enterprises

According to *Global Digital Enterprise Comprehensive Competitiveness Development Report* in the Blue Book on China's Digital Economy, the United States, Japan, and China have continued to become the top three global digital enterprise competitiveness in 2020 based on the comprehensive competitiveness ranking of digital enterprises from four indicators: scale competitiveness, efficiency competitiveness, innovation competitiveness, and growth competitiveness. The number of American enterprises is the highest, an increase of 9 compared to 2019; Next is Japan, which is 3 fewer than in 2019; China has one more company than in 2019; Rep. of Korea has one more company than in 2019, ranking from fifth to fourth; there are 4 in Taiwan, China. There are no digital enterprises of the Russian Federation and Mongolia selected. From the geographical distribution of the top 100 comprehensive competitiveness of digital enterprises, it can be seen that the Russian Federation and Mongolia have a significant gap with other countries in Northeast Asia in promoting the Digital transformation and upgrading of real economy enterprises. From the perspective of rankings, the top ten enterprises in Northeast Asia are China's Huawei, Rep. of Korea's Samsung, and China's Alibaba Group, which are ranked sixth, seventh, and tenth respectively, which have always been among the world's leading enterprises, maintaining large-scale growth and stable growth rates.

Table 6. Geographical Distribution of the Global Top 100 Digital Enterprises in 2020[30]

Region	Enterprise quantity	Region	Enterprise quantity
United States	56	Italy	1
Japan	13	Israel	1
China	10	Saudi Arabia	1
Rep. of Korea	5	Luxembourg	1
Taiwan, China	4	Netherlands	1
Spain	2	France	1
Germany	2	Ireland	1
India	1		

5. ICT Industry Development in Northeast Asian Countries

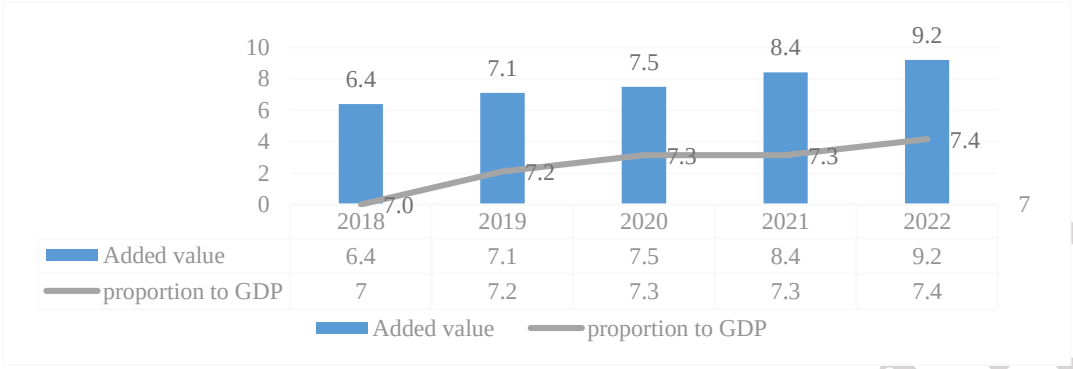
5.1 China's ICT Industry Development

The development of China's ICT industry continues to improve, with the added value and GDP proportion of the ICT industry steadily increasing. According to the China Academy of Information and Communications Technology, in 2022, China's ICT industry has developed rapidly, with industry revenue reaching nearly 28.8 trillion yuan, an increase of about 7.8% year-on-year, accounting for about 23.1% of GDP. The added value of the ICT industry exceeded 9.2 trillion yuan, a year-on-year increase of 9%, accounting for about 7.4% of GDP.

Fig. 7 Added value of ICT industry and proportion to GDP (2018-2022)

[30] XU Limei. *Global Digital Economy Enterprise Competitiveness Development Report (2021)*[M]. Blue Book on Digital Economy, China Social Science Literature Publishing House,2022.1: pp. 41-88.

