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121

US CHIPS and Science Act and Its Impact on Russia's High-Tech Sector

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April 2023

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ISBN 978-5-907318-84-7

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Introduction

The confrontation between the world's leading economies in the high-tech sector has become a sort of *proxy war* of this new age. We are witnessing a standoff on the markets for chips, 5G technology and artificial intelligence as a modern-day reincarnation of traditional great power rivalry and competition to maintain and expand their influence along their borders and across the world.

The advent of this new age has not altered the leading role of the state in national security. Today, just as many centuries ago, it is the state that has the ability to counter external threats by bringing together human, financial and technological resources. The current conflict unleashed by the transition from a unipolar to a multipolar world, which has not spared Russia, demonstrates that only the state with its budgetary power, in cooperation with private high-tech businesses, can ensure technological and digital sovereignty.

While originally designed to promote connectivity and positive complementarity in a globalised world, digital technology is now taking on a completely different role.

First, there is an effort to use national or bloc-based digital platforms, including in chip manufacturing, to deconstruct or drive apart elements of the global economic system that don't conform to the present-day reality and threaten state sovereignty, perceived as it is by most countries as an ultimate value.

Second, digital platforms are emerging as tools of non-military confrontation between competing powers who are seeking to push their rivals out of specific market segments and create path dependence for them by undermining or destroying similar platforms in unfriendly countries.

Today, Russia and its foreign partners, primarily within the BRICS framework, do not see a worthy place for themselves in a US-led global architecture. These countries contribute to building a new, better balanced and fair global political and economic architecture by creating and developing their own digital platforms. Chip manufacturing lies at the core of these efforts.

Why did the United States pass the CHIPS and Science Act? The political economy of chip manufacturing

The importance of chips for global economic development became increasingly apparent during the economic crisis caused by the Covid-19 pandemic. In 2021 alone, global sales of memory chips used for creating multithreaded environments increased by 26.2 percent year-on-year to $555.9 billion. This surge in demand during the pandemic went hand in hand with growing demand for computers, home appliances and medical equipment; stagnating investment in ICT; failures by suppliers to quickly scale up manufacturing; and disruption of transport and logistics chains for supplying components and finished products. About 200 manufacturing sectors around the world suffered from chip shortages, resulting in $210 billion worth of losses as of the end of 2021 for the car manufacturing industry alone.

Today, these short-term negative effects from the pandemic have been compounded by longer-term geopolitical challenges that state and non-state actors face in the ICT sector. Various countries have turned to stress resilience, a notion popular among political scientists, in their effort to assess the state of supply chains and ways to change them considering the impending threat of a global recession and the growing technological conflict between the United States and China, the world's largest consumer of chips.

At the start of his administration in January 2021, President Joe Biden directed his staff to carry on with the measures introduced by his predecessor and further expand them in order to contain China

in the high-tech sector. Washington is taking a two-pronged approach to chip manufacturing: **1)** helping US companies hold on to their dominance in this sector; and **2)** minimising China's role on the global market for semiconductors.

This is a knowledge-intensive sector, which requires a lot of investment. For that reason, modern chip research, development, and manufacturing require huge resources, measured in the hundreds of billions of dollars. No company or even most major states can afford to spend that much. The US government made chip manufacturing a matter of politics and security. Considering the scale and strategic importance of its agenda for this sector, it needs to put together an interstate coalition, as well as ensure that apart from the military and diplomats, federal economic agencies, lawmakers in Washington and heads of major US technology companies are on board.

In her remarks at the Atlantic Council on April 13, 2022, US Treasury Secretary Janet Yellen said that the United States must promote trade that is not only free, but also secure, i.e., designed to protect Washington and its allies from threats posed by their geopolitical adversaries. She introduced a new term, *friend-shoring,* which means that only allies loyal to US interests will be able to take part in developing, manufacturing, distributing and purchasing high-technology products.

The federal CHIPS and Science Act,[1] which took almost eighteen months to draft and was signed by President Biden on August 9, 2022, was designed to deliver on the objective as articulated by Janet Yellen.

