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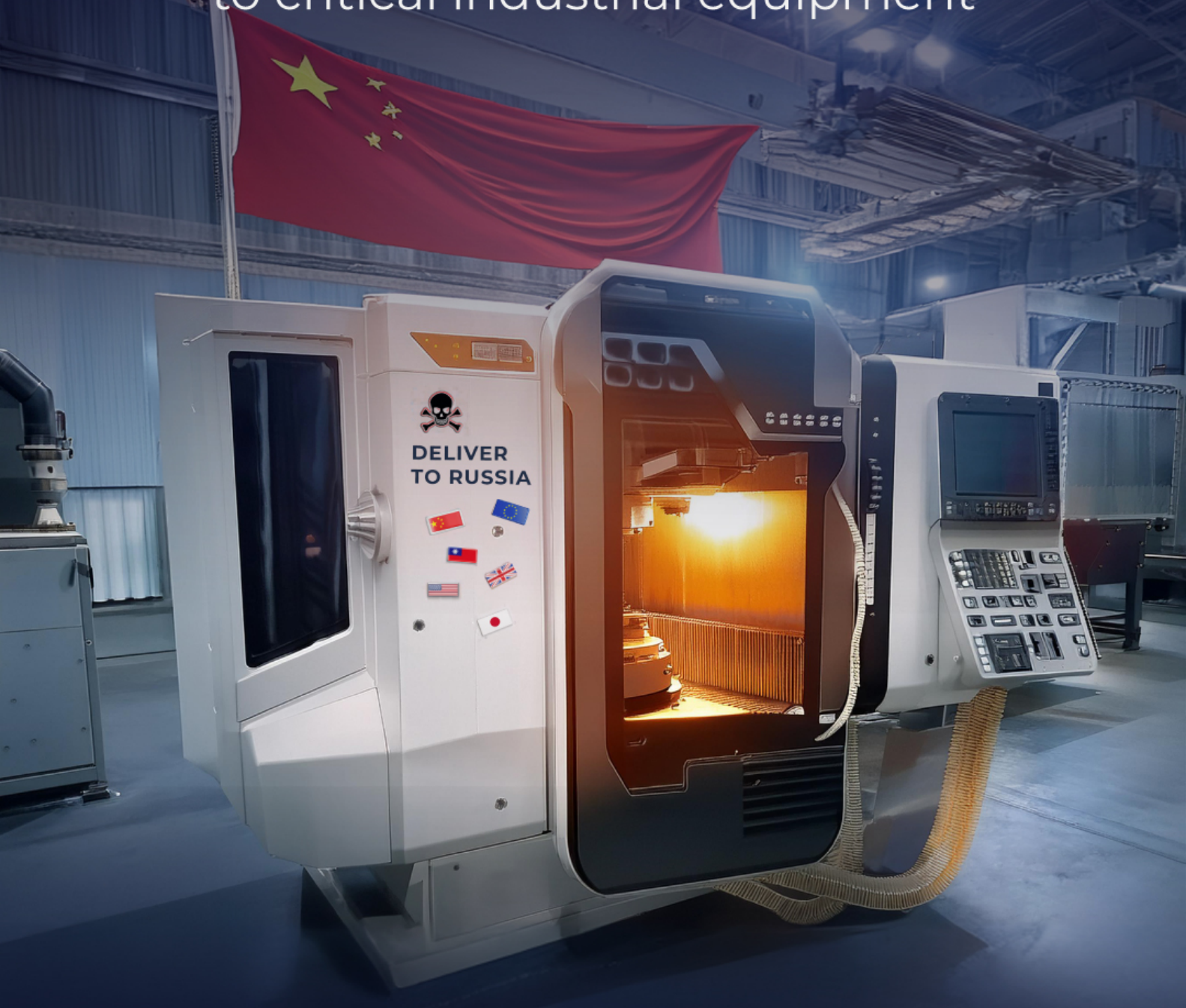
Third-best option:

China's rising role in Russian access to critical industrial equipment



ECONOMIC
SECURITY COUNCIL
of UKRAINE

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THIRD-BEST OPTION:
China's rising role in Russian access to critical industrial equipment

By Olena Yurchenko (ed.), Denys Hutyk, Olena Zhul, Bohdan Kovalenko, Oleksiy Borovikov, Bohdan Veselovskyi, Anastasiia Opria

ABOUT ESCU

The Economic Security Council of Ukraine (ESCU) is a Kyiv-based institution established in 2021 with the purpose of countering internal and external threats to the security of the state. Since the outbreak of the Russian full-scale invasion of Ukraine, the ESCU has used open-source analysis to investigate Russia's access to foreign technologies critical to the production of weaponry and military equipment employed in the battlefield. Based on the results of its research and keeping in mind its primary goal, namely maintaining security and supporting the territorial integrity of Ukraine, the ESCU also develops policy recommendations aimed at curtailing Russia's military capacity.

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ECONOMIC
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EXECUTIVE SUMMARY

The aggressive war that the Russian Federation has been waging on the territory of Ukraine for more than two years is not only about weapons that are directly used on the battlefield but also about the technologies that keep the stockpile of such weapons growing.

Currently, the production capacity of Russia's military-industrial complex is operating at a record high of 84%. With **63-65% of all Russian capital equipment being worn out**, new machine tools, in particular those with computer numerical control, are becoming one of the most critical technologies that the Russian war machine seeks to obtain at any cost.

During the first year of the full-scale invasion, the issue of Russian access to foreign CNC machines remained out of the sanctions coalition's focus, which allowed the aggressor state to increase its imports significantly. At the same time, due to the lack of domestic production, **Russia's dependence on external supplies of industrial equipment and relevant components was and still is at 70-90%**. Moreover, the vast majority of machine tools delivered to Russia end up in the hands of its military producers and are used to **maintain existing facilities or build new production shops**.

Since the end of 2023, members of the sanctions coalition have made great efforts to block Russia's access to Western CNC equipment. Under the pressure of the imposed sanctions, constant losses of military equipment at the frontline, and a shortage of production capacity, **the Russian Federation is finding new ways to circumvent the restrictions and maintain or even increase imports of machine tools**.

In 2023 and 2024, **China became the leading supplier of industrial equipment to the Russian Federation**, accounting for 80-90% of the machine tools imported by the aggressor state. Such Sino-Russian trade cooperation is based on **three workarounds, which still depend on Western input:**

Supply of machine tools manufactured in the countries of the sanctions coalition to Russia through China as a re-export hub

Regarding the number of companies involved in exporting machine tools manufactured in the sanctions coalition to Russia, China ranks second after Turkey. In 2023 and the first quarter of 2024, **340 Chinese entities exported Western machine tools to Russia worth USD 568.6 million**. 70% of Russian companies that received these products have ties to the military-industrial complex. Despite this fact, **90% of the largest Chinese suppliers are still not under sanctions**. At the same time, some were founded during the invasion or are run by Russian citizens, meaning they have clear red flags.

Exports to Russia of machines manufactured at the factories of Western companies in China

22 of the 30 largest Western manufacturers of CNC machines have factories in China. The equipment produced at these factories is much easier to get to Russia, as it only crosses the Sino-Russian border. In 2023 and early 2024 alone, **Russian companies received USD 50 million worth of Western-quality machine tools made in the PRC.** Among the manufacturers with production facilities in China, some companies serve the critical industries of their own countries, namely energy, aerospace, and defense. At the same time, **only 1 of the 12 most significant suppliers of such products to Russia is currently sanctioned**.

Russian imports of Chinese machine tools, the production of which depends on Western components, technologies and expertise

Under the pressure of sanctions, the **Russian defense industry increasingly uses machine tools from Chinese manufacturers**. Today, Chinese brands that export products that they have manufactured themselves are the largest suppliers of equipment to Russia.

However, Chinese machine tools entering Russia can only be produced with Western technology. **13 of the 16 largest Chinese CNC machine tool manufacturers exporting to Russia maintain close ties with the countries of the sanctions coalition** by importing high-tech Western components, opening R&D centers in Germany or Japan, entering partnerships with Western technology corporations, and establishing subsidiaries in Western and Western-allied countries.

The analysis presented in this study demonstrates that **manufacturers of dual-use goods, in particular CNC machines and related components, are not making maximum efforts to block Russia's access to critical technologies**. While Chinese producers are looking for ways to occupy a free niche in the Russian market, Western companies do not control their distribution networks, the activities of their subsidiaries, or the ultimate destination of the final products, of which their components and software become a part. Thus, not only do manufacturers and their subsidiaries not contribute to enhancing the sanctions regime, but **they may also undermine the effectiveness of existing sanctions instruments, such as those used in the financial sector**.

The states of the sanctions coalition, in particular those with the most significant extraterritorial influence, need to create new tools and improve existing ones to:

- **Encourage Western manufacturers** of CNC machines and related components to closely monitor the export of their products to China and **prevent their equipment from being supplied not only directly to Russia but also to irresponsible Chinese manufacturers**, taking all necessary measures, including controlling the activities of their subsidiaries in the PRC.

- **Discourage Chinese manufacturers** of CNC technology from **cooperating with the Russian market in any available form**, directly or indirectly, as well as to conduct thorough due diligence on their part.

Achieving these two goals is only possible with the large-scale use of leverage underlying economic statecraft, namely the **dependence of both Western and Chinese manufacturers on constant access to foreign expertise, technology, investment, markets, etc**.

Some members of the sanctions coalition **already have tools suitable for this purpose**, and their decisive use in practice can further disrupt Russian supply chains that have not yet recovered from recent financial sanctions[1]. At the same time, each of the instruments analyzed in this report has numerous gaps that reduce their effectiveness.

The members of the sanctions coalition need to urgently close these gaps to put the instruments into operation as quickly as possible or create a new **legal framework that would fully meet the**

[1] US Foreign Direct Product Rules, 14 package of EU sanctions, US Executive Orders 14105 and 14114, etc.

needs and threats of the time and pose a deadly threat to violators, as happened to banks at the end of last year.

In addition, Western and Western-allied states need to **move away from the reactive, cautious, and ad hoc application of primary and secondary sanctions** and begin strategically and massively countering Russian trade networks to achieve real supply chain disruption.

CHAPTER 1. RUSSIA'S ACCESS TO CNC EQUIPMENT: INTERIM ACHIEVEMENTS AND NEW CHALLENGES

CNC machines in the focus of the sanctions coalition

More than two years of the Russian Federation's full-scale invasion of Ukraine have demonstrated the critical and terrifying role that modern technology plays in supporting aggression, invasive actions and war crimes committed by rogue states. Since February 24, 2022, the international community has repeatedly seen the lines between civilian and military technologies blur, and the category of dual-use goods constantly expands.

From the first days of Russia's invasion of Ukraine, the world was shocked by the amount of Western-made civilian microelectronics found inside Russian aircraft, Iranian UAVs, and even North Korean missiles.

However, apart from the Western components found on the battlefield, some technologies often go unnoticed by the general public but play an even more critical role in creating the deadly weapons that the Russian Federation uses in Ukraine. These technologies include high-precision industrial equipment, which is abundant in every Russian military factory.

Computer Numerical Control (CNC) machines are among the most advanced industrial equipment used in military production. Fully automated and requiring minimal human intervention, CNC machines have revolutionised global manufacturing by providing unparalleled precision, efficiency, and resilience.

Before the full-scale Russian invasion of Ukraine, a limited number of Western and Western-allied states, namely Germany, Japan, Switzerland, Italy, Taiwan, South Korea, the UK, and the US, had a relative monopoly on producing this high-tech industrial equipment. This monopoly made other countries, including the Russian Federation, dependent on Western supplies.

Despite years of attempts at import substitution, at the beginning of the full-scale invasion, Russian industry was 70% dependent on Western CNC machines. In contrast, its dependence on original Western components and machine parts was even more significant—about 80%—90%[2].

At the same time, between 70% and 80% of all machines in Russia have been used by the military-industrial complex, which has given Western partners a critical lever of influence on the Russian war machine that remained relatively overlooked until late 2023.

According to the Russian analytical agency BusinesStat, in 2023, Russia imported 60,000 units of various machine tools, including CNC machines – thus, imports of machine tools for materials processing grew by 61%[3]. As FT reports based on Russian customs returns, after the beginning of the full-scale invasion, Russia doubled down on its imports of CNC machine tools—from USD 29,46 million in January 2022 to USD 120,86 million in July 2023[4]. A Ukrainian Trap Aggressor reported in November 2023, from January 2021 to July 2023, Russia imported more than 15,000 computer

[2] https://reb.org.ua/en/reporting/cnc-machinery-20-curtailing-russias-military-production-62ggk2
[3] https://dzen.ru/a/ZlYijjBBSlv5Qn1W
[4] https://www.ft.com/content/d16c688d-9579-4f1d-a84f-ca29ca2f0bc0

numerical control (CNC) machine tools worth USD 1.42 billion[5]. While increased transaction costs in the context of sanctions may be responsible for the overall rise, there is no denying that Russians increased imports of CNC machines at least two-fold or threefold.