(Unit: trillion yuan, %)



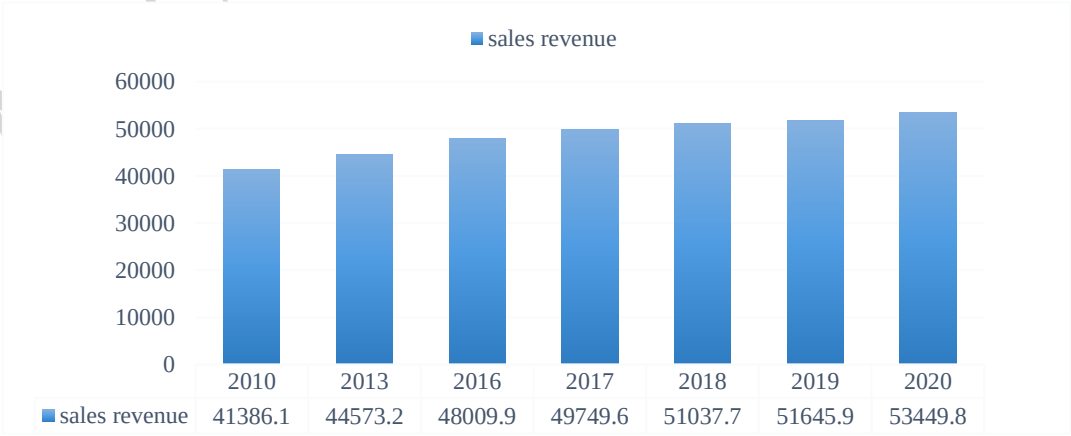
5.2 The Russian Federation's ICT Industry Development

The ICT industry is the core part of the Russian Federation's digital economy, contributing over 90% of the added value of the digital economy. However, in recent years, the proportion of the added value of the Russian ICT industry to ICT has not changed much, and its contribution to economic growth is not high. The added value of the ICT industry accounted for 3.1% of GDP in 2020 and 2.9% in 2019.[31]

5.3 Japan's ICT Industry Development

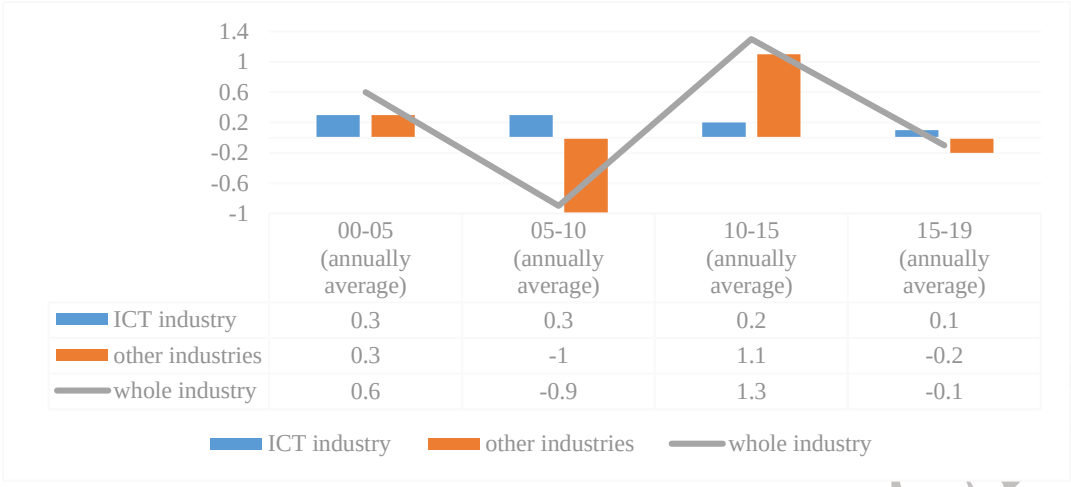
According to data from the official website of the Ministry of Economy, Trade and Industry of Japan, the growth rate of Japan's ICT industry is stable, and the sales revenue of the information and communication industry in 2020 was 53449.8 billion yen.[32] From the average contribution rate of economic growth over the past five years, the contribution rate of the ICT industry to economic growth from 2000 to 2019 has been positive, indicating that the progress of the digital economy can bring positive effects to economic development.[33]