The new law came at precisely the right moment, at least as far as US economic security is concerned. According to a recent report released by Semiconductor Industry Association and Boston Consulting Group, the United States saw its share of the global chip manufacturing market

[1] See: H.R.4346 – CHIPS and Science Act // 117th Congress. URL: https://www.congress.gov/bill/117th-congress/house-bill/4346/text

decline from 37 percent in 1990 down to the current 12 percent, while China has been able to ramp up its production of microcircuits from zero to 24 percent of the market. The report concluded that an additional $1 trillion would have to be invested to hypothetically create an alternative to the existing global supply chain in the semiconductor sector featuring self-reliant local supply chains in certain regions of the world, for example, for satisfying present-day demand for semiconductors in Europe, China, or BRICS countries. SIA and BCG experts also believe that this will drive up prices for semiconductors by 35 to 65 percent. This is the price the world will have to pay for US-Chinese economic decoupling in chip manufacturing. The Biden administration showed that it was ready to foot its part of the bill by signing the CHIPS and Science Act.

What's new in the CHIPS and Science Act?

The CHIPS and Science Act sets forth the following priorities for the United States in terms of developing its semiconductor industry: nanotechnology, clean energy, quantum computing and artificial intelligence. It provides $54.2 billion worth of subsidies for building chip manufacturing plants in the United States, as well as a tax credit equal to 25 percent of the investment by chipmakers in building manufacturing facilities, which is expected to raise an additional $24.3 billion in private investment for the sector. The federal government committed to allocate about $174 billion between 2022 and through fiscal year 2027 to finance high-technology R&D, including interagency programmes for promoting industrial innovation and facilitating market access for inventions developed with federal subsidies.

From an economic standpoint, the United States wants to catch up with the global chip making industry by making a huge leap forward and secure the main prize – the world's fourth largest product market after oil, petrochemicals and automobiles.

As for the political-economic implications, the new law is clearly designed to counter China. In its attempts to constrain China's technological advancement, Washington has unleashed a conflict with potentially unpredictable consequences and drawn its satellites into it. In 2021, the United States and the EU established the EU-US Trade and Technology Council with ten working groups that will focus on rebalancing trans-Atlantic supply chains for semiconductors, creating an early-warning system for anticipating threats of chip shortages caused by China, etc. However, the council's work came to a virtual standstill right after its launch when Biden followed up the signing of the CHIPS and Science Act by approving the multi-billion Inflation Reduction Act (IRA) just a week later, on August 16, 2022.[2] It enabled Washington to attract high-tech companies from the EU and other regions to its territory by relying exclusively on financial and economic incentives such as government subsidies and tax preferences. Instead of working together with others to develop the chip sector and other kinds of advanced manufacturing operations, the United States put its stakes on reshoring the production of these products from Europe on its own territory.

In the short run, Washington's effort to entice chip manufacturers to move production from Europe and East Asia to Texas, Arizona, and California will lead to higher prices. US partners in Europe will be the first to suffer, considering that they are already facing shortages and high prices in the microelectronics sector. In the longer run, even armed with new technology American companies may still lose customers around the world, including in the CIS, Africa, Latin America

[2] See: H.R.5376 – Inflation Reduction Act of 2022 // 117th Congress. URL: https://www.congress.gov/bill/117th-congress/house-bill/5376/text

and in certain Southeast Asian countries where Beijing has been rapidly expanding its presence. There is little doubt that China will respond with a strategy echoing the American effort to divide up the markets, while opting for more caution in its methods, as it always does in its diplomatic efforts.

How will the CHIPS and Science Act affect the global ICT industry?

Chip manufacturing consists of three major stages, with companies around the world usually focusing on just one of them:

Design, including R&D and software development. Companies specialising in chip design while outsourcing their manufacturing are called fabless, which means that they lack production facilities – factories. US Nvidia is one such example.

Fabs use designs developed by fabless companies to make chips. Taiwan's TSMC is one of them.

Semiconductor assembly and testing outsourcing enables companies to test chips and prepare them to be installed in electronic devices. In this category, examples include Taiwan's ASE Technology Holding Co. and US Amkor Technology Inc.

The United States currently leads in everything related to R&D, including in electronic design automation (EDA), intellectual property (IP), microcircuit design and advanced manufacturing equipment. East Asia, in particular Taiwan and South Korea, have been at the forefront of wafer fabrication, a sector that required high levels of investment backed by

government subsidies, as well as reliable infrastructure and a qualified workforce. Today, China is the leader in assembly, packaging and testing, which are all less labour intensive and do not require as much investment. However, China has been proactively investing in expanding its operations along the entire semiconductor manufacturing chain. The United States views this as an effort by Beijing to challenge its leadership in this sector in the foreseeable future.

Already in force, the CHIPS and Science Act seeks to reshape the existing landscape by confining US allies within a separate mini universe. The framework Washington is trying to build provides for the free movement of capital and technology among its members, surrounding pro-US friend-shoring with a high wall to shield it from competition with China, while also preventing Russia and other US opponents from acquiring the chips they need.