Fortunately, in the past nine months, the efforts to block Russian access to foreign CNC machinery and related technologies have been robust and multifaceted. They involved essential steps and decisions taken by the key members of the sanctions coalition, the most prominent countries producing Western CNC machines, including the US, European Union, United Kingdom, Japan, Taiwan, and South Korea.

In the *United States*, the CNC-related measures have been particularly stringent. Effective April 8, 2022, the Department of Commerce mandated that all items on the Commerce Control List (CCL), including CNC machine tools, require export licenses for Russia and Belarus[6]. This requirement extends to in-country transfers within these nations and certain foreign-produced items under the Foreign Direct Product (FDP) rules. On November 2, 2023, the US Department of the Treasury imposed significant sanctions, targeting numerous Russian CNC machine tool manufacturers and importers[7]. Most importantly, Executive Order 14114, issued on December 22, 2023, further empowered the Treasury's Office of Foreign Assets Control (OFAC) to impose secondary sanctions on foreign financial institutions involved in significant transactions related to the transfer to Russia of critical goods, such as CNC machines, regardless of origin[8]. Finally, in the latest US sanctions package dated June 12, 2024, 5 cases of secondary sanctions related to the export of CNC machines were introduced[9].

The *European Union* has also taken comprehensive steps to block Russian access to CNC technologies since the end of last year. The 12th sanctions package of the EU, effective December 19, 2023, bans almost all CNC machines, critical components, and related software from being sold to the Russian Federation[10]. The EU has also implemented strict transit and re-export restrictions, including a ban on the general transit of CNC goods through Russia and an obligatory inclusion of a "No Russia" clause in sales contracts related to the export of CNC machines.

The *United Kingdom's* response was similar in content and scope to the restrictions imposed by its Western partners. London introduced new regulations in December 2023 to restrict Russian access to British CNC machines[11], and further sanctions were placed in February 2024 to target importers and manufacturers essential to Russian military production[12].

Japan imposed strict export bans on CNC machines and related technologies through amendments to its Foreign Exchange and Foreign Trade Act, with prohibitions taking effect on March 31, 2023[13],

[5] https://zn.ua/eng/how-the-russian-federation-circumvents-sanctions-for-the-production-of-high-tech-weapons-.html
[6] https://www.bis.doc.gov/index.php/policy-guidance/country-guidance/russia-belarus
[7] https://home.treasury.gov/news/press-releases/jy1871
[8] https://ofac.treasury.gov/media/932436/download?inline
https://home.treasury.gov/news/press-releases/jy2011
[9] https://home.treasury.gov/news/press-releases/jy2404
[10] https://eur-lex.europa.eu/eli/reg/2023/2878
[11] https://www.legislation.gov.uk/uksi/2023/1364/made
https://www.legislation.gov.uk/uksi/2019/855/schedule/3I
https://www.legislation.gov.uk/uksi/2019/855/schedule/3E
[12] https://www.gov.uk/government/news/new-uk-sanctions-mark-two-years-since-russias-illegal-invasion-of-ukraine
[13]https://www.meti.go.jp/policy/external_economy/trade_control/01_seido/04_seisai/downloadCrimea/20230331gaiyo.pdf

and April 5, 2024[14]. *South Korea's* Ministry of Trade, Industry, and Energy (MOTIE) updated its Public Notice on Trade of Strategic Items, imposing bans on dual-use goods, including CNC machines, as of April 28, 2023[15] and February 21, 2024[16]. The South Korean export control authorities are applying a presumption of denial for all restricted items.

Taiwan has also partially restricted CNC technology exports to Russia and Belarus. On January 4, 2023, Taiwan's Ministry of Economic Affairs (MOEA) expanded the "List of High-Tech Goods Exported to Russia and Belarus," incorporating more items under export controls, including those under Category 2 of the ECCN, which covers CNC machine tools[17]. Following the Washington Post investigation[18], the MOEA further restricted exports on February 7, 2024, adding 77 specific CNC-related HS codes to the list and increasing penalties for violations by over 15 times to TWD 1 million (USD 32,055)[19].

Another proof that the issue of blocking Russian access to Western CNC machines has been prioritised within the sanctions coalition is the collective steps taken by Western and Western-allied states, namely, updating the so-called High Priority Items List, which sets common priorities for enforcement agencies of several countries (the US, EU, UK and Japan) and now includes several types of CNC machines as well as their components in Tier 4.B[20].

Thus, as of 2024, Russia's dependence on foreign CNC machines is no longer unnoticed. On the contrary, it has become one of the priorities of Western countries' sanctions and export control policies to stop Russian aggression.

All the decisions taken at the end of last year and during this year have significantly complicated the Russian military-industrial complex's direct access to Western industrial equipment. Direct exports of CNC machine tools from the member states of the sanctions coalition to the Russian Federation have declined dramatically.

However, the demand for high-precision industrial equipment in the Russian military-industrial complex has not disappeared. It is growing rapidly in the context of the aggressor state's production capacity being at its maximum. That is why Moscow is not ready to accept the restrictions imposed and is looking for ways to circumvent them and avoid shortages. The following sections of this study will analyse China's role in supporting such attempts by the Russian Federation.

[14] https://www.meti.go.jp/press/2024/04/20240405001/20240405001-1-3.pdf
[15] https://www.kimchang.com/en/insights/detail.kc?sch_section=4&idx=27282
[16] https://www.kimchang.com/ko/insights/detail.kc?sch_section=4&idx=29221
[17] https://www.trade.gov.tw/english/Pages/Detail.aspx?nodeID=86&pid=755256
[18] https://www.washingtonpost.com/investigations/2024/02/01/taiwan-russia-sanctions-cnc/
[19]https://www.trade.gov.tw/Pages/Detail.aspx?nodeID=40&pid=778230&dl_DateRange=all&txt_SD=&txt_ED=&txt_Keyword=&pageindex=1&history=
[20] https://www.bis.gov/articles/russia-export-controls-list-common-high-priority-items
https://finance.ec.europa.eu/system/files/2023-09/list-common-high-priority-items_en.pdf
https://www.gov.uk/government/publications/russia-sanctions-common-high-priority-items-list
https://www.meti.go.jp/policy/external_economy/trade_control/01_seido/04_seisai/downloadCrimea/20240222oshirase_russia.pdf

Russia's response to Western sanctions

As described in the previous section, at the end of last year, members of the sanctions coalition focused on blocking the Russian Federation's access to Western CNC machines, which led to a significant reduction in direct exports of this industrial equipment by Western and Western-allied states.

Nevertheless, Russian imports of CNC machines have not stopped. Russia's military-industrial complex, the ultimate user of most of the machines in the aggressor state, continues to seek and find workarounds to obtain critical equipment. The intensity and success of such attempts are due to the conditions in which the Russian Federation's military machine is currently operating, namely the conditions of the production capabilities deficit.

During the St. Petersburg International Economic Forum in June 2024, Sberbank Chairman German Gref claimed that Russian production capacity is at 84%, a record high in Russian history[21]. Coupled with the human resources deficit—the Russian media outlet Izvestia estimated that Russia was short of 4.8 million workers in 2023[22]—Russia desperately needs new means of production to sustain military capacity. Moreover, as of 2023, 63-65% of capital equipment in the military and related industries was worn out. Many manufacturers use machines with a service life of more than 25 years, while equipment with a service life of up to five years accounts for only 4-7%. Only at some production facilities does this figure rise to 9%[23].

The demand for increased production is genuinely staggering due to Russia's unprecedented battlefield losses, which are estimated to include more than 8,800 armoured fighting vehicles (including tanks), 34,359 aircraft, 326 helicopters, 28 ships, and 14,106 artillery pieces — approximately USD 54.88 billion in equipment since February 2022[24]. Hence, military production became the main priority for the Russian government, with a record-breaking 30% increase in military spending in 2024, reaching RUB 36.6 trillion (EUR 376.7 billion)[25].

Given all the above, it is no wonder Russia still prioritises the constant supply of CNC machines and other industrial equipment. However, the Russian machine-building industry still cannot independently produce the required number of high-precision CNC machines. While Russian media are replete with stories about CNC machine development and successful import substitution, most of these reports serve propagandist purposes rather than reflect reality. In 2023, Russia produced 9,269 machine tools, up from 7,221 in 2022, with imports of 60,000 units – a tenfold difference and a staggering illustration of import dependency[26].

On the other hand, Russian domestic machine tool builders cannot compete in price with imported goods. For example, the average cost of a Russian-made machine tool was RUB 7.5 million in 2022, while the average price of an imported machine tool was RUB 4.4 million[27]. Thus, despite constant

[21] https://www.gazeta.ru/business/news/2024/06/04/23173315.shtml
[22] https://iz.ru/1624816/mariia-stroiteleva/kak-zhe-bez-ruk-defitcit-rabotnikov-v-2023-godu-sostavil-48-mln?utm_source=yxnews&utm_medium=desktop
[23] https://loc-tech.ru/novosti/rossiya-perezapuskaet-federalnyj-proekt-po-razvitiyu-stankoinstrumentalnoj-otrasli/
[24] https://www.newsweek.com/russia-cost-war-ukraine-tank-losses-military-spending-1887831
[25] https://www.euronews.com/business/2023/11/28/russia-approves-record-spend-for-military-in-new-budget
[26] https://dzen.ru/a/ZlYijjBBSlv5Qn1W
[27] https://stanki-expo.ru/novosti/tpost/87ydvamjj1-situatsiya-v-stankostroenii-na-mart-2023

attempts to develop its production of CNC machinery, in 2024 this sector of the Russian industry is still dependent on imports, which Moscow is trying to maintain by looking for ways to circumvent Western sanctions. For instance, Interfax reported, citing the statistics of the Federal Customs Service, that the volume of Russian imports decreased by 9% to USD 84.6bn in January-April 2024. Nevertheless, the decline in "machinery and equipment" — an essential category for the Russian economy—was only 4% (to USD 42.8bn)[28] — not as low as expected. The Russian Federation achieves such figures thanks to supplies from the so-called third jurisdictions, usually not members of the sanctions coalition. Such states include Turkey, the UAE, Central Asian countries, etc. However, this study focuses on analysing a country's contribution that stands out from the rest of the "third jurisdictions".

In parallel with the imposition of stricter sanctions and trade restrictions by Western countries, China is becoming a key supplier of goods and technologies critical to Russia's military-industrial complex. According to an analysis of Chinese customs data by the Carnegie Endowment, Beijing exports over USD 300 million worth of dual-use items—those with commercial and military applications—to Russia every month. In 2023, China was responsible for approximately 90% of Russia's imports of goods covered under the G7's high-priority export control list[29]. Russia's reliance on China for high-priority products surged from 32% in 2021 to 89% in 2023.

Machine tool exports from China to Russia grew 10-fold to USD 68 million from USD 6.5 million in February 2022. According to the Financial Times, in July 2023 alone, 57% of Russian imports of CNC machine tools came from China, up from 12% before the invasion[30]. Some analysts paint even a bleaker picture. For instance, Pavel Luzin, a visiting scholar at Tufts University and an expert on the Russian armed forces, writes that based on UN statistics on total Russian imports of machine tool parts, China's share grew to 32% in 2022 and to 80-90%, if not more, in 2023[31].

The US authorities have already recognised this crucial role of Chinese supplies. In an interview with BBC News, US Secretary of State Antony Blinken stated that China bolsters Moscow's war machine by supplying essential components. He noted that approximately 70% of the machine tools imported by Russia come from China[32].

Considering all of the above, it is safe to say that China is currently a critical supplier that supports Russia's access to CNC machines, thereby strengthening the military-industrial potential of the aggressor state. It is worth noting that the growth of Russian imports from China is not something radically new, as this trend has been developing since the beginning of the full-scale invasion. Nevertheless, a detailed analysis and breakdown of this problem, presented in the following sections, demonstrates several main patterns of Sino-Russian cooperation in the CNC field, allowing us to understand the challenge better and select more effective tools to address it.