Fig. 8 Sales revenue of ICT industry in 2010-2020 unit: billion yen）



[31] LAN Qingxin, WANG Chunyu, NI Gula. *Development of Russian Digital Economy and New Challenges Faced by Sino Russian Digital Economy Cooperation* [J].Northeast Asia Forum, 2022,31(05): pp. 111-128.
[32] Ministry of Economy, Trade and Industry of Japan: *2021 年情報通信業基本調査(2020 年度実績)*, https://www.meti.go.jp/statistics/tyo/joho/result-2.html.
[33] Yilan. *Research on Japan's Digital Reform and Digitalization Measures*, [D]. Heilongjiang Academy of Social Sciences, 2022.6.1: p 38.

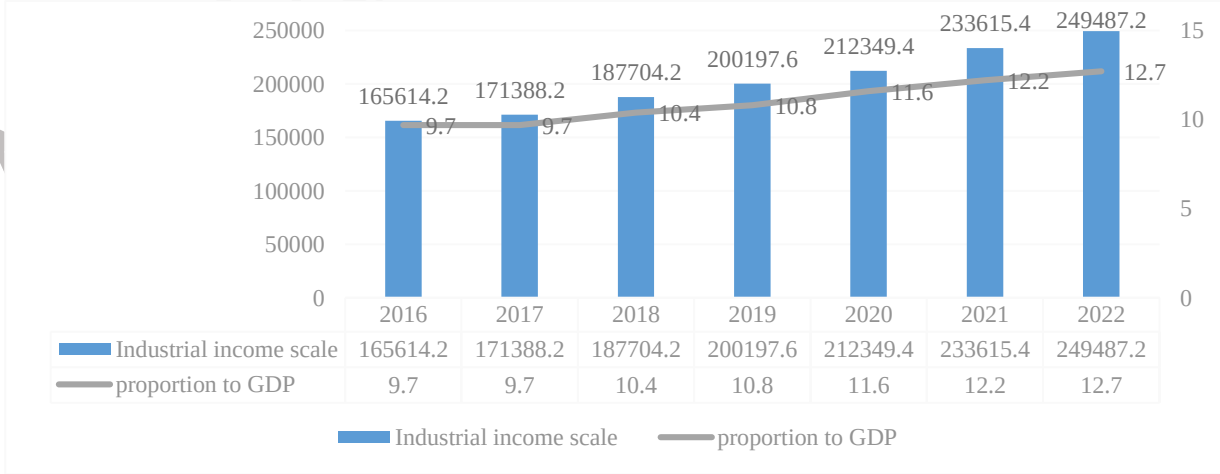
Fig. 9 The average contribution rate of ICT industry to actual GDP every five years (in 2000-2019)



5.4 Rep. of Korea's ICT Industry Development

Rep. of Korea attaches great importance to the development of the ICT industry, which started relatively late and developed rapidly. On January 1, 2019, the Rep. of Korea Ministry of Science, Technology, Information and Communications issued *the 2019 Comprehensive Implementation Plan for R&D Projects in the Field of Science, Technology, and ICT*, which plans to invest 915.3 billion Korean won in the ICT field for ICT research and development, ICT technology industrialization projects, ICT talent cultivation, ICT research environment, and infrastructure construction. The Rep. of Korea government continues to expand its investment in the ICT field, making it new blue ocean driven by innovative economy. In 2020, the ICT industry drove a total annual export volume of 183.6 billion US dollars, industrial imports of 112.6 billion US dollars, and a trade surplus of 71 billion US dollars. According to the data from the public portal website ITSTAT launched by the Ministry of Information and Communications of Rep. of Korea, the scale of the ICT industry and its proportion to GDP have steadily increased in recent years, and the development prospects of the ICT industry are promising.

Fig. 9. ICT Industry Scale and proportion to GDP (2016-2022)[34] *(Unit: billions Korean won, %)*



[34] ITSTAT: *ICT 산업 규모*, https://www.itstat.go.kr/itstat/kor/tblInfo/TblInfoList.html?vw_cd=MT_ATITLE.

II. Challenges in Digital Economic and Trade Cooperation in Northeast Asian countries

1.Challenges of Political Mutual Trust

The unfavorable international situation affects the overall economic and trade cooperation in Northeast Asia. In recent years, the United States has been interacting with its allies, using its monopoly position in international multilateral mechanisms to encircle China in terms of technology policy coordination, technology standards and specifications formulation, and technology governance models, block the flow of advanced technology and talent, and strictly controlled the import and export of core components. At the same time, the unstable political gaming situation in Northeast Asia countries has caused significant obstacles to the smooth flow of economic and trade cooperation, which is also not conducive to the normal cooperation of the digital economy.

2. Challenges of Digital Divide

Countries in Northeast Asia have increased their efforts to focus on the development of the digital economy, but the overall level of digital economy development varies among countries. The digital economy of Japan and Rep. of Korea started early, and the overall level of digital economy development ranks among the top countries in Northeast Asia. The development of the Russia Federation and Mongolia are relatively lagging, and there is a "digital divide" between countries within the region. From the perspective of digital infrastructure, according to data released by the International Telecommunication Union (ITU), the level of network infrastructure construction in various countries in Northeast Asia is uneven, and the proportion of computer households in Mongolia is lower than the global average. From the perspective of digital technology, according to the 2020 GCI index, there is a gap in the development level of new generation information technology fields such as broadband, cloud computing, artificial intelligence, and the Internet of Things among Northeast Asian countries. As shown in Table 8, the overall level of new generation information technology in Japan and Rep. of Korea has entered the world's advanced ranks, and China has reached the upper middle level, while the Russia Federation is relatively backward. China has developed rapidly in the fields of cloud computing and artificial intelligence, with two indices scoring higher than Switzerland (63/45), ranking third in the total score, and ranking first in the world, and, however, there are significant shortcomings in the field of the Internet of Things; the Russia Federation's scores in cloud computing, artificial intelligence, and the Internet of Things are all lower than the world average, and there is still a significant gap in the development level of ICT core technology compared to China, Japan, and Rep. of Korea; Mongolia is not included in the GCI index survey.

Table 7. Key indicators for development of Network infrastructure in Northeast Asian countries in 2021

Key Indicators	China	Japan	Rep. of Korea	Russian Federation	Mongolia	Globe
Fixed-telephone subscriptions per inhabitants	13	49	45	18(2020)	12	11
Mobile-cellular telephone subscriptions per 100 inhabitants	122	161	141	169	140	106
Active mobile-broadband subscriptions per 100 inhabitants	105	224	117	108	116	82
Proportion of 3G Network coverage（%）	100	100(2020)	100	96	100	70（2022）
Proportion of 4G Network coverage（%）	100	100(2020)	100	90	99	86
Percentage of individuals owning a mobile phone（%）	-	93(2020)	98	98	94	73（2022）
Percentage of individuals using the Internet（%）	73	90(2020)	98	88	84	66
Percentage of families owning a computer（%）	-	76(2020)	74	73	33	47（2017）
Percentage of families owning the Internet （%）	-	97(2020)	100	84	80	55（2017）
International bandwidth usage per Internet user (kbit/s）	52	25(2017)	87(2018)	63(2019)	91	77（2017）
Fixed-broadband subscriptions per 100 inhabitants	38	36	44	24	11	17

Table 8. Global connectivity index on the Northeast Asian countries in 2020

Economy	Ranking	Total score	Broadband	Cloud computing	AI	Internet of things
China	22	62	84	66	48	42
The Russian Federation	42	50	72	36	27	33
Japan	9	75	99	57	36	99
Rep. of Korea	13	71	96	45	30	66
Average score	---	---	62	42	30	40