Quite naturally, the CHIPS and Science Act marked a new level in the confrontation between the United States and China. Washington took the first step to tighten its export policy for semiconductor products and equipment on September 7, 2022, when it decided to ban US tech companies seeking federal funding from investing these funds in China or developing their advanced technology at their facilities in China over the next decade. In October 2022, the Biden administration released a long list of export control measures limiting access for Chinese companies to US chip production technology. In January 2023, US and Dutch government officials negotiated export controls on chip production technology. It is the Netherlands that is home to ASML Holding, which has a de facto monopoly in making photolithography machines used for printing the latest chip designs.

In the summer and autumn 2022, the US blacklisted over 30 Chinese semiconductor manufacturers as untrustworthy partners. These decisions by the administration cost the Chinese ICT sector $8.5 billion, according to an initial assessment. In a matter of a few days in August 2022, shares in Chinese chipmakers fell between 4 and 20 percent on the Shanghai Stock Exchange.

But how have US businesses responded to the effort by their own government to promote technological decoupling? So far the support has been far from unanimous. China accounts for a substantial share of revenue generated by American hardware and software companies: 32 percent of revenue for Applied Materials, 34 percent for Lam Research, and 25 percent for AMD и NVIDIA. However, they have not taken the risk of confronting their government on this issue, but have been insisting that it adjust its measures to account for the short-term interests of hundreds of US companies who are not ready to instantly give up on the Chinese market, shift their operations elsewhere in Asia or bring manufacturing back to US soil.

We believe that the United States chose the wrong moment to enact the CHIPS and Science Act. Semiconductor chip prices surged during the pandemic, but by the summer of 2022 this cycle came to an end. Washington's decision to move forward with the act took shape in a unique environment shaped by a long-term upward trend in chip prices, exacerbated by surging demand for computers and advanced home appliances during lockdowns. Then the economy bounced back after the pandemic in the developed world, which again led to a short-term spike in demand for chips.

In 2021 and 2022, economic growth in the United States, Europe and East Asia far exceeded previous years, with GDP increasing in the US between October 2020 and March 2022 in the range of 7 to 10 percent per year. However, this was followed by an energy crisis and higher inflation, sending the US economy into the red. This led to a debate among experts on whether a global economic crisis would begin as early as in 2023. Most EU countries followed a similar pattern between autumn 2020 and the summer of 2022, albeit with slightly lower fluctuations in their GDP figures. So, after experiencing a period of recovery, by mid-2022 the economies of the Global North started decelerating or stopped growing altogether.

From this perspective, the bold move by the White House in August 2022 to promote decoupling within the global chipmaking sector would have been reasonable between autumn 2020 and autumn 2021, but beyond that point it appears unjustified. Two years on, this decision seems excessively radical, extremely costly and strategically risky. It threatens to undermine the global standing of US businesses while lacking the destructive power needed to crush the Chinese semiconductor chip sector.

Impact of the CHIPS and Science Act on the Russian ICT sector

The Russian ICT sector has been dealing with a host of challenges internationally during its formative period. Two of these challenges are particularly important for our purposes.

First challenge: The development of the Russian digital platform is geographically pre-determined in terms of exports and creating added value chains. Information technology and communications has been a global industry since its earliest days but the unipolarity crisis of the early 2000s prompted the start of the decoupling process. Although fragmentation of the global digital space has been uneven, the events of 2022, including heightened tensions between China and the United States over Taiwan, have made decoupling inevitable in the short term. Consequently, the markets of unfriendly countries are now closed or restricted for original information technology developed in Russia. Not only that, but in the countries of the Global South, where Russian IT

companies are currently expanding, the markets open to new Russian digital products are still taking shape.

Second challenge: The technology war Washington and its allies are waging on Russia. In addition to the obvious aspects of this war (thousands of sanctions imposed by unfriendly countries on specific companies and entire sectors based on the Russian digital platform), other significant hostile steps by the West have included blocking access to cloud products for Russian users; the phenomenon of overcompliance, or excessive compliance with sanctions, making it impossible even for sanction-free companies to expand their contractor networks; blocking updates for already purchased digital products; an increase in the number and scale of attacks in Russian cyberspace due to vulnerabilities in the outdated software; malware embedded in the free software that Russian users still have access to.

According to Andrei Shastin, Director for Strategic Initiatives and Partnerships at Auriga,[3] additional risks to import substitution may stem from limited scaling opportunities for Russian IT products. The Russian ICT sector comprises only a dozen companies with just over 500 workers. Russian tech companies, including those developing and experimenting with semiconductor manufacturing, have under 100 employees, which means that achieving full-fledged import substitution and especially a new modern chip production industry in Russia is not feasible. Even if there are companies that offer high-quality sought-after products, their modest resources and limited customer bases prevent them from promoting innovative products even on the Russian market.