The study by the Economic Security Council of Ukraine, based on data for 2023 and partial data available for 2024, divides Chinese imports of CNC machine tools to Russia into three categories, namely:

[28] https://www.interfax.ru/business/966012
[29] https://carnegieendowment.org/russia-eurasia/politika/2024/05/behind-the-scenes-chinas-increasing-role-in-russias-defense-industry?lang=en
[30] https://www.ft.com/content/d16c688d-9579-4f1d-a84f-ca29ca2f0bc0
[31] https://jamestown.org/program/chinese-machine-tools-serve-as-russias-safety-net/
[32] https://www.bbc.com/news/world-asia-china-68905475

1) Supply of machine tools manufactured in the countries of the sanctions coalition to Russia through China as a re-export hub.

2) Exports to Russia of machines manufactured at Western companies' factories in China.

3) Russian imports of Chinese machine tools, the production of which depends on Western components, technologies and expertise.

Other researchers have already described these categories or patterns in the context of supplying a more comprehensive range of goods critical to the Russian military machine[33]. That is why the purpose of this study is to provide a more detailed view of this problem concerning the supply of CNC machines to Russia, as well as to provide key stakeholders and policymakers with several sets of data and recommendations that can help to implement practical steps towards completely blocking Russian access to a strategically important type of industrial equipment.

[33] https://kse.ua/wp-content/uploads/2024/01/Challenges-of-Export-Controls-Enforcement.pdf

CHAPTER 2. CHINA AS A CNC LIFELINE: THREE DIMENSIONS OF THE PROBLEM

Chinese reexport network

According to the list described at the end of the previous section, one dimension of Chinese exports of CNC machine tools to Russia is the supply of machinery produced in the territory of the sanctions coalition states but entering Russia via China, namely through networks of Chinese distributors, logistics companies, and procurement entities.

As of today, the re-export of Western-origin products through China and other third jurisdictions is a well-known and repeatedly investigated method used by the Russian Federation to circumvent sanctions restrictions. Nevertheless, as this study aims to show all the components of Chinese exports of CNC machine tools to Russia, this dimension cannot be ignored. Moreover, this part of the study will focus on collecting information on specific Chinese and Russian companies involved in the CNC supply chain that are not yet under sanctions by Western countries. Thus, the study's authors aim to provide enforcement agencies with up-to-date data on those involved in sanctions circumvention and demonstrate the time and scope lag between Russian attempts to restructure supply chains and Western steps aimed at disrupting them.

This study meticulously analysed Russian imports for 2023 and the first quarter of 2024 under 18 Harmonized System (HS) codes corresponding to various CNC machine tool products[34]. To obtain data specifically on the supply of machine tools manufactured in the member countries of the sanctions coalition, the primary jurisdictions producing CNC machines (namely Germany, the United States, Switzerland, the Czech Republic, Austria, Italy, the United Kingdom, Japan, Taiwan, and South Korea) were selected as a secondary criterion for the analysis.

The analysis revealed that at least 2,113 companies supplied CNC machines manufactured in the ten abovementioned jurisdictions to Russia during 2023 and Q1 2024[35]. Among these suppliers, Chinese entities rank second (340 companies, or 17.5%), behind only Turkey by 9% (508 companies, or 26.16%). The rest of the suppliers originate from Germany (8.50%), South Korea (6.75%), Taiwan (6.08%), Italy (5.92%), the UAE (4.63%), Lithuania (2.47%), and Serbia (2.21%)[36]. The total volume of all exported CNCs amounted to USD 4.5 billion. Chinese companies accounted for **USD 568.6 million** or **12.6%** of all supplies during 2023 and the first quarter of 2024[37].

Moving from the broader picture to a more targeted analysis, it is worth noting that for some countries producing CNC machines, China plays a much more significant role as a re-export hub. These are primarily countries geographically close to China, but not exclusively. For instance, Chinese companies account for 41.12% of entities reexporting Japanese CNC products to Russia. As for Taiwanese CNC machinery, Chinese companies make up 26.25% of all suppliers. For South Korean equipment, this figure is 19.05%. Finally, two more cases of CNC supplies to Russia made via Chinese interlocutors include products produced in the US and UK. Between January 2023 and

[34] HTS codes 8207, 8482, 8456-8466, 8471, 8485, 8501, 8502, and 8537 and their subgroups
[35] Trade data
[36] Trade data
[37] A smaller share of the total number of suppliers than the share of the volume of supplies may indicate that Chinese suppliers supply CNC products to Russia for smaller amounts than exporters from other countries.

March 2024, Chinese firms comprised 29.41% and 17.73% of all American and British CNC product suppliers, respectively.

Based on the abovementioned criteria, this study also identifies a list of 36 unique Chinese companies that are among the top twenty suppliers of Western CNC machines to Russia for the whole of 2023 and the top 20 for the first quarter of 2024[38]. Impressively, 33 out of 36 identified companies or 92%, are not sanctioned by any members of the sanctions coalition. Only one company was included in the United States and Switzerland sanctions lists. Two more legal entities are designated only by the US.

When evaluating the potential impact of such Chinese suppliers on the Russian military-industrial complex, it is crucial to note that 80% to 90% of all machine tools imported by Russia are used for military purposes[39]. Such a high percentage underscores the strategic importance of these supplies to Russia's defence capabilities and a critical lifeline China represents for Russia's military production and technological advancement.

However, in addition to supplying dual-use goods to the state waging war of aggression and whose military-industrial complex is the primary user of imported industrial equipment, some identified Chinese companies have clear signs of involvement in sanctions circumvention, the so-called red flags[40].

For example, the Chinese companies Agu Information Technology Co. LTD and Yinuo Supply Chain Management Co. LTD, which together exported USD 75 million worth of American and Taiwanese-made CNC machines to Russia in 2023 and the first quarter of 2024, were first established during the full-scale invasion, namely in April and August 2022, respectively.

Both companies supplied machines to Russian importers with close trade ties to the Russian military-industrial complex. For example, the largest client of Agu Information Technology Co. LTD was the Russian company LLC Vneshekostil (ru: ООО "Внешэкостиль", TIN: 7724362880), which has been under US blocking sanctions since September 2023[41].

In its turn, Yinuo Supply Chain Management Co. LTD became a supplier for the Russian LLC Energy Industries (ru: ООО "ЭНЕРДЖИ ИНДАСТРИЗ", TIN: 7701374173). According to the public procurement registers and financial data available to the Economic Security Council of Ukraine, the latter has cooperated with Russian military-industrial complex enterprises, including JSC Admiralty Shipyards (the largest manufacturer of diesel-electric submarines), FGUP Kombinat Elektrokhimpribor (a nuclear weapons complex company), OJSC Dolgoprudnenskoye Scientific Production Plant (developer and manufacturer of Buk-M1, Buk-M1-2, Buk-M2, and Buk-M3 anti-aircraft guided missiles), JSC MIC NPO Mashinostroyenia (manufacturer of P-500 Bazalt, P-1000 Vulkan, P-700 Granit, 3M25 Meteorit, P-800 Onyx, Zirkon, Bastion, Redut missile systems as well as UR-100, UR-200, and UR-500 series intercontinental ballistic missiles).

The other two companies on the list, namely Shenzhen Blue Hat International Trade Co. LTD (Shenzhen Blue Hat) and Guangzhou White Sun Intermodal LTD (Guangzhou White Sun), which

[38] For a complete list of Chinese suppliers of foreign CNC machines and their Russian clients, please consult Annex I
[39] https://reb.org.ua/en/reporting/cnc-machinery-20-curtailing-russias-military-production-62ggk2
[40] For more detailed information concerning Chinese suppliers and Russian importers of foreign CNC machines, see Annexes I, II, III
[41] https://ofac.treasury.gov/recent-actions/20230914

exported more than USD 1 million worth of Taiwanese and British CNC technologies to Russia, are run by people of Russian origin. In particular, the director of Shenzhen Blue Hat is Elena (Sharikova) Malitckaia, a former resident of Chelyabinsk, Russia[42][43]. Guangzhou White Sun is managed by another person named Marina Shaydarova, who is Russian. According to available public data, Shaydarova lived in Khabarovsk, Russia, before moving to China[44]. Marina even has her own YouTube channel, explaining how to build business relations with Chinese companies [45]. Even though Shaydarova publicly claims to be engaged in “white logistics,” in 2024, the Chinese company, in which Marina is a director, supplied machines to the Russian LLC Periton Engineering (ru: ООО "Перитон Инжиниринг", TIN: 7703426927), which came under US blocking sanctions in February this year[46].

A company with no less interesting background is the Chinese enterprise Qingdao Leader Metrology Instruments Co. LTD (Shandong Province). This company is perhaps the smallest among all the suppliers identified in this study. In 2024, Qingdao Leader Metrology Instruments exported British CNC products to Russia for USD 393,764. However, in this case, quite different details are of most interest. According to the public data, the company is a Sino-American joint venture. In particular, the company's website states that Qingdao Leader Metrology Instruments Co., ltd (Leader Metrology) was invested by America Leader Metrology Inc. in 2003[47]. This information on the official website is accompanied by a photo of the company's headquarters, with the US and Chinese flags placed next to each other in the yard. Some certificates published on the Qingdao Leader Metrology Instruments website mention the company as a “China-US Joint Enterprise”[48]. The same name is used by some distributors [49] and Russian public sources[50].

Despite the potential connection with the United States, in 2024, Qingdao Leader Metrology Instruments supplied products to the Russian company LLC NORGAU RUSSLAND (ru. ООО "НОРГАУ РУССЛАНД", TIN: 7727159340). According to historical data from Russian public procurement registers, before the full-scale invasion, NORGAU RUSSLAND actively cooperated with such Russian companies as JSC PO Sevmash (manufacturer of nuclear-powered and diesel-electric submarines), NPO Toriy (manufacturer of ultra-high frequency devices for radar and satellite communication systems), JSC Konstruktorskoe Buro Priborostroeniya (developer of high-precision guided weapons for ground forces, navy and air force, air defence systems, rapid-fire cannons and combat small arms), JSC Votkinsk Machine Building Plant (manufacturer of Topol-M and Iskander missile systems), etc.

According to business records available to the Economic Security Council of Ukraine, after the start of Russia's full-scale invasion of Ukraine, NORGAU RUSSLAND did not stop cooperating with the Russian military-industrial complex. In late 2023 and early 2024, NORGAU RUSSLAND sold products to JSC CRI Central Scientific Research Institute Burevestnik (developer of 152-mm self-propelled howitzer 2S43 "Malva," 120-mm self-propelled gun 2S40 "Flox," 82-mm self-propelled mortar 2S41

[42] https://cn.linkedin.com/in/elena-malitckaia-2b1a7940
[43] https://www.facebook.com/elena.malitckaia/about?locale=mt_MT
[44] https://www.youtube.com/watch?v=-o0mM7KrdF8
[45] https://www.youtube.com/channel/UCeq_GcpKUMQH8uoNJRBf9ug
[46] https://ofac.treasury.gov/recent-actions/20240223#:~:text=OBSHCHESTVO%20S%20OGRANICHENNOI%20OTVETSTVENNOSTYU%20PERITON%20INZHINIRING
[47] http://leadermetrology.com/en/leidunjianjie/
[48] http://leadermetrology.com/en/zizhirongyu/#lg=1&slide=2
[49] https://www.cmm.com.sg/products.php?id=54
[50] https://декларации-соответствия.рус/kompaniya/china-us-joint-enterprise-qingdao-leader-metrology-instruments-coltd-cn/

"Drok"), JSC United Engine Corporation (manufacturer of engines for Russian military aircraft and missiles), Imperial Tula Arms Plant (manufacturer of the AKS-74U, Konkurs-M anti-tank guided missile, GP-25 40mm under-barrel grenade launcher, A-91 automatic grenade launcher system, VSS Vintorez sniper rifle, and AS Val automatic rifle).

In addition to the individual cases, this study analysed all the largest Russian entities which imported Western CNC equipment from China in 2023 and Q1 2024[51]. The final list of 33 companies includes the largest customers of each Chinese supplier identified in the previous stage and described above. Of the entire list of Russian importers, 22 companies (or 67%) have ties to the Russian military-industrial complex, confirmed by historical data from Russian public procurement registers or business records available to the Economic Security Council of Ukraine. Despite numerous completed defence contracts, 16 entities are not under international sanctions. Among the rest, six companies are included in the US sanctions lists, three are designated in the UK, and only one is under EU sanctions.

The research presented in this section focuses exclusively on the CNC machine tools and related products sector. Despite their critical role in the aggressor state's military-industrial complex, CNC machines are only part of a vast list of dual-use goods to which the Russian Federation is trying to maintain access.