1. Challenges of Cybersecurity

In the current complex and ever-changing international situation, cybersecurity issues in various countries around the world are becoming increasingly prominent. While developing the digital economy rapidly, countries around the world are striving to improve the network supervision system mechanism and supervision system, advance the level of digital security assurance, and strengthen the construction of cybersecurity infrastructure. Northeast Asian countries attach varying degrees of importance to ensuring network security. According to *the Global Cybersecurity Index* released by the International Telecommunication Union (ITU), in 2020, Japan, Rep. of Korea, and the Russian Federation ranked among the top ten, indicating their importance to national information security. China, ranking 33, urgently needs to improve its ability to maintain and defend its information infrastructure network security, effectively safeguard national cyberspace sovereignty and security, and jointly build a community with a shared future in cyberspace. Mongolia's ranking has dropped from 15 in 2014 to 120 in 2020, which implies its cybersecurity infrastructure too weak to fully recognize the information security issues brought about by digital globalization.

Table 9. Ranking of global cybersecurity index on the Northeast Asian countries in 2014-2020[35]

Economy	2014	2017	2018	2020
China	14	32	27	33
The Russian Federation	12	10	26	5
Japan	5	11	14	7
Rep. of Korea	5	13	15	4
Mongolia	15	103	85	120

III. China's Opportunities in Digital Economic and Trade Cooperation in Northeast Asian Countries

1. Jointly Building a Cross-border Digital Service Trade Platform in Northeast Asia

UNCTAD estimates that the global value of e-commerce sales (B2B and B2C) reached almost $26.7 trillion in 2019. This corresponded to about 30% of GDP and represented an increase of 4% from 2018 ($25.6 trillion). In 2018 and 2019, China, Japan, and Rep. of Korea ranked among the top ten in terms of e-commerce sales, whose total sales of e-commerce accounting for 27.09% and 27.45% of global e-commerce sales. (Table 10)

[35] ITU: *Global Cybersecurity Index (2014, 2017, 2018, 2020)*, https://www.itu.int/en/ITU-D/Cybersecurity/Pages/global-cybersecurity-index.aspx.

Table 10. E-commerce sales: top ten countries by 2018-2019[36,37]

Rank	Economy	Total e-commerce sales ($ billion)		Share of total e-commerce sales in GDP （%）	
		2018	2019	2018	2019
1	United States	8640	9580	42	45
2	Japan	3280	3416	66	67
3	China	2304	2604	17	18
4	Rep. of Korea	1364	1302	84	79
5	United Kingdom	918	885	32	31
6	France	807	785	29	29
7	Germany	722	524	18	14
8	Italy	394	431	19	22
9	Australia	348	347	24	25
10	Spain	333	344	23	25
	10 above	19110	20218	35	36
	World	25648	26673	30	30

In 2019, the estimated value of global B2B e-commerce was $21.8 trillion, representing 82% of all e-commerce, and B2C e-commerce sales were estimated at $4.9 trillion, up 11% over 2018. As shown in Table 11, in 2018 and 2019, China, Japan, and Rep. of Korea also ranked among the top in global B2B e-commerce sales, whose total sales accounted for 25.04% and 25.18% of global B2B e-commerce sales. Among them, Japan accounted for 14.66 and 14.85, ranking first in B2B development among Northeast Asian countries. As shown in Table 12, in 2018 and 2019, China, Japan, Rep. of Korea, and Russia ranked among the top 20 in global B2C e-commerce sales, with China ranking first in the world. Based on the above data analysis, it can be concluded that China, Japan, and Rep. of Korea are all leading the world in the development of e-commerce among Northeast Asian countries, and the development momentum of digital service trade platforms is strong. China should leverage this advantage to collaborate with other countries in Northeast Asia to build a cross-border digital service trade platform in Northeast Asia, establish and improve cross-border e-commerce management systems that are suitable for various countries in the region, improve the convenience level of various aspects of cross-border e-commerce, and improve the construction of a digital trade service system in Northeast Asia.

Table 11. B2B e-commerce sales: top ten countries by 2018-2019[38,39]

[36] UNCTAD: *Estimates of Global E-commerce 2018*, https://unctad.org/system/files/official-document/tn_unctad_ict4d15_en.pdf.
[37] UNCTAD: *Estimates of Global E-commerce 2019 and Preliminary Assessment of COVID-19 Impact on Online Retail 2020*, https://unctad.org/system/files/official-document/tn_unctad_ict4d18_en.pdf.
[38] UNCTAD: *Estimates of Global E-commerce 2018*, https://unctad.org/system/files/official-document/tn_unctad_ict4d15_en.pdf.
[39] UNCTAD: *Estimates of Global E-commerce 2019 and Preliminary Assessment of COVID-19 Impact on Online Retail 2020*, https://unctad.org/system/files/official-document/tn_unctad_ict4d18_en.pdf.

Rank	Economy	B2B e-commerce sales ($ billion)		Share of B2B e-commerce sales in total e-commerce（%）	
		2018	2019	2018	2019
1	United States	7542	8319	87	87
2	Japan	3117	3238	95	95
3	China	943	1065	41	41
4	Rep. of Korea	1263	1187	93	91
5	United Kingdom	652	633	71	72
6	France	687	669	85	85
7	Germany	620	413	86	79
8	Italy	362	396	92	92
9	Australia	326	325	94	94
10	Spain	261	280	78	81
	10 above	15772	16526	83	82
	World	21258	21803	-	-

Table 12. B2C e-commerce sales: top 20 countries, 2019[40]

Rank	Economy/region	B2C e-commerce sales ($ billion)	Share of B2C e-commerce sales in GDP（%）	Online shoppers (million)	Online shoppers (% of internet users)
1	China	1539	10.7	639	75
2	United States	1261	5.9	189	80
3	United Kingdom	251	8.9	42	88
4	Japan	178	3.5	55	54
5	France	116	4.3	38	77
6	Rep. of Korea	115	7.0	27	66
7	Germany	111	2.9	56	84
8	Spain	64	4.6	23	64
9	India	61	2.1	70	20
10	Canada	53	3.0	24	84
11	Hong Kong (China)	38	10.4	2	38
12	Italy	35	1.8	19	49
13	Russian Federation	31	1.9	34	35
14	Mexico	31	2.5	26	32
15	Netherlands	29	3.2	12	84
16	Thailand	27	5.3	5	14
17	Ireland	25	6.4	2	73

[40] UNCTAD: *Estimates of Global E-commerce 2019 and Preliminary Assessment of COVID-19 Impact on Online Retail 2020*, https://unctad.org/system/files/official-document/tn_unctad_ict4d18_en.pdf.

18	Australia	21	1.5	12	73
19	Malaysia	19	6.0	15	35
20	Brazil	16	0.9	48	39
	20 above	4021	5.9	1339	59

2. Actively Building the Northeast China-the Russia Far East Digital Free Trade Zone

2.1 The broad prospects for economic and trade cooperation between the three northeastern provinces of China and Russia

On March 21, 2023, leaders of China and the Russian Federation jointly signed *The Joint Statement on Deepening the Comprehensive Strategic Collaborative Partnership between China and Russia in the New Era*, laying a new blueprint for the development of China-the Russian Federation relations in the future period. In 2022, the bilateral trade reached a record high of 190.271 billion US dollars, an increase of 29.3% year-on-year. China has remained the largest trading partner of the Russian Federation for 13 consecutive years. According to customs data from the three northeastern provinces of China (Table 13), the import and export trade volume between the three northeastern provinces and Russia is showing an upward trend. From January to July 2023, the total import and export trade between the three northeastern provinces of China and Russia accounted for 33.4% of the total import and export trade between China and Russia, indicating broad prospects for economic and trade cooperation between the three northeastern provinces and Russia. Taking the Heilongjiang Free Trade Zone as an example, from January to October 2022, the trade between Heilongjiang Free Trade Zone and Russia reached 24.519 billion yuan, a year-on-year increase of 52.6%, which is 10.5 percentage points higher than the increase in the province's trade volume with Russia, accounting for 82.9% of the total foreign trade volume of the Free Trade Zone. The continuous deepening of the strategic partnership and bilateral economic and trade relations between China and the Russian Federation has laid a solid foundation for actively promoting the upgrading of the existing free trade zones into digital free trade zones.

Table 13. Statistics on Import and Export Trade Volume with Russia in 2021-2023 (1-7)
(unit: billion RMB yuan, %)[41,42,43,44]

	China	Heilongjiang Province		Liaoning Province		Jilin Province	
	Trade Volume	Trade Volume	year-on-year	Trade Volume	year-on-year	Trade Volume	year-on-year
2021	948.66	131.34	34.8	28.66	31.2	10.44	80.6
2022	1276.06	185.47	41.3	35.91	25.2	34.67	54.1
2023 (1-7）	931.95	115.59	14.4	31.93	92.2	163.77	95.3

41 http://www.customs.gov.cn/customs/302249/zfxxgk/2799825/302274/302277/4899681/index.html.
42 http://shenyang.customs.gov.cn/shenyang_customs/zfxxgk4391/fdzdgknr57/bgtj98/3420901/index.html.
43 http://changchun.customs.gov.cn/changchun_customs/zfxxgk4846/3010576/4960753/3010754/a537cae8-1.html
44 http://harbin.customs.gov.cn/harbin_customs/467898/467900/467902/index.html.

2.2 Significant results in cost reduction and efficiency improvement in the construction of digital platforms in the three northeastern provinces of China

According to customs data from the three northeastern provinces of China, in 2022, the trade volume between Heilongjiang Province and the Russian Federation reached RMB 185473.69 million yuan, a year-on-year increase of 41.3%; The trade volume between Liaoning Province and the Russian Federation was RMB 35907.84 million yuan, an increase of 25.2% year-on-year; The trade volume between Jilin Province and the Russian Federation was RMB 17327.25 million yuan, a year-on-year increase of 65.0%. The prospects for economic and trade cooperation between the three northeastern provinces of China and the Russian Federation are broad.

In August 2020, Liaoning Province further promoted the first logistics infrastructure project between China and the Russian Federation to drive smooth trade through facility connectivity. By promoting the construction of four major tasks, including the construction of a Sino-Russian customs cooperation platform, overseas warehouses, a hub port for China Europe freight trains, and a "channel+free trade" window with the Russian Federation, it vigorously promoted the development of the Belerast logistics center project, shortened customs clearance time, and reduced trade costs, so as to build it into a demonstration project for modern logistics cooperation.

In August 2021, the "single window" physical platform for international trade and cross-border e-commerce public service platform in Heilongjiang Province were put into operation. The service process of "one point access, one submission, one inspection, one click tracking, and one click processing" effectively reduces customs clearance costs for enterprises and provides 7×24-hour customs clearance consultation service. After the phased operation, the overall clearance time for port imports in the province is 19.7 hours, ranking 6th in the country and 1st in the four northeastern provinces and regions; the overall customs clearance time for exports is 0.41 hours, ranking fifth in the country and first in the four provinces and regions in Northeast China.

In 2022, the import and export volume of cross-border e-commerce in Jilin Province increased by 68.1%. The import and export volume of Changchun Xinglong and Hunchun

Comprehensive Bonded Zone increased by 318.9% and 165.6% respectively. Since September 2022, the Hunchun Railway Port has been operating 24/7, equipped with additional regulatory personnel and laboratory testing equipment to ensure that customs staff are on duty all the time and facilitate enterprise customs clearance.

Jilin province has also actively promoted the efficiency and energy increase of port channels to the Russian Federation, and made every effort to build a bridgehead for Hunchun's economic and trade cooperation with the Russian Federation, a marine economic development demonstration zone, a cross-border e-commerce comprehensive demonstration zone, a comprehensive bonded zone, a pilot project for the implementation and processing of mutual trade, and a pilot project for the way of market procurement trade have been approved successively. The construction of a "one center and five plates" economic and trade cooperation hub for Russia has been accelerated.

. The continuous improvement of digital platforms helps to build a digital free trade zone.

3. Focusing on high-end think tank and forum for the development of the digital economy to help the integration of "industry+education+research+application" in China's Digital Economy

On February 20, 2023, Northeast Asia Forum for Digital Economy Industry Cooperation was grandly held in Shenyang, China, which focused on the development and future of the digital economy

in Northeast Asia, with the theme of "Digital Driving, Industry Innovation and Win-win Cooperation". Famous experts, scholars, and representatives of leading enterprises in the field were invited to gather together to empower and build a new development pattern for the digital economy, in order to establish approach to connect "government+industry+academia+research+financ e+services", to promote the digitalization, networking, and intelligent development of traditional industries in Northeast China. On August 23 of the same year, the 2023 Northeast Asia Digital Economy Development Forum, with the theme of "Digital Empowerment and Shaping Smart Industries", was held in Changchun, Jilin, China, whose aim was to further promote the deep integration of digital technology and the real economy, empower the transformation and upgrading of traditional industries, and promote the birth of new industries, new formats, and new models. More than 200 industry experts and scholars, as well as representatives from various sectors of industry, academia, and research, jointly focused on topics such as regional collaboration, digital cooperation, and industrial digital exploration in Northeast Asia, providing suggestions and suggestions for the digital transformation of cities in Northeast Asia. China has established platforms for learning and exchange in the digital economy, focusing on cutting-edge perspectives in the field of digital technology, exchanging and interacting with relevant experts and scholars from Northeast Asian countries and internationally leading digital technology enterprises, sharing the achievements of digital resource construction, and promoting the integrated development of the digital economy through industry, academia, research, and application.

VI. Conclusion

With the innovation of new generation information technologies such as the Internet, cloud computing, big data, and artificial intelligence, the deep integration of the digital economy and traditional industries has led to comprehensive changes and breakthroughs in business structure and industry concepts. The global traditional industries are accelerating their transformation and upgrading towards digitization, networking, and intelligence, and the scale of the digital economy continues to expand. In response to the global trend of digital development, countries in Northeast Asia seize the new opportunities brought by the rapid development of the digital economy, focus on the development of the digital economy, and expand their cooperation to continuously extend in depth and breadth. As the second largest digital economy in the world for many consecutive years, China's digital economy accounted for 18% of the total digital economy scale among 47 major countries in the world in 2021, and 64% of the total digital economy scale in the four countries in Northeast Asia (China, Japan, South Korea, and Russia).[45] China should further upgrade its strategic position in the digital economy, firmly grasp the initiative in development, and promote the development of the digital economy to a new level. Firstly, it should seize the initiative in digital technology innovation and enhance the independent innovation ability of Chinese brands. Taking Huawei mobile phone chips as an example, the Huawei server chip Kunpeng 920 can already be independently produced, and its data center chips can be completely independent of other countries' supply chains. The second is to strengthen government guidance and establish a sound digital talent incentive system. From the perspective of national strategy, the report of the 20th National Congress of the Communist Party of China clearly states that "the talent is the first resource". Digital economy talents are the primary resource for digital development. Taking JD Technology as an example, on February 14, 2022, more than 130 recruitment information was

[45] CAICT: *White Paper on Global Digital Economy(2022)* , Dec. 2022, p.15, http://www.caict.ac.cn/kxyj/qwfb/bps/202212/P020221207397428021671.pdf.

released, with the highest demand for various product managers and development engineers. Job salaries range from 30000 to 70000 RMB yuan per month, with some high-level architects earning salaries of up to 110000 RMB yuan and receiving 15 months of salary per year. Therefore, China needs to fully implement the digital China strategy, accelerate the development of the digital economy becoming stronger, better, and larger, so as to achieve high-quality development of the digital economy.