It should be noted also that the Russian digital platform is out of balance. Software can be divided into three categories, which are system software, applications software and programming tools. Russian companies have made major progress in applications software,

[3] Andrei Shastin expressed this view at the RUSSOFT news conference, “IT industry on the verge of a choice: joining world leaders or serving other countries’ solutions”, on November 8, 2022, in Moscow.

with particularly successful banking and communications products, information security and business process automation solutions. When it comes to system software, there are several fast-growing players (e.g. Astra Linux and BaseALT) but overall, this segment lacks certain essential product and program components, which the digital platform still needs to acquire in order to become resistant to any external shocks. As for programming tools, this segment is relatively small and essentially unstable. Many crucial technologies are being replaced with open-source software, though others currently lack an alternative.

Russian IT and telecom engineers are known worldwide for their talent and training, but this has not yielded a full-scale national digital platform as a self-sufficient and equal competitor on the international market. After the start of the special military operation in Ukraine in February 2022, the development of specific components for the national digital platform, along with the industry's almost entire output, has been geared toward the Russian domestic market. IDC estimates that in 2021, the Russian market totalled 2.4 trillion roubles, continuing its period of rapid growth into the second decade of the century.

However, the generally optimistic projections for the Russian ICT sector's growth prospects do not apply to the semiconductor industry which is developing slowly, substantially lagging behind both world leaders and the needs of major Russian corporations. The chips produced in Russia or in cooperating countries based on Russian designs can decently manage a narrow scope of tasks related to the country's defence capacity and maintaining digital components of the public administration system. Imported chips are still necessary for addressing a wider scope of production tasks.

The Russian ICT sector is currently feeling the immense pressure of the sanctions imposed by the United States and its satellites. In 2022, it faced a choice: either to continue serving foreign companies in need of outsourcing while releases of original products remain limited, or

to become a centre of the global ICT ecosystem in its own right, to build its own technological framework based on alternative solutions that replace the products used in the leading economies.

The second path has earned support at the highest political level in Russia. Its main feature is accelerated development of the domestic semiconductor industry. However, political will is not enough; adequate government funding is also crucial to successfully address problems that may arise. More than that, the captains of the Russian ICT sector must be willing and able to withstand serious foreign competition.

Conclusion

The modern semiconductor production chains formed in the pre-COVID era when technological sanctions were rare and imposed with caution. These chains are as global as can be and, as a result, vulnerable to external impact, be it a pandemic, geopolitical tensions and associated trade wars, or natural and man-made disasters. The chip market is a good example of the United States and its allies attempting to narrow the scope of intergovernmental cooperation in this strategically important economic sector going forward, while condemning the rest of the planet to technological underdevelopment.

Practical implementation of the US CHIPS and Science Act will ripple across the globe and speed up de-globalisation. While the law primarily seeks to contain China, it creates new development challenges for the Russian ICT sector, adding to the import-substitution challenges that the Russian government already has to overcome. As the United

States and the EU join efforts to monitor the chip market, which includes monitoring purchases of technology and software required for semiconductor manufacturing, costs for the Russian industries will increase and progress toward forming a world-class national chip industry will slow.

Creating a technological union to stimulate research and manufacturing of world-class semiconductors based on the scientific achievements and industrial capacities of the two countries would be a reasonable response from Russia and China to the hostile actions of the United States and its allies in Europe and East Asia. Decisions could be made at the government level but executed by both state and private companies in Russia and China. Subsequently, the union could be joined by EAEU members and China's partners in the Belt and Road project.

The Russia-China technological union could pursue the short-term goal of minimising the effects of the US CHIPS and Science Act that will undoubtedly prompt adoption of similar bills and government programmes in the EU, Japan, South Korea and Taiwan. Experts in Moscow and Beijing will need to share information about threats to the ICT sector in both countries and coordinate measures to neutralise and minimise such threats at the government level.

In the long-term, Russia and China could expand their cooperation in the semiconductor industry to create a cooperation format in IT and other economic sectors that would not violate their sovereignty while providing additional stimuli for consistent growth in the era of de-globalisation. Today Russia is bearing the full brunt of sanction warfare designed to ruin its economy and de-stabilise its society. But the CHIPS and Science Act also arms the United States with the technological and trade sanctions to strangle China in a similar fashion.

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