Global technology space in the XXI century: formation of a bipolar configuration

Narimanov Nariman Fariman oglu
Candidate of Economical Sciences, Associate Professor
Academy of the FPS of Russia

Narimanova Olga Vladimirovna
Candidate of Economical Sciences, Associate Professor, Head of the Department
Ryazan State Medical University

Annotation. The article examines the tendency towards the formation of a bipolar configuration of the global technological space in the context of the fourth industrial revolution. The article analyzes the positions in the field of high technologies of two world leaders - the USA, which has been leading in technological innovation since the beginning of the twentieth century, and China, which has made a real technological breakthrough over the past 20 years. The coronavirus pandemic not only does not reverse the trend towards bipolarity in the global technological space, but, on the contrary, makes it even more pronounced. It is becoming more and more difficult for other countries to bridge the technological gap with the United States and China, which creates new challenges for the stable development of the global economy. The article concludes that for Russia in these conditions, aggravated by tough Western sanctions, the main strategy should be to rely on its own potential in combination with the adaptation of available Chinese technologies. Russia needs to more effectively use international cooperation in the field of digitalization with the EAEU and BRICS countries, as well as additional opportunities provided by the Chinese Digital Silk Road project.

Keywords: global technological space, world technological leader, bipolar configuration, technological power, technological wars, digital technologies, Digital Silk Road.

Introduction

The most important condition for successful economic development is technological progress. The modern "coronavirus shock" only underlines the relevance of this postulate. Thanks to technological breakthroughs over the past 20 years, China has become a global technology leader alongside the United States, bringing the global technology space to a bipolar one. Technological inequality in the world is growing and increasing its instability.

The purpose of the study is to analyze trends in the balance of power between the leaders of the global technological space - the United States and China - in the XXI century.

Materials and methods

The research is based on the materials of the World Bank, the UNESCO Institute for Statistics, as well as scientific publications of domestic and foreign experts. General scientific research methods were used: analysis and synthesis, induction and deduction, systems approach, comparative analysis, economic and statistical analysis.

Results and discussion

According to leading researchers in the field of economic growth, the contribution of technological factors and innovations to the country's economic dynamics ranges from 1/3 to 2/3 [1,2,3]. Technological innovations, according to the theory of big waves by N.D.Kondratyev, always give impetus to the next upward wave of a new long economic cycle lasting 55 years.

Economic leadership at all times belongs to countries that have gained superiority in technological development. Thus, Great Britain, which during the first industrial revolution (early 18th - mid-19th centuries) invented and introduced steam engines, mechanical looms, new methods of iron smelting, became a world leader in industry, world trade and colonial expansion.

The second industrial revolution (the last third of the 19th century - 1914) brought the United States to a leading position in the world economy thanks to the active introduction of such innovative technologies as electricity, the transition to mass production, the use of assembly lines, replaceable units and parts, the use of internal combustion engines .

During the third industrial revolution (1980s - early 21st century), South Korea, Taiwan, Hong Kong, Singapore broke out into the ranks of world leaders, who, on the basis of automation and computerization, were able to achieve great success in electronics (household computers and individual components), in computer production control systems. Finally, the new, fourth industrial (technological) revolution, which began in the second decade of the 21st century, is characterized by radical technological shifts as a result of the integration of physical, biological and digital technologies, which leads to the blurring of boundaries between individual industries and types of human activity, the massive introduction of cyber-physical systems, the emergence of fundamentally new products and markets of the future [4,5].

The coronavirus pandemic, which has masked the already approaching global economic crisis, has once again confirmed that any country needs sufficient technological potential to overcome the cyclical crisis and to overcome the shock conditions provoked by non-economic factors. So, Russia, significantly inferior in many areas to the world technological leaders, nevertheless proved its superiority and high scientific potential in the field of biotechnology and genomics, thanks to which it was the first in the world to register an effective vaccine against coronavirus, which was named "Sputnik V" [6,7,8].

The current “coronavirus shock” sharply enhances the role and importance of a wide range of technologies for maintaining and monitoring health, including those based on the convergence of biotechnology with IT. It should be expected that the role of remote and sparsely populated industries (robotics), blockchain technologies in the financial sector, unmanned vehicles, including using artificial intelligence, partial virtualization of movements (primarily tourism) [9,10,11]. The pandemic not only does not cancel the main trends operating in the global technological space, but, on the contrary, makes them more pronounced.

The influence of the technological factor on economic development in our time has increased significantly, the phenomenon of technological power has appeared, which largely determines economic power. After all, if there are no technological innovations, then the economy is deprived of long-term development prospects. An increasingly active role in the struggle for technological power is played by technological wars, which are becoming an indispensable element of economic wars. An example of this is the US policy towards the Chinese company Huawei, which leads the world in the production of telecommunications equipment and ranks second in the world in the production of smartphones (20% of the world market). The United States also launched a technology war with other Chinese high-tech companies, most notably another telecommunications giant, ZTE. Similar wars can be expected in the field of satellite Internet, 5G networks, and shale oil production. As a reaction to the threat of technological wars, there is a tendency towards technological isolation, for example, a number of countries consider it necessary to insure themselves against disconnecting the national segment of the Internet from the global network. As a result of such actions, costs will inevitably increase, and the quality of the final product of import substitution will decrease in comparison with the world analogue.

The development of the fourth industrial revolution is increasingly giving the global technological space a bipolar configuration, the centers of which are the United States and China. These two countries now account for 75% of all blockchain technology patents; 90% of the market capitalization of the 70 largest digital platforms; 69% (344 out of 500) of the most powerful supercomputers (China has 227, the United States has 117); more than 40% of data centers existing in the world; more than 50% of expenses on the Internet of Things; 36% of global e-commerce turnover; more than 75% of open cloud computing technologies [12].

According to experts, no country will be able to resist the formation of a bipolar structure of the global technological space in the foreseeable future. It is becoming more and more difficult for other countries to bridge the technological gap with the United States and China. Technological inequality is turning into a new challenge for the stable development of the global economy.

If the technological and economic hegemony of the United States dates back to the beginning of the twentieth century, then China has made a technological breakthrough in a historically short time. The PRC demonstrates very high rates of assimilation of new technologies and their rapid promotion to the markets. This is largely facilitated by the extremely capacious domestic market, which creates a growing demand for innovative products.

China currently accounts for 90% of the world's PC and mobile phone shipments. The number of Chinese firms operating around the world from 2010 to 2018 increased from 10.2 thousand to 37.2 thousand. In terms of the number of global companies, China is only slightly behind the United States: in 2018, the Global Fortune-500 included 111 firms from mainland China and Hong Kong

and 126 from the United States to its list. In 2018, 64.8% of all patent applications registered in the world were Chinese and 18.6% of all articles published in scientific and technological journals [13].

In some important technological indicators, China is already significantly ahead of the United States, while in others it is gradually catching up. The latter include indicators in the field of artificial intelligence, which is assigned a special role in the technological race of the 21st century. In 2017, China adopted a plan to take the country to a leading position in the world in the field of artificial intelligence by 2030, and already in 2018 the country's investments in this area exceeded 50% of the world. The main share is provided by three Chinese technology giants - Baidu, Alibaba and Tencent [14].

An important competitive advantage of China is 5G technologies, which accelerate information transfer by more than 100 times compared to 4G networks and allow various things to be connected to the Internet. The Chinese company Huawei has more than 16,000 patents in the 5G field, which has made it a world leader. Such technologies, combined with artificial intelligence, become the basis of the country's technological superiority in various industries and spheres of human activity, giving it enormous technological and economic power.

China will have the largest number of 5G connections by 2025, at 416 million, according to the Global Association of Financial Markets, more than North America and Europe combined. Meanwhile, the PRC has already begun developing networks of a new generation - 6G, which allow wireless remote access to artificial intelligence at the level of the human brain in real time.

China came out on top in the world in terms of the number of industrial robots installed and second in terms of production of liquid crystal panels. He is also leading in the "quantum race", expanding his quantum communications around the world. About 50% of quantum technology innovations in the past 10 years have been developed by Chinese companies and universities. China is ahead of all other countries in the number of patents obtained for communications using quantum technologies. At the same time, the USA remains the leader in the number of patents for quantum computing, including software [15].

Quantum computers can crack the best classical encryption in seconds, so quantum encryption may be the only way to secure communications. It should be noted that quantum technologies are dramatically accelerating developments in the field of artificial intelligence. Therefore, the PRC has created the National Laboratory of Quantum Sciences, the volume of investments in which is about $ 1 billion. China's rapid advancement is observed in the field of blockchain technologies, big data, drones, unmanned seagoing vessels, military and space technologies, and biotechnology.

It is important to emphasize that China is actively pursuing a policy of localizing modern technologies in national jurisdiction. Thus, the "Made in China" program, which has been in effect

since 2015, provides for the conquest of 40 to 90% of the market by domestic players in 11 out of 23 subsectors allocated in the program. In fact, this means a policy of import substitution in the field of high technologies.

China's technological advances are associated with large expenditures on research and development, which from 2000 to 2019 grew 50 times and exceeded $ 450 billion, which brought China to the second place in the world after the United States in this indicator and provided a significant lead in third place in Japan. During 2015-2019. Every year, China became the world leader in promotion in The Global Innovation Index, which is calculated by 82 indicators and reflects the level of innovative development of 129 countries. China overtook the United States in the number of fast-growing technology private startups (unicorn companies) with a capitalization of over $ 1 billion. At the end of 2019, it was in first place in the world, with 206 “unicorns” (42%), while in the United States there were there were 203, and in Europe - only 34. At the same time, in terms of the total capitalization of “unicorns” - 262 billion dollars - China surpassed the United States four times [16].

Foreign investment plays a significant role in China's technological development. For 2010-2019 The 20 largest foreign multinational companies (MNCs), primarily Amazon, Alphabet and Wolkswagen, have implemented 73 projects in the PRC in the field of innovative development, and in the following India and the UK - 59 and 55 projects, respectively. Note that if in the early 2000s multinational companies preferred China due to the low cost of land, capital and labor, now they are attracted by the presence of highly qualified specialists and high technologies.

China's technological breakthrough was also facilitated by a change in strategy regarding the structure of foreign assets. In 2010, China abandoned the strategy of acquiring fuel and raw materials assets and companies to enter new foreign markets in order to expand exports and switched to a strategy of buying brands and technologies necessary to orient its economy primarily towards domestic consumption. At the same time, China began to transform from a country that copies innovations into a country that generates them. This has significantly expanded the geographic presence of the PRC in the global technological space. Currently, 23 of the largest Chinese technology companies have 2500 overseas points of presence, 447 university and research partnerships, 115 projects to create smart cities or public safety systems, 88 initiatives to develop 5G in different regions of the world [17].

Despite China's indisputable technological breakthrough, its scientific, technical and technological potential is still inferior to that of the United States. China has closed or even closed the technological gap with the world leader, primarily in the field of technologies of low complexity with relatively low technological barriers. However, for a number of complex technologies, China's dependence on foreign supplies and developments remains significant. The McKinsey Global

Institute estimates that China still receives technology from multinational companies 20-40% of the time.

China's dependence on the United States and some other countries in the field of key technologies remains due to the lack of basic research in the country. For this reason, China is characterized by an import-dependent model of participation in global technological exchange. In 2018, the volume of its import payments for the use of intellectual property amounted to $ 35.8 billion, while export receipts for the use of Chinese property were 6.4 times less - 5.6 billion. For the United States, on the contrary, an export-oriented model is characteristic. So, in 2018, their technological exports amounted to $ 128.7 billion (33.8% of the global volume), which is 2.3 times higher than the corresponding imports ($ 56.1 billion) and 23 times higher than the volume of Chinese technological export. At the same time, more than 30% of China's import payments for the use of intellectual property came from the United States. For example, in the manufacture of sophisticated robots, China relies on imports of American advanced technology for key components: servo motors, gearboxes, and control systems.

Aware of its continued technological dependence on the United States, China is pursuing a flexible foreign economic policy that takes into account the country's real capabilities. In exchange for some of the US trade concessions, China has made a number of significant commitments to US intellectual property in technology. The fact is that, according to the United States, its annual losses from China's illegal use of American intellectual property rights range from $ 300 billion to $ 500 billion. As a result, China had to agree to the following US demands for the protection of its intellectual property: forms of coercion of American companies operating in China to transfer technologies in favor of local firms; compliance with strict rules in e-commerce in order to suppress the supply of substandard and fake goods; the use of only licensed software by state institutions and state-owned companies, etc. [18].

A new successful decision in the Chinese foreign economic strategy was the promotion of the Digital Silk Road initiative from 2019. This vibrant brand brings together several official government programs and export concepts covering various areas of digitalization of the Chinese economy: «Made in China 2025», «Internet Plus», «Manufacturing Superpower», «Big Data Strategy», «Cyber Sovereignty», «Development Strategy of Cloud Technologies», «Standardization of Artificial Intelligence».

Aliplay, a Chinese electronic payment platform part of the Alibaba Group, has established a direct presence or operates through local operators in more than 40 countries in Europe and Asia. China has launched the Spatial Information Corridor, which consists of communications, positioning and surveillance satellite systems it supports. In strengthening China's technological influence, an important role is assigned to the creation of telecommunications infrastructure in the states

participating in the Belt and Road Project. Experts believe that the Digital Silk Road has become the focus of this project, since data flow management is an important condition for changing the geopolitical balance in favor of China.

Conclusion

World economic development is characterized by unevenness, periodic changes in the balance of power between the participants in the global economy. This, in turn, is due to the patterns of development of technological progress, the emergence, development and implementation of technological innovations in different countries. In the 21st century, a significant reformatting of the global technological space is taking place, in which two main development poles - the United States and China - are becoming more and more distinct. This poses new challenges for all other countries. As for Russia, due to tough and constantly increasing Western sanctions, its main strategy should be relying on its own potential, complemented by the adaptation of available Chinese technologies. It is necessary to effectively use the additional opportunities provided by the Chinese Digital Silk Road project. The possibilities of international cooperation in the field of digitalization, including cooperation with the EAEU and BRICS countries, are far from being fully realized by Russia. The national project "Digital Economy" proceeds from the preservation of a significant share of foreign software in state corporations and companies with state participation (up to 30%). In this regard, it seems necessary to work out a "roadmap" for the coordinated development of the digital space of the EAEU with the Chinese "Digital Silk Road". As you know, 2020 and 2021 have been declared "cross" years of Russian-Chinese scientific, technical and innovation cooperation, which makes it possible to significantly increase the number of joint technology projects within the framework of the Digital Silk Road.

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