However, even such a narrow analysis demonstrates China and Russia's extensive trade cooperation network. Thanks to dozens of Russian and Chinese intermediaries, the aggressor's military-industrial complex continues to import and use high-tech equipment manufactured in the territory of the sanctions coalition. At the same time, the analysis of sanctions in place outlined above clearly shows that the pace of imposing restrictions lags behind the pace of development of Sino-Russian trade relations. Numerous enterprises supporting Russian access to CNC machines remain off the designations lists despite the obvious red flags and impressive supplies.

[51] Please consult Annexes II, III for a complete list of Russian importers as well as detailed analysis of their connections to Russia's MIC

Western production on Chinese soil

Even though the previous section of this study was devoted to one of the most common Russian schemes for circumventing sanctions restrictions, namely the import of goods produced in the territory of the sanctions coalition through the so-called third jurisdictions, the Russian Federation and its military-industrial complex have another, to some extent even simpler, way to obtain equipment of Western quality and precision. This method involves purchasing CNC machines manufactured at production facilities located in mainland China that Western companies own.

To analyse this problem in more detail, the authors of the study compiled a list of the 30 largest brands originating from Western and Western-allied countries (South Korea, Taiwan, Japan, Germany, the US, Switzerland, Belgium, Sweden) and producing CNC machines, based on open data and public business rankings.[52].

According to the research based on open-source information, 22 out of 30 Western brands in question have direct subsidiaries registered in China (See Table 1). At the same time, four Taiwanese companies from the preliminary list have been supplying their equipment to Russia directly from the production sites located in Taiwan (See Table 2). It is worth noting that this study considers only subsidiaries with their production facilities in China, without considering technical support, training, or sales centres. In other words, 22 Western brands that are leaders in the global CNC market produce their equipment in China.

Table 1: Products of Western subsidiaries in China delivered to Russia

Brand name	Chinese subsidiary	Total cost of deliveries *(2023-Q1, 2024)*	Quantity of products delivered
South Korea			
DN Solutions	DN Solutions China Co., LTD.[9]	$11,359,242.72	64 items
Doosan Machine Tools	Doosan Machine Tools (China) Co., Ltd.[10]	$7,816,567.82	29 items
Taiwan			
Delta Electronics	Delta Electronics (Jiangsu) LTD[11]	$6,788,456	60 items
Leadwell Machinery LTD	Ningbo Leadwell Trading Co., LTD	$3,630,418.05	16 items
Goodway Machine Corp.	Goodway Machine (Wujiang) Co. Ltd.[12]	$12,136,901	99 items
Japan			
Mazak	Yamazaki Mazak Machine Tool (Liaoning) Co., LTD[13]	$955,644.80	4 items
Makino	Makino (China) Co., LTD.[14]	$707,882.00	5 items

[52] FANUC (Japan), DN Solutions (South Korea), Doosan Machine Tools (South Korea), I MACHINE TOOLS CORP. (Taiwan), VICTOR TAICHUNG MACHINERY WORKS CO., LTD (Taiwan), L.K. MACHINERY CORP. (Taiwan), KAO FONG MACHINERY CO., LTD (Taiwan), LEADWELL MACHINERY LTD (Taiwan), HERMLE (Germany), Heidenhain (Germany), EMAG (Germany), DMG MORI (Germany-Japan), Hyundai Wia (South Korea), KOVOSVIT MAS (Czech Republic), GF Machining Solutions (Switzerland), HAAS Automation (USA), Hardinge (USA), MAZAK (Japan), OKUMA (Japan), TRUMPF (Germany), AMADA (Japan), Bystronic (Switzerland), Siemens AG (Germany), Walter AG (Germany), LVD (Belgium), Mycronic (Sweden), Akira Seiki (Taiwan), Delta Electronics (Taiwan), Goodway Machine Corp. (Taiwan), Makino (Japan).

OKUMA	BYJC-OK Beijing Machine Tool Co., LTD [15]	$387,741.00	1 item
Amada	Qingdao Amada Numerical Control Machinery Co., LTD[16]	$79,961.10	2 items
	Anhui Amada Machine Tool Manufacturing Co., LTD	$76,587.10	4 items
	Amada (China) Co., LTD.[17]	$15,396.56	2 items
Fanuc	Beijing Fanuc Electromechanical Co., LTD[18]	$10,406.25	4 items
	Shanghai-Fanuc Robotics Co.,LTD	$86,455.63	5 items
	Beijing-Fanuc Mechatronics Co., LTD	$1,069.68	4 items
German brands			
Siemens AG	Siemens Standard Motors LTD[19]	$1,070,657	337 items
TRUMPF	Jiangsu Jinfangyuan CNC Machine Co., LTD [20]	$971,363.88	26 items
DMG Mori	DMG Mori Tianjin Factory[21]	$697,537.00	2 items
Heidenhain	DR. Johannes Heidenhain (China) Co., LTD[22]	$169,650.96	24 items
	Heidenhain (China) Co.,LTD	$181,776.90	27 items
Walter AG	Walter Wuxu Co., LTD [23]	$263,029.75	70 items
EMAG	Emag (China) Machinery Co., LTD[24]	$10,666.09	3 items
USA			
Hardinge	Hardinge Precision Machinery (Jiaxing) Company Limited[25]	$701,065.00	3 items
	Hardinge Machine (Shanghai) Co., LTD	$137,873.00	1 item
HAAS Automation	Haas Automation Asia Co., LTD [26]	$583,905.86	17 items
Switzerland			
GF Machining Solutions	GF Machining Solutions Chnagzhou Co., LTD[27]	$489,868.00	1 item
Bystronic	Bystronic (Shenzhen) Laser Technology Co., LTD[28]	$419,123.94	155 items
Belgium			
LVD	Maanshan LVD CNC Machine Tool Co., LTD[29]	$633,909.60	26 items
Sweden			
Mycronic	Mycronic Co., LTD (Shanghai)[30]	$10,094.26	3 items

Table 2: Taiwanese CNC producers supplying machinery to Russia directly

Brand name	Total cost of deliveries *(2023-Q1, 2024)*	Quantity of products delivered
I Machine Tools Corp[32]	$13,171,416.54	343 items
L.K. Machinery Corp[33]	$3,774,540.53	13 items
Kao Fong Machinery Co., LTD[34]	$2,233,609.60	12 items
Akira Seiki[35]	$3,538,568	86 items

Each of these Chinese subsidiaries operates as a separate legal entity, and its unique name is indicated in the trade documents every time its product is exported. This feature makes it possible to trace whether the Russian Federation receives CNC machines manufactured by Western brands in China.

According to the trade data available to the Economic Security Council of Ukraine, during 2023 and the first quarter of 2024, USD 50 million worth of products produced by Chinese subsidiaries of Western CNC manufacturers were exported from the PRC to Russia. Although this might seem insignificant compared to the total volume of Russian CNC machine imports, it should again be emphasised that this case represents Russian maintained access to high-tech. These high-quality Western technologies will most likely be used to develop the Russian military-industrial complex. Thanks to the relatively easy access to products from Chinese subsidiaries of Western brands last year and in the first quarter of this year alone, Russian military plants received about 1,000 unique items.

At the same time, most of the supplies referred to above do not come directly from Chinese subsidiaries of Western brands but are exported via Chinese interlocutors. The case of the American company Hardinge is described below to illustrate the typical supply chain of Western machine tools manufactured in China and exported to Russia.

Hardinge Inc. is a multi-national private producer of high-precision, computer-controlled machine tool solutions headquartered in Elmira, New York[53]. Hardinge has occupied 80% of the market for small- and medium-sized ultra-precision turning in the United States and Europe.[54] According to the website, the company develops equipment for the aerospace, defence and energy industries[55], evidenced by Hardinge's participation in official procurements of the US Departments of the Navy and Army and NASA [56].

Production sites and subsidiaries in Asia widely represent Hardinge. In 1996, the company established a wholly owned subsidiary in Shanghai, Hardinge Machine Tool (Shanghai) Co., Ltd.,

[53] https://hardinge.com/
[54] https://www.stylecnc.com/blog/top-10-best-cnc-machine-manufacturers-brands.html
[55] https://hardinge.com/industries/
[56]https://fpds.gov/ezsearch/fpdsportal?indexName=awardfull&templateName=1.5.3&s=FPDS.GOV&q=Hardinge+INC&x=22&y=8

which also serves as Hardinge's demonstration, training, and maintenance centre in China.[57] The company's largest production site in China is the Hardinge Jiaxing factory, established in 2010.[58]

According to the trade records[59], in 2023, three vertical CNC machines manufactured by Hardinge Precision Machinery (Jiaxing) Company Limited and worth USD 701,065 were delivered to the Russian Federation via Chinese distributor Beijing Zhuangguan International Import&Export Trade Co Ltd (not sanctioned by any member of the sanction coalition).

The Russian importer of Hardinge's equipment was LLC NPP Technoproekt (ru: ООО НПП "Технопроект", TIN: 5835034400), a Russian research and production company specialising in the development and production of pipeline valves for the gas, oil, and nuclear industries as well as for power and railway engineering.[60] NPP Technoproekt is not subject to any international sanctions. Still, it had open state contracts[61] to supply machine tools and fittings to Russian military-industrial enterprises, namely Federal State Unitary Enterprise Combine Electrokhimpribor (producer of nuclear warheads designated in Ukraine[62]) and PJSC Scientific Production Association Iskra (designer, manufacturer, and supplier of solid-fuel rocket engines for intercontinental ballistic missiles sanctioned by the US OFAC, EU, France, Switzerland, and Ukraine [6364]).

Another illustrative case is one more American company, Haas Automation Inc. Like Hardinge, Haas Automation is a privately owned machine tools and rotary products manufacturer. The company is headquartered in Oxnard, California[65]. Haas fulfils orders for US government customers, including the US Army, US Department of Defense, US Marine Corps, US Navy, National Guard, and NASA[66]. At the same time, the company owns a production facility in China named Haas Automation Asia Co., LTD. In March 2023, PBS NewsHour reported that Haas Automation had kept supplying its machinery to Russia directly until October 2022[67].

According to trade records, in 2023, two processing centres produced by Haas Automation Asia and worth USD 496,870 were delivered to Russian LLC AMG (ru: ООО "Компания "АМГ", TIN: 7720821959) designated in the US and UK by the Chinese entity Ele Technology Co., LTD. LLC AMG, registered in Moscow, is actively cooperating as a supplier with Russian-sanctioned military plants. According to business records available to the ESCU, in late 2023 and early 2024, LLC AMG supplied goods to such companies as JSC Aviaagregat (manufacturer of landing gear for military aircraft), Almaz Research and Production Enterprise (manufacturer of ultra-high-precision electronic equipment for military aviation), and JSC 163 Armored Vehicle Repair Plant.

[57] https://europe.hardinge.com/about-us/our-history/
[58] https://www.youtube.com/watch?v=FT8iNEpf90s
[59] Trade data
[60] https://solenoid.ru/
[61] https://checko.ru/company/npp-tekhnoproekt-1025801209334?extra=contracts&law=223&role=supplier
[62]https://ru.wikipedia.org/wiki/%D0%AD%D0%BB%D0%B5%D0%BA%D1%82%D1%80%D0%BE%D1%85%D0%B8%D0%BC%D0%BF%D1%80%D0%B8%D0%B1%D0%BE%D1%80
[63] https://mashnews.ru/permskoe-npo-iskra-planiruyut-peredat-korporaczii-takticheskogo-raketnogo-vooruzheniya.html
[64] https://www.opensanctions.org/entities/NK-dBYuvK6gZEmnftFQDCtBG3/
[65] https://www.haascnc.com/index.html
[66] https://www.army.mil/article/146696/transitioning_from_manual_to_automated_machining
[67] https://www.pbs.org/newshour/show/american-company-accused-of-violating-sanctions-doing-business-with-russian-arms-industry

In April 2024, AMG LLC received two more machining centres from Ele Technology Co., LTD, manufactured at the Haas Automation plant in China[68]. The value of the exported equipment was over USD 1.5 million.

The cooperation between the Chinese company Ele Technology Co., LTD and LLC AMG has already been studied in detail by the Center for Advanced Defense Studies experts. In their report published in June this year[69], C4ADS described how the Russian supplier of critical products for the military-industrial complex received equipment of the Japanese brand Tsugami from Ele Technology. At the time of this study's publication and the C4ADS report, Ele Technology Co., LTD was not under any foreign sanctions.

The cases described above clearly demonstrate that the products of Western brands that are suppliers of critical technologies for their countries' defence, aerospace, or energy sectors continue to enter the Russian Federation through their production sites in China. As we can see, Chinese intermediaries play a significant role in the abovementioned supplies.

This study identifies the 12 biggest Chinese entities that, during 2023 and Q1 2024, provided Russia with CNC machinery produced by the subsidiaries of Western brands in the PRC (See Table 3). The total value of these Chinese companies' supplies to Russia over the relevant period is over USD 20 million. Nevertheless, only one entity on the list provided below is designated by at least one member of the sanctions coalition.

Table 3: Top Chinese interlocutors exporting products of Western subsidiaries in China to Russia

Chinese interlocutor	Sanctions imposed	Total cost of deliveries *(2023-Q1, 2024)*	CNC brands delivered
Silver Technology Ltd	USA (OFAC)[36]	$4,215,395	DN Solutions China Co., LTD
Dalian Xin Peng Hai M&E Equipment Co.,LTD	No	$2,849,407	
Shenyang Zhanxin Electromechanical Equipment Co.,LTD	No	$2,350,933	
Hong Kong Corporate Business Services LTD	No	$4,136,213	Doosan Machine Tools (China) Co., LTD
Ningbo Leadwell Trading Co.,LTD	No	$3,630,418	Ningbo Leadwell Trading Co., LTD
Suzhou Sup Bestech Machine Tools Co.,LTD	No	$971,363	Jiangsu Jinfangyuan CNC Machine Co., LTD
Shanghai Maihong Trading Co.,LTD	No	$875,517	Yamazaki Mazak Machine Tool (Liaoning)Co., LTD
Beijing Zhuangguan International Import&Export Trade Co.,LTD	No	$701,065	Hardinge Precision Machinery (Jiaxing) Company Limited

[68] Trade data

[69] https://c4ads.org/reports/war-machine/

Shanghai Maihong Trading Co.,LTD	No	$697,537	DMG Mori Tianjin Factory
Maanshan LVD CNC Machine Tool Co.,LTD	No	$632 716	Maanshan LVD CNC Machine Tool Co., LTD
Shenyang China Foundation Stone Trade Co.,LTD	No	$615,785	Makino (China) Co., LTD
Ele Technology Co.,LTD	No	$496,870 (+ 2 shipments in Q2 2024)	Haas Automation Asia Co., LTD

Even though most CNC machines manufactured by Western companies in China are exported to Russia not directly but through Chinese intermediaries, there are several exceptional cases. Taiwanese brands Leadwell Machinery LTD and Goodway Machine Corp are among them.

Goodway Machine Corp is a Taiwanese manufacturer of CNC machines and machining centres[70]. The company has strong ties with the Japanese CNC machine industry. All Goodway machines are based on the latest Japanese technology and components such as spindle bearings, controls including servo and spindle motors, curve couplings, and much more. Top-grade casting beds and components are machined using Mitsui Seiki and Toshiba machine tools.[71]

In 2023 and the first quarter of 2024, Goodway's Chinese subsidiary Goodway Machine (Wujiang) Co. Ltd supplied USD 12 million of CNC products directly to Russia.[72] Russian company that received most of the deliveries conducted by Goodway Machine (Wujiang) Co. Ltd was LLC Weber Comehanics LLC (ru: ООО Вебер Комеханикс, TIN: 7709307370), a Moscow-based distributor designated by the US OFAC for supplying CNC machines to Russian military-industrial plants.[73]

Another Taiwanese company that directly exports CNC machinery to Russia is Leadwell Machinery LTD. The Chinese subsidiary of the Taiwanese brand, Ningbo Leadwell Trading Co. Ltd., supplied over USD 3 million worth of CNC equipment to Russia in 2023 and the first quarter of 2024.[74] The leading Russian importer, LLC Obltransterminal (ru: ООО ОТТ, TIN: 5053042571), a distributor of CNC machines, is also under US OFAC sanctions.[75]

All of the findings in this section indicate that Chinese exports of CNC machine tools to Russia are a multifaceted problem that goes beyond the vast network of Chinese distributors and front companies. China not only re-exports CNC machines made in the West but also serves as a convenient platform for Western companies to produce equipment, which then gets to Russia much more accessible and with fewer intermediaries (or no intermediaries).

As in the previous section, the figures reflecting the restrictions imposed by Ukraine's allies in response to sanctions circumvention are disappointing. Most companies in this study are not included in the sanctions lists and continue to trade with the aggressor state.

[70] https://www.goodwaycnc.com/
[71] https://www.goodwaycnc.com/exhtml_goodway/goodway_en/company_profile/production.htm
[72] Trade data
[73] https://www.opensanctions.org/entities/NK-JxfFooycsFgTMTmFmQQLBF/
[74] Trade data
[75] https://www.opensanctions.org/entities/NK-Zn5i2cpdeeTsK44Uw5Fup3/

However, this section raises an even more severe gap in the sanctions regime against Russia, namely the negligence of Western manufacturers and their lack of control over directly owned subsidiaries in third countries.

Chinese machine tools as a source of Western technologies

As described in the previous sections, the first two dimensions of Chinese CNC exports to Russia concerned Russia's continued access to Western-branded machine tools due to re-export schemes involving Chinese distributors or subsidiaries of Western companies producing their equipment in the PRC. Under the conditions relevant before the Russian Federation's full-scale invasion of Ukraine, the study would have ended with the analysis of these two patterns.

Before February 24, 2022, the Russian military industry depended on CNC machinery and components manufactured in Western and Western-allied states. Despite China's being the biggest producer and exporter of CNC machines, Russia, especially its MIC, did not buy or use Chinese tools because of their inferior quality, precision, and technical support. Russian industries, particularly those involved in high-precision manufacturing and military production, favoured Western machine tools for their superior performance and reliability. The perception has been that Chinese machines could not meet advanced industrial and military application requirements[76].

In its substance, this perception corresponded with reality. In 2021, the average price of Western CNC machine tools imported by China reached RMB 1.75 million per set, whereas the export price of a Chinese set of machinery was just RMB 100 thousand. Foreign CNC machines achieved a horizontal positioning accuracy of 0.015/1,000mm and a repeat positioning accuracy of 0.003-0.007mm. Chinese machines lagged with a positioning accuracy of 0.025/1,000mm and a repeat positioning accuracy of 0.01-0.015mm[77]. Additionally, the mean time between failures (MTBF) for foreign CNC machines exceeded 5,000 hours, compared to 2,000 hours for Chinese machines, which suffered from issues like oil, liquid, and gas leaks[78]. These significant factors, including price disparity, level of precision and regularity of failures, underscored the gap in quality and technological advancement between Chinese and Western products.

However, the Western sanctions, which targeted the exports of critical Western technologies and high-precision machinery to Russia, left the country with limited options. The sanctions disrupted the supply chain of Western CNC machines, which were essential for Russia's military production and other high-tech industries. With a significant gap in their industrial capabilities, Russian weapons and military equipment producers had to turn to Chinese suppliers, which the open-source data can already prove.

One example is the Izhevsk Unmanned Systems Research and Production Association of the Kalashnikov Concern, which manufactures Russian reconnaissance drones used in Ukraine[79] [80]. In March 2024, a CNC machine produced by the Chinese Dalian Machine Tool Group (DMTG)[81] was observed at facility[82]. A month before this news, Russian media reported that Izhevsk Unmanned Systems planned to increase its UAV production 10-fold in 2024, which was made possible due to

[76] https://reb.org.ua/en/reporting/cnc-machinery-20-curtailing-russias-military-production-62ggk2
[77] https://daxueconsulting.com/chinas-machine-tools-industry/
[78] https://bit.ly/3Y9iToM
[79] https://en.supercam.aero/catalog/?id=items
[80] https://anna-news.info/razvedyvatelnyj-bespilotnik-supercam-s350-v-svo/
[81] http://dmtg.com/en
[82] https://twitter.com/zerkzal/status/1773885903657730493

the commissioning of a new 5,800 square meter production shop as well as newly installed CNC equipment and an increased number of machining centres[83].

Another Russian defence plant, NPO Kurganpribor[84], which produces capsule bushings for land and naval artillery, fuses for tank rounds, multiple rocket launchers, anti-aircraft missile systems, guided and unguided aviation missiles and aviation bomb armament[85], features CNC machines from various Chinese manufacturers, namely Zhe Jiang Headman Machinery Co.,ltd (Headman)[86] and Shandong Weida Heavy Industries Co.,ltd (Weida)[87]. In August 2024, Russian media reported that NPO Kurganpribor had opened a new 1,500-square-meter production site, where dozens of new machines were installed, according to the governor of the Kurgan region, Vadim Shumkov[88].

According to public procurement registries, Chinese SOLEX machines are used by JSC Asteys, a Russian enterprise producing military special equipment, including "Patrol" armoured vehicles designed to transport personnel and cargo, tow trailer systems, and install bullet and mine protection for military and special equipment[89] [90].

The main Russian producer of Shahed UAVs, located in Alabuga Special Economic Zone (Yelabuga, Republic of Tatarstan)[91], also uses Chinese CNC machines mixed with the ones of German and Taiwanese origin. The internal documentation of the enterprise leaked last year[92] reveals that the production facilities for Shahed UAVs utilise machine tools of such Chinese producers as Ningbo Dekay[93], Wattsan[94], and NOVICK Digital Equipment[95].

The cases described above prove that in the face of the constant demand for defence products, a shortage of production capacity, and restricted access to Western equipment, the Russian military-industrial complex is increasingly switching to Chinese-branded machines, which was hard to imagine several years ago. Nevertheless, even though seemingly isolated from the influence of the sanctions coalition, cooperation between the Russian military-industrial complex and Chinese manufacturers of machine tools is affected by the monopoly on developing and producing advanced CNC technologies held for decades by Western and Western-allied states. The Chinese machine-building industry, which is currently trying to fill the vacant niche in the Russian market, remains critically dependent on foreign components, software, and expertise[96].

For instance, foreign companies dominate the industrial software sector, which is crucial for the production and usage of Chinese CNC machine tools. CAD (Computer-Aided Design[97]) and CAE

[83] https://rostec.ru/news/izhevskie-bespilotnye-sistemy-uvelichat-vypusk-bespilotnikov-v-desyat-raz/
[84] https://kurganpribor.ru/about/
[85] https://kurganpribor.ru/about/
[86] https://www.headmancnc.com/
[87] http://www.weida-mc.com/
[88] https://dzen.ru/a/ZqsqhSMaR2FxAN-m
[89] https://war-sanctions.gur.gov.ua/tools/279
[90] https://war-sanctions.gur.gov.ua/tools/278
[91] https://www.currenttime.tv/a/uzhe-vovsyu-sobirayut-chto-izvestno-o-proizvodstve-dronov-shahed/32490123.html
[92] https://simorgh.io/data/SaharaThunder/
[93] http://www.nbdekay.cn/html/en/
[94] https://wattsan.com/
[95] http://www.novick.cn/Company_Description/
[96] For a detailed breakdown of the dependency of Chinese CNC industry on the foreign CNC components and technologies, please consult Annex IV
[97] Software is used for creating detailed 2D commonly used in engineering, architecture, and product design.

(Computer-Aided Engineering[98]) software, essential for the design and simulation[99], are primarily developed and supported by non-Chinese entities, with over 90% of the CAD market and significant shares in CAE. The so-called PLM (Product Lifecycle Management[100]) software, crucial for managing product lifecycles, is also dominated by non-Chinese firms, holding a 77.5% market share. MES (Manufacturing Execution System[101]) software, essential for factory process monitoring, sees a 35% share held by foreign companies[102].

Western and Western-allied states are also the biggest suppliers of hardware critical for producing and employing Chinese machinery. For example, control instruments like PLCs (Programmable Logic Controllers[103]) and DCS (Distributed Control Systems[104]), which are vital for CNC machine operations, usually come from non-Chinese companies, which hold nearly 100% of the small and medium/large PLC markets and 65% of the DCS market.

Foreign firms primarily lead the CNC systems market, with a combined 57.5% share, and the Industrial PCs[105] (IPCs) market, with an 85% share. The automation equipment market, including HMIs (Human-Machine Interfaces[106]) and machine vision systems, has non-Chinese shares of 55% and 52.5%, respectively. Fibre lasers, essential for high-efficiency laser solutions, are dominated by foreign companies, with a 52% market share[107].

Precision components for quality control, including spectrometers, tensile testers, and microscopes, are heavily supplied by non-Chinese firms. Motor components like AC Servo systems[108] and linear motors[109] are dominated by non-Chinese companies, with a 65% share for servo systems and 80-85% for linear motors. Sensors, including rotary encoders[110] and proximity switches[111], have non-Chinese market shares ranging from 37.5% to 92.5%. Relays[112] and contactors[113], essential for

[98] Software tools that enable engineers to simulate and analyze the performance of components and assemblies under various conditions, often used to optimize designs before physical prototypes are made.
[99] https://medium.com/@mecsoftcorporation11/cad-cam-and-cnc-machining-explained-7ca4c5827ddf
[100] Software that manages the entire lifecycle of a product from inception through engineering design and manufacturing to service and disposal, integrating people, data, processes, and business systems.
[101] Software that monitors and manages manufacturing operations on the shop floor, providing real-time data and control to ensure efficient production processes.
[102] https://bit.ly/3Y9iToM
[103] An industrial digital computer designed for the control of manufacturing processes, such as assembly lines, or robotic devices, which requires high reliability and ease of programming.
[104] A control system for industrial processes where control elements are distributed throughout the system rather than being centralized, typically used in complex, large-scale processes.
[105] A computer designed for industrial use, typically ruggedized and capable of withstanding harsh conditions, used for tasks such as controlling machinery, data acquisition, and real-time processing.
[106] The interface through which humans interact with machines, typically involving display screens, buttons, and touch interfaces, used in various industrial applications to control and monitor systems.
[107] https://bit.ly/3Y9iToM
[108] A type of motor system that uses feedback to precisely control the motion and position of mechanical components, commonly used in CNC machines and robotics.
[109] A type of electric motor that produces linear motion instead of rotational motion, often used in applications requiring precise, high-speed movement.
[110] A sensor that converts the angular position or motion of a shaft or axle to an analog or digital code, used in various industrial machines for precise control.
[111] A sensor that detects the presence or absence of an object without physical contact, commonly used in automation and safety systems.
[112] An electrical device that opens or closes circuits electromechanically or electronically, commonly used for controlling a high-power circuit with a low-power signal.
[113] An electrically-controlled switch used for switching an electrical power circuit, similar to a relay but capable of handling higher currents, often used in industrial machinery.

switching circuits, see an average non-Chinese share of 55%, highlighting China's reliance on international technology for its CNC machine tool industry[114].

This critical dependence of the Chinese industry clearly shows that even the supply of Chinese machine tools to Russia, which has become the third-best option for Russian customers as access to Western CNC machines (first option) and Taiwanese and South Korean ones (second option) becomes increasingly difficult, still relies on Western technology.

The close integration of the Chinese industry with foreign components, technologies, and expertise makes machine tools produced in China and cooperation with the Chinese market a convenient platform Russia uses to maintain its access to critical industrial solutions.

An example of such attempts by the Russian Federation to use China as a source of Western technology is the Penza-based machine tools manufacturer Stankomashstroy. In August 2023, Russian media reported that Stankomashstroy planned to open a production facility for five-axis metalworking centres in China, investing RMB 50 million (about USD 7 million) in the project. The company in the Xiangyang high-tech zone would manufacture and develop CNC machine tools, only 30% of which would be sold in China. The remaining 70% was intended for export, mainly to Russia.

According to the industry publication Mashnews, which cites Russian experts in the metalworking equipment sector, the Chinese project of Stankomashstroy is unusual for the market[115]. Typically, a large manufacturer with significant competencies opens an enterprise abroad and, as a result, brings technology and production culture and trains local specialists. Yet, Stankomashstroy did not produce its five-axis machine tools and heavily used Japanese, German, French and Taiwanese components and software before the full-scale invasion, so it is difficult to assume that a Russian company will export technologies to China. Thus, Russian experts see Stankomashstroy's plans as attempts to facilitate access to Western technologies since even to build a plant in China, importing a significant amount of foreign equipment will be necessary.

An equally striking example of the Chinese CNC machine tool industry's dependence on Western components and Russian access to Chinese products with critical components from sanctions coalition members is Russia's largest exhibition of metal processing equipment, Metalloobrabotka (eng. Metalworking).

Before the full-scale invasion of Ukraine, Metalloobrabotka was dominated by Western companies, with only a few (up to five) Chinese participants[116]. In 2022, the number of Chinese exhibitors increased slightly to ten. However, a significant shift occurred in 2023, with 305 Chinese companies participating[117], and by 2024, this number skyrocketed to 648[118]. The analysis of customers' video reviews of the trade exhibition presented below demonstrates the perennial demand for Chinese CNC machines with Western technologies in Russia[119].

[114] https://bit.ly/3Y9iToM
[115] https://mashnews.ru/stankomashstrojnachnyot-vyipuskat-v-kitae-novyie-stanki.-v-rossii-on-ix-ne-delaet.html
[116] https://www.metobr-expo.ru/en/exhibition/exhibitors/
[117] https://www.metobr-expo.ru/common/img/uploaded/exhibitions/metalloobrabotka/docs/2023/metall23_catalogue.pdf
[118] https://dzen.ru/a/ZlOJOjBBSlv57peu
[119] For more detailed analysis of Metalloobrabotka 2023 and 2024 see Annexes VI, VII

The primary criterion for determining dependence on Western technologies in this study is the presence or absence of CNC control units manufactured in Western or Western-allied countries in Chinese machine tools exhibited at the Metalloobrabotka trade fair in 2023 and 2024. A CNC control unit is a machine's most essential and high-tech component. Its brain reads the CAD software programs and provides specific commands. Another reason for this choice of criteria for the study was that there are a minimal number of companies in the world capable of producing high-quality CNC control units, and all of them are based in states that are members of the sanctions coalition. The list of such companies includes Siemens (Germany), Fanuc (Japan), Mitsubishi Electric (Japan), Heidenhain (Germany), Bosch Rexroth (Japan), and Okuma (Japan).

In 2023, the CNC machines exhibited by Chinese companies at Metalloobrabotka were a mix of those with Chinese and Western controllers. According to video reviews, out of 12 machines presented by 11 Chinese producers, eight were equipped with the Western CNC controllers made by FANUC, Siemens and Bosch. Only four machines had Chinese controllers installed.

In 2024, despite an even more enormous surge in Chinese exhibitors, Chinese producers' usage of Western components was common, underscoring Russian limited interest in Chinese-based equipment. This year, 11 CNC machines (out of 12 machines exhibited) by 8 Chinese companies were equipped with Western controllers of the same brands (FANUC, Siemens, Bosch, Mitsubishi).

The above statistics and the example of the Metalloobrabotka trade fair prove that Russian access to machine tools with Western technology today highly depends on the cooperation of a minimal number of foreign companies with the Chinese CNC industry. This situation creates an important lever of influence that can be but is not fully utilised by the representatives of the sanctions coalition.

In addition to the lists of the largest suppliers of Western-made machines and exporters of Western-branded machines manufactured in China, which were described in detail in the previous sections, this paper also identifies the biggest suppliers of CNC machines to Russia in 2023, regardless of their jurisdiction.

The detailed trade records analysis shows that all the top 20 companies exporting CNC machinery to Russia are Chinese. Yet, the most interesting finding is that 16 of them not only supply machines but also produce them. This ratio again proves that Chinese companies have become the undisputed leaders in exporting CNC machines to Russia and suggests that Chinese industrial equipment manufacturers, unlike Western ones, continue to work directly with the Russian market without using intermediaries. However, the Russian Federation is not the only jurisdiction with which Chinese manufacturers maintain close relations. Out of 16 producers, at least 13 have confirmed connections with Western and Western-allied markets[120].

The most common types of ties that connect Chinese manufacturers with members of the sanctions coalition include a) R&D centres located in countries with significant expertise in CNC technology, b) imports of components made by Western brands, c) use of software from foreign developers, d) official partnerships with Western technology corporations, and e) subsidiaries registered in the countries of the sanctions coalition, which facilitates even greater access to Western technology.

[120] For more information concerning connections of Chinese CNC producers with the members of the sanctions coalitions see Annex V

For instance, Chinese machine tools producer Neway CNC Equipment imports advanced equipment from Germany, Spain, Italy, and Switzerland while having an R&D centre in Germany and a subsidiary in Houston, Texas[121]. Another Chinese brand owning a branch in the US is Jinan Senfeng Laser Technology Co. Ltd[122]. Apart from its presence in the American market, the company has a German R&D centre, official partnerships with Siemens (Germany), SMC Corporation (Japan), Schneider Electric (France), IPG Photonics (US), ABB (Switzerland), as well as imports components from THK (Japan), DELTA (Taiwan) and uses software by the Australian manufacturer of CNC grinding machines, motion controls and manufacturing solutions ANCA.

The top 5 countries leading in terms of ties with Chinese CNC manufacturers include Japan (ties with 12 Chinese brands), Germany (9 Chinese brands), Taiwan (7 Chinese brands), the United States (6 Chinese brands), and Switzerland (5 Chinese brands). Thus, the analysis in this report reflects the general trends in the CNC market, where all of the above countries, especially Japan and Germany, are leading the way, with the US also contributing to legitimising Chinese manufacturers and facilitating their access to Western technologies. Nevertheless, it should be noted that the identified Chinese manufacturers of CNC machines have ties not only to the top five countries but to all key members of the sanctions coalition.

Although all of the Chinese companies analysed in this section are among the largest suppliers of CNC machines to the Russian Federation, only three are under foreign sanctions. At the same time, the vast majority of the identified brands still have unimpeded access to Western technology and often even cooperate directly with foreign corporations through official partnerships.

This section provides a complete picture of Chinese CNC machine tools exported to Russia. While the previous two patterns described in the report are not new phenomena but long-standing trends that are scaling up in parallel with the increasing sanctions pressure and the depletion of Russian industrial capacity, the processes analysed in this section were not typical of the Russian Federation before the full-scale invasion. Under the influence of foreign restrictions, Russia and its military-industrial complex are increasingly switching to the use of Chinese-branded machines, which in turn are trying to occupy the free market. However, even in this scenario, Western companies and, accordingly, Western governments retain critical capabilities to influence Russian supply chains.

[121] https://www.machinetools.com/ru/brands/neway#:~:text=For%20machine%20process%20machining
[122] https://www.sfcnclaser.com/about-us.html

RECOMMENDATIONS

It is important to note that this report should not be viewed as a study of the Chinese industry or Chinese export activities. The main object of the analysis conducted by the Economic Security Council of Ukraine is the changes that Russian supply chains are undergoing under the influence of foreign restrictions.

The critical task of the Economic Security Council of Ukraine is to slow down the military machine of the state that is waging an aggressive war on our land. To this end, the ESCU team tries to thoroughly investigate the workarounds used by the aggressor to maintain its defence complex and provide it with advanced foreign technologies.

China has become the leading supplier and jurisdiction in the CNC machine tool sector through which most machine tools entering Russia and its military plants pass. The detailed analysis presented in this report repeatedly proves this.

However, China is not the only country helping the Russian Federation import foreign equipment. As this report shows, Turkey, South Korea, Taiwan, some members of the European Union, and Central Asian countries, although smaller than China, play a significant role in Russian supply chains.

In addition, while this study aims to analyse Russian access to foreign CNC machine tools in depth, it is worth noting that machine tools are one of the essential products, but not the only one, on which Russia's military-industrial expansion is based.

Given all of the above, all of the challenges of the sanctions regime described below, as well as the recommendations proposed by the Economic Security Council of Ukraine, although based on the analysis of Sino-Russian trade relations in the CNC sector, are more universal in nature and apply to most foreign goods to which Russia still has access.

Finally, the changes in Russia's supply chains that are currently evident, namely the significant rapprochement between China and Russia and their transformation into mutually reinforcing and rescuing partners, suggest that the task facing Ukraine and its partners, namely maintaining global security and countering current and potential aggression, is becoming increasingly complex and requires decisive, creative and large-scale solutions. The points below provide several recommendations and a particular vision of such solutions.

1. Transforming ad hoc sanctions against violators and facilitators into a full-fledged and decisive counteraction to Sino-Russian trade networks to achieve real disruption

As this report's detailed analysis shows, the restrictions imposed by the members of the sanctions coalition have not kept pace with the expansion of the network of suppliers and importers that support Russia's access to critical foreign equipment.

Most Chinese legal entities most actively exporting CNC machines to the aggressor state are not on the sanctions lists, even though a significant share of their trade activity occurred in 2023. Moreover, in some cases, Chinese industrial equipment suppliers have apparent red flags indicating their direct ties to the Russian Federation or their fictitious status.

An equally large number of Russian companies importing industrial equipment from China have not yet been subjected to restrictions by the sanctions coalition. Numerous Russian "civilian" enterprises that have been serving the Russian defence industry for years, including manufacturers of lethal weapons used against the Ukrainian civilian population, remain undesignated.

In addition, as of August 2024, only a few Chinese CNC machine tool manufacturers, among Russia's most significant equipment suppliers, were sanctioned by at least one member of the sanctions coalition. This gap in the international sanctions regime allows Chinese brands to own subsidiaries in the US, EU, or Japan on the one hand and supply critical equipment to a country waging an aggressive war directly without using intermediaries on the other.

Moreover, two and a half years after the start of the Russian full-scale invasion of Ukraine, the Russian military-industrial complex is still not sanctioned comprehensively. Many Russian enterprises involved in producing weapons, which are the end users of foreign high-precision equipment, are not included in any sanctions lists. This, in turn, restrains the large-scale application of secondary sanctions against companies that indirectly support the Russian military-industrial complex. When foreign authorities focus primarily on cooperation with already sanctioned Russian enterprises as a primary criterion for the designation of intermediaries that facilitate sanctions evasion, the first step should be to thoroughly sanction the Russian defence industry, which includes about 6,000 manufacturers and another 10,000 affiliated companies. Without such a first step, the enforcement of existing sanctions cannot be comprehensive, as “civilian” entities servicing and supplying a non-designated Russian enterprise involved in defence production may be left out of the authorities' attention or given a lower priority.

Western partners' sanctions against the Russian military-industrial complex and trade networks should become more extensive and decisive. Only the simultaneous blocking of all critical suppliers involved in the export and import of CNC machines over a certain period can temporarily disrupt Russian logistics networks and force the aggressor to pay an additional price for their restructuring. With 5 to 15 suppliers included in a single sanctions package, the Russian Federation is gradually and much more easily rebuilding its supply chains without incurring significant losses.

Finally, including an actual number of Chinese suppliers, Russian importers, and end users of foreign CNC machines in the sanctions lists will significantly facilitate the private sector's compliance with the sanctions legislation, including Western manufacturers and financial institutions.

2. Harmonizing export control provisions and trade bans in the CNC technology sector at the level of all members of the sanctions coalition

Despite all the decisions taken by the members of the sanctions coalition to restrict the Russian Federation's access to foreign CNC machines, the scope and comprehensiveness of the restrictions imposed by different countries still vary significantly.

For example, while the European Union and the United Kingdom have imposed total bans on the export and re-export of CNC technology and related components to Russia, Taiwanese authorities have a more lenient approach to the supply of CNC machines. Even with the new restrictions introduced in 2024, Taiwan has roughly covered only 60% of the CNC-related goods critical to the Russian Federation (48 HS codes, or 35% of CNC-related codes, are missing). This approach

difference explains why Taiwanese manufacturers continue cooperating directly with the Russian market while Taiwanese equipment replaces European products for Russia.

Similar trade bans and export control regime gaps still apply to Japan and South Korea. The lists of goods prohibited for delivery to the Russian Federation in both countries lack about 11 and 50 HS codes, respectively. Moreover, neither Japan nor South Korea has introduced a ban on re-exporting CNC technology to Russia (the so-called 'No Russia' clause), weakening the counteraction to Russian access to high-precision industrial equipment.

In turn, the primary tool for coordinating enforcement efforts among the sanctions coalition members, the Common High Priority Items List, currently includes only six HS codes related to the CNC sector. The HS codes included in the list are 6-digit, meaning they cover an even narrower range of goods and technologies.

As in most industrial sectors, the leading manufacturers of CNC machines and their components originate from different countries, making it challenging to control supplies. However, the number of such countries is quite limited, which is a unique feature of the CNC market. Thus, effective coordination between the major producing countries and harmonisation of export restrictions could make it much more difficult for Russia to access vital industrial equipment. Currently, national legislation of individual members of the sanctions coalition and collective instruments (CHPIL) do not comprehensively cover all types of equipment imported by Russia. Moreover, Western partners must focus not only on exporting and re-exporting finished machine tools but also shift their attention to a wide range of components critical to machinery production or their repair, upgrade, and technical support.

3. Improving counteraction to the re-export of CNC machines and their components to Russia by financial institutions

At the end of 2023, the United States adopted Executive Order 14114, which prohibited any foreign financial institution from directly or indirectly supporting significant transactions related to the transfer to Russia of specific critical goods, including CNC machines, regardless of origin[123]. The E.O. became a game changer and had a severe negative impact on Russia's access to industrial equipment. Moreover, the Executive Order has created an adequate legal framework that allows blocking the supply of critical products to Russia through strict banking compliance.

However, the current list of goods and technologies covered by Executive Order 14114 includes only five categories related to the CNC sector: numerically controlled (CNC) machine tools, additive manufacturing (AM) machine tools, semiconductor manufacturing equipment and specific bearings. This list should be expanded to include a much more comprehensive range of products. As with the previous point regarding trade restrictions and export controls, the US government should pay more attention to critical components used to manufacture and maintain CNC machines, not just finished equipment.

Moreover, the existing and new categories should be clarified and specified significantly by developing detailed guidelines for financial institutions. The definition of numerically controlled

[123] https://ofac.treasury.gov/media/932436/download?inline
https://home.treasury.gov/news/press-releases/jy2011

(CNC) machine tools is rarely used in trade documentation and business agreements. Instead, the materials available to financial institutions may use dozens of names that refer to specific types of machines and their specific operation. The whole sector of CNC technology includes more than 100 HS codes. That is why better guidance and detailing of the provisions by the US government and other governments (since the requirements of E.O. 14114 apply to foreign financial institutions) can significantly facilitate compliance and thus improve the effectiveness of this critical and impactful instrument.

Equally crucial for the effective implementation of the provisions of E.O. 14114 is the timely inclusion in the sanctions lists of foreign suppliers and Russian importers of CNC machines involved in the supply chains of the aggressor state's military-industrial complex. A legal entity's sanctioned status is one of the primary red flags that financial institutions' automated due diligence system considers.

4. Taking decisive measures to urgently improve sanctions compliance and due diligence by Western, Western-allied and Chinese manufacturers

Although this study focuses on Sino-Russian trade cooperation, each dimension of Chinese CNC machine exports to Russia described above contains some contribution from Western manufacturers. More precisely, a certain amount of negligence and lack of effort on the part of Western businesses, which unfortunately facilitates Russian access to equipment massively used in weapons production.

When it comes to Russia's imports of machinery produced in the territory of the sanctions coalition through a network of Chinese distributors and front companies, it is worth focusing not only on the measures taken by Moscow and Beijing but also on the actions that can be taken by Western manufacturers whose products end up in military plants. CNC machine tool producers could do much more to control the re-export of their equipment, including using GPS trackers and remote monitoring systems that would allow them to more effectively track the machine's path and remotely block it in case it falls into the wrong hands. Such steps also include regular visits to customers' enterprises, photo and video inspections, and requests for blueprints of parts to be produced on imported equipment.

At the very least, manufacturers could independently conduct and publish (or at least submit to the authorities) investigations similar to the one presented in this report. The team of the Economic Security Council of Ukraine, like most civil society organisations investigating Russian supply chains, works solely with open data. On the other hand, manufacturers have access to much larger and more valuable information.

Individual producers have already taken some of the steps described above[124] or have expressed such intentions[125]. However, proper monitoring of distribution networks using new, up-to-date solutions has not yet become a trend in the CNC market.

When machines manufactured at Chinese factories of Western companies end up in Russia, the contribution or inaction of foreign businesses becomes even more pronounced. Parent companies

[124] https://www.ft.com/content/c47296e8-662a-4f21-bf1b-226b238717e7
[125] https://english.cw.com.tw/article/article.action?id=3619

from the United States, Germany, Japan, Taiwan, and other countries that manufacture CNC machines need to take much greater responsibility for the activities of their subsidiaries abroad. Without such thorough and responsible monitoring, it would be easy for Chinese distributors to purchase Western-quality equipment in their domestic market and supply it to Russia.

Equally important is the contribution of Western manufacturers and leading technology corporations to developing the Chinese CNC industry. As the analysis in the previous sections shows, Chinese manufacturers of high-precision industrial equipment that actively supply their products to Russia are critically dependent on access to foreign expertise, components, and software. Such access is obtained not through industrial espionage but via official partnerships with Western corporations and R&D centres in the countries of the sanctions coalition. Western manufacturers need to tighten control over supplies to China to check their Chinese customers for ties to the Russian Federation and take more interest in where their CNC control unit, bearing, fibre laser, or software will go and as part of what end product.

As Russia's supply chains become more complex and sophisticated, the issue of effective and thorough corporate compliance and due diligence is becoming increasingly critical to limiting Russia's military capabilities, as the private sector often has more tools, better access to information, and significantly greater technological and industry expertise to monitor and trace supply chains than the civil society or enforcement agencies.

The members of the sanctions coalition have already begun to engage more actively with the private sector in this context, using incentives and guidance, expanding the range of obligations, and raising the level of responsibility for violations. However, the main breakthroughs in this area relate to the financial sector, not to producers of dual-use goods.

Once again, Executive Order 14114, mentioned repeatedly in this report, is the best illustration of this thesis. The new legal framework, which partially delegated enforcement to the private sector and compelled financial institutions to monitor transactions related to the Russian military-industrial complex independently and, most importantly, stop such transactions (and thus physical deliveries), has dramatically disrupted the Russian supply chains.

Nevertheless, comprehensive and effective enforcement requires the involvement of all stakeholders who have a decisive influence on the goods and technology flows. In addition to government authorities and financial institutions, these stakeholders include manufacturers who produce dual-use goods for the global market. The unevenness of obligations, proactivity, control, and level of responsibility between the financial and manufacturing sectors may undermine the effectiveness of the instruments laid down in Executive Order 14114 and similar decisions.

Already today, one can see that while Chinese banks are actively (and often proactively) responding to the introduction of E.O. 14114 by improving their due diligence systems and blocking transactions related to the export of machine tools to Russia[126], Chinese industrial equipment manufacturers are trying to occupy a free niche in the Russian market, looking for ways to circumvent the tight banking

[126] https://x.com/Segozavr/status/1763270921844875775

controls. Methods for such evasion may include opening accounts in regional banks on the border with the Russian Federation[127], using cryptocurrency to pay for supplies[128], and barter trade[129].

At the same time, Western producers and suppliers of advanced technologies lack control, due diligence, and often outright negligence, which makes the above task much more accessible for Chinese manufacturers and distributors.

Given all the above, the critical task of the members of the sanctions coalition currently consists of two interrelated elements:

a. To **encourage** Western manufacturers of CNC machines and related components for their production and technical support to closely monitor the export of their products to China (and other jurisdictions involved in the sanctions evasion) and prevent their equipment from being supplied not only directly to Russia but also to irresponsible Chinese manufacturers, taking all necessary measures, including controlling the activities of their subsidiaries in the PRC.

b. To **discourage** Chinese manufacturers of CNC technology from cooperating with the Russian market in any available form, directly or indirectly (for example, through Central Asian countries).

Such results can only be achieved if both Western and Chinese manufacturers feel a significant risk of being among the violators, who will threaten them not with material or financial losses but with the termination of business activities.

While in the case of financial institutions, such a threat, after the introduction of E.O. 14114, is the risk of blocking correspondent accounts in the United States – a punishment comparable to death for a bank that conducts international activities – the situation about manufacturers is primarily about the interdependence of industries in different countries.

As clearly shown in this study, Chinese CNC manufacturing relies heavily on the supply of European components, cooperation with Japanese R&D centers, the presence of branches in the United States, etc. In turn, Japanese, Taiwanese, and German manufacturers of CNC control units may depend on each other, as well as the use of Swiss semiconductors, attraction of foreign investments, and contracts with the US government. The latter is evidenced by the fact that German Siemens[130] and Japanese FANUC[131], which are relative monopolists in the CNC controllers market, are actively involved in US government procurement while continuing to cooperate with irresponsible Chinese manufacturers.

Therefore, in a scenario where Western manufacturers feel a real threat to their business activities and begin scrutinizing Chinese customers and stopping cooperating with irresponsible ones, Chinese

[127] https://youtu.be/KAjCVBnA1PA?t=89
[128] https://www.cnbc.com/2024/07/30/russia-considers-legalizing-crypto-as-a-form-of-payment-amid-sanctions.html
[129] https://www.reuters.com/markets/first-russia-china-barter-trade-may-come-this-autumn-sources-say-2024-08-08/
[130]https://fpds.gov/ezsearch/fpdsportal?q=Siemens&s=FPDS.GOV&templateName=1.5.3&indexName=awardfull&x=0&y=0&sortBy=SIGNED_DATE&desc=Y
[131] https://fpds.gov/ezsearch/search.do?indexName=awardfull&templateName=1.5.3&s=FPDS.GOV&q=fanuc

companies' behavior may change as they prioritize maintaining access to global markets over maintaining the industrial potential of the Russian Federation.

Some members of the sanctions coalition already have tools that allow them to implement such a scenario. One of the most effective, at least on paper, is the so-called Foreign Direct Product Rules (FDPR) in the United States[132]. Under the US Export Administration Regulations (EAR)[133], FDPR extends American export control jurisdiction to certain foreign-made goods that are the direct product of US technology or software. This rule is intended to prevent foreign companies from using US technology to create products outside the United States and then export those products to countries or entities subject to sanctions or other restrictions.

Despite the significant level of extraterritoriality and potential impact, the FDPR contains several gaps and loopholes, which, as already researched by representatives of the Kyiv School of Economics[134], may reduce its effectiveness. Such shortcomings include a) significant dependence on the use of American technologies, components or software in the production of the final foreign product (in turn, E.O. 14114 covers transactions in any world currency, not only in dollars), b) a mandatory requirement that both the American technology involved in the production of the final product and the final product of foreign origin itself must belong to the list of goods controlled under the EAR (the provisions of the EAR relating to the CNC technologies remain imperfect, including a limited amount of equipment and components imported by the Russian Federation), c) weak or completely absent provisions regarding the responsibility of foreign parent companies for the activities (in particular, violations) of their own subsidiaries, d) a low level and too narrow a range of penalties that await violators (mainly fines and cancellation of export privileges), e) numerous exemptions for partner countries, which automatically exempt Japanese, German, South Korean, British, Swedish, Australian, French, and Italian companies mentioned in this report from the FDPR.

Another essential tool under the US EAR that interacts with the FDPR is the so-called De Minimis Rule, which extends the provisions of American export control to foreign goods containing a particular share of American technology. The main drawback of the De Minimis Rule is that for most products exported and re-exported to Russia, such a share of American technology must exceed 25%, which is too high a threshold for a country waging an aggressive war. For example, in its January report, the Kyiv School of Economics recommended[135] reducing the threshold to 0%, similar to the existing restrictions on supplying lithography equipment to China. In addition, the De Minimis Rule shares weaknesses identical to the FDPR, namely too much reliance on the non-exhaustive EAR list of goods and a similarly insufficient level of penalties.

The 14th package of EU sanctions, adopted in June this year, was a massive step toward involving manufacturers in effectively enforcing trade restrictions, export control provisions, and individual designations. In it, member states significantly improved the framework of requirements for sanctions compliance and due diligence of European companies.

For the first time, provisions of the 14 package introduced at least partial liability of parent companies registered in the EU for the activities of their subsidiaries in third jurisdictions. The package also enshrined the concepts of mandatory sanctions compliance and due diligence. Starting

[132] https://www.reuters.com/technology/what-is-fdpr-why-is-us-using-it-cripple-chinas-tech-sector-2022-10-07/
[133] https://www.bis.gov/regulations
[134] https://kse.ua/wp-content/uploads/2024/01/Challenges-of-Export-Controls-Enforcement.pdf
[135] https://kse.ua/wp-content/uploads/2024/01/Challenges-of-Export-Controls-Enforcement.pdf

in June, European companies whose goods enter Russia without their knowledge will not be exempt from liability for violating sanctions if they have not avoided such re-exports. Moreover, European parent companies must ensure that their subsidiaries take similar measures.

At the same time, the final version of the provisions included in the new EU sanctions package is much weaker compared to the initial proposals of the European Commission and individual member states. For example, the liability of parent companies for violations of their subsidiaries is limited by the laws of third countries and the businesses' capabilities. Moreover, subsidiaries will not be obliged to add a provision to their contracts with customers prohibiting the re-export of products to Russia (the so-called "No Russia" clause), which automatically undermines all of the above innovations. The mandatory due diligence that European companies must conduct is not standardised and is sometimes described as "simple checks." Similarly to the US law, the obligations imposed by the European Union apply to a limited number of goods, which in particular do not include all types of CNC machines and related components, the export and re-export of which to Russia was banned in the 12th sanctions package. The new European sanctions lack extraterritoriality, a long-term challenge for the EU. However, the European market is critical for Japanese, Taiwanese, South Korean, and Chinese businesses. Most importantly, the text of the 14th package is unclear about the level of responsibility for violating the new rules, which, as explained above, is a critical factor that affects the behavior of the private sector.

One more important tool that allows blocking irresponsible producers from accessing Western markets is Executive Order 14105, signed by President Biden on August 9, 2023[136]. The E.O. directs the Secretary of the Treasury to establish a program that prohibits or requires notification of investments in advanced technology sectors critical to national security. These prohibitions and notification requirements would apply to transactions with a Covered Foreign Person engaged in certain specified activities. A “covered foreign person” includes a person from a country of concern (the only such country is currently China, including Hong Kong and Macau). Now, “covered activities” are limited to three technology areas: semiconductors and microelectronics, quantum information technologies, and AI systems.

Thus, although Executive Order 14105 has considerable potential, without expanding the list of so-called "countries of concern" and "covered activities," it is currently unable to influence the behavior of Chinese manufacturers of CNC machines supplying equipment to Russia, nor the inaction of Western corporations that continue to cooperate with such Chinese brands.
The above description of available tools and solutions is not only intended to demonstrate the existing shortcomings and gaps that should be addressed by the respective governments but is primarily designed to show how much scope there still is for the sanctions coalition to block Russia's access to critical industrial equipment and other dual-use goods.

This report names and provides at least partial data on several dozen Chinese and foreign brands directly or indirectly involved in Russian supply chains. Consistent and decisive dialogue with these brands and the actual use of the abovementioned tools can significantly disrupt Russian import networks that have not yet fully recovered from the new financial sanctions imposed last year.

[136] https://www.federalregister.gov/documents/2023/08/11/2023-17449/addressing-united-states-investments-in-certain-national-security-technologies-and-products-in

At the same time, in parallel with the use of existing instruments in their current form, foreign authorities need to close the gaps described above. This can be done by making ad hoc changes to each instrument or by collecting all the necessary provisions in one new legal framework, which will become an analogue of Executive Order 14114, dedicated not to the financial sector but to producers of dual-use goods. It is essential for such a new legal framework to be based on principles that correspond to the level of threats posed by Russian aggression to global security and to:

a. Provide for mandatory sanctions compliance and due diligence, as well as high requirements for manufacturers and significant liability risks for negligence.
b. Apply not only to finished machine tools (or other dual-use finished goods) but also to components that could be transported to Russia as part of finished goods.
c. Cover not only goods produced with the use of American or European technologies but also any items of foreign origin that are critical to maintaining the military potential of the Russian Federation (similar to EO 14114, which covers all transactions in any currency as well as all designated technologies and components regardless of their origin).
d. Enshrine a critically high level of punishment for violations, which will threaten the violator (regardless of its geographical and legal location) with the termination of business activities as a result of total blocking of access to the American and European markets, which in turn should combine the tools and levers of all relevant authorities (for example, the Department of Commerce, Department of the Treasury, State Department, etc. in the United States) and may include but not be limited to the following measures:

    - ban on imports of American and European components;
    - prohibition of cooperation with the US and EU in the field of R&D, engineering and intellectual property rights;
    - ban on the use of American and European software;
    - ban on the use of consulting services provided by US and European companies;
    - freezing of assets and blocking access to the banking system;
    - prohibition of participation in public procurement and termination of current contracts with government agencies;
    - prohibition of doing business in the United States and the EU;
    - closure of business visas for top managers of companies violating the provisions;
    - cancellation of export licenses, exceptions and privileges.

ANNEXES

Annex I: Biggest Chinese suppliers of CNC machinery to Russia (2023, Q1 2024)

Supplier Name[137]	Total Import Volume *(2023, Q1 2024)*[138]	Country of Origin[139]	Sanctions	Russian counterparts connected to MIC[140] [141]
Ele Technology Co. LTD[142]	USD 82 273 962,23	Japan, Taiwan	N/A	Company AMG LLC
Hainan Foreseer Trading Co. LTD[143]	USD 6 170 456,60	Japan	N/A	N/A
Songwei CNC Machinery Co. LTD[144]	USD 810 250,10	Japan	N/A	VARUS LLC
Agu Information Technology Co. LTD[145]	USD 230 844 080,18	USA, Taiwan	EU[146]	N/A
Semicor Shanghai Eastern Machinery Industrial Corporation LTD[147]	USD 28 567 402	USA	N/A	N/A
Hefei Biopin Import & Export Trading Co. LTD[148]	USD 57 391 307,66	USA	N/A	N/A
Yinuo Supply Chain Management Co. LTD[149]	USD 4 204 595,28	USA	N/A	Energy Industries LLC
Afox Corporation LTD[150]	USD 217 659 308,93	Taiwan	EU[151]	New IT Project LLC
Guangzhou White Sun Intermodal LTD[152]	USD 4 580 670,14	Taiwan	N/A	LLC Periton Engineering
Silver Technology LTD[153]	USD 42 949 887,10	South Korea	US (OFAC)[154]	SFT LLC MMT LLC SFT Asia LLC
Time Art International LTD[155]	USD	South Korea	N/A	N/A

[137] Information about Chinese suppliers is based on corporate records provided by the Center for Advanced Defense Studies (C4ADS)
[138] Trade records
[139] Trade records
[140] Trade records
[141] For more detailed information concerning Russian importers see Annex Y
[142] Social Credit Code: 914403000775394696; Address: Number 3018, Shennan Avenue, Huahang Community, Huaqiangbei Street, Futian, Shenzhen, Guangdong, PRC; Owners: Liu Limin (50%), Zeng Yuanchao (50%); Legal representative: Zeng Yuanchao; Establishment date: 21.08.2013
[143] Address: 570110, Hainan Province, Yangpu Economic Development Zone, East Area, Government Service Center; Director: Sun Jian
[144] Flr 2 , Bld 19, No. 199 Guangfulin East Road, Songjiang Dist, 201613 , Shanghai, China; Global Sales Executive: Ray Zhao; Establishment year: 2017
[145] Address: Unit 22, 2/F, Foo To Building, 98 Argyle Street, Mongkok, Kowloon, Hong Kong; Establishment date: April 2022
[146] https://shorturl.at/1PI5i
[147] Address: Pilot Free Trade Zone, Shanghai, Room 1125, No. 35, Rijing Road
[148] Address: 5th Floor, Block S2, Evergrand Crystal International Plaza, Longchuan Rd, Baohe District, Hefei,Anhui Province, China 231500; DIrector: Nickyro Wang; Establishment year: 2018
[149] Addresses: Zhejiang Province, Yiwu City, Jinhua City, Suxin OR Flat 1512, 15/F, Lucky Centre, No.165-171 Wan Chai Road, Wan Chai, Hong Kong; Establishment date: 17.08.2022
[150] Address: NT, Ma On Shan, Wu Kai Sha Village, 2f, No.13, Lane 5; Establishment year: 2008
[151] https://shorturl.at/AVSc7
[152] Address: #1707C, Tower C, Poly World Trade Building, No. 1000, Xingang East Road, Haizhu District, Guangzhou, 520308, China; Director: Marina Shaydarova
[153] TIN: 2396095; Address: Room 2708, Asia Trade Center, No. 79 Lei Muk Road, Kwai Chung, New Territories, Hong Kong; Establishment date: 28.06.2016
[154] https://shorturl.at/7ARyX
[155] Addresses: New Territories, Hong Kong, 10-14 Kwei Tei Stree OR Guangdong province, Shenzhen City, Futian District, Yi Tian Road No. 3013, South International Plaza, Building A, Office 1917, China

	127 726 548,43			
Jos Systems LTD[156]	USD 472 863	South Korea	N/A	N/A
Hangzhou Zezheng Machinery Co. LTD[157]	USD 713 239,96	South Korea	N/A	Osnastik LLC
Huizhou Oleading Technology Co. LTD[158]	USD 979 733,15	United Kingdom	N/A	DATAPRINT LLC
Shenzhen Blue Hat International Trade Co. LTD[159]	USD 39 606 606,65	United Kingdom	N/A	N/A
China US Joint Enterprise Qingdao Leader Metrology Instruments Co. LTD[160]	USD 2 501 246,69	United Kingdom	N/A	NORGAU RUSSLAND LLC
Xi An Lead Metrology Co. LTD[161]	USD 978 479,93	United Kingdom	N/A	N/A
Bomesc Offshore Engineering Company LTD[162]	USD 12 786 724,48	Switzerland	N/A	ARCTIC LNG 2 LLC
Z Tech Wuxi Precision Machinery Co. LTD[163]	USD 1 234 441,50	Switzerland	N/A	PROMINTECH LLC OTS TECHNOLOGIES LLC
Guangzhou Tofee Electro Mechanical Equipment Co. LTD[164]	USD 4 784 372,21	Switzerland	N/A	VEZA LLC
J Parker Combustion Equipment Jiangsu Co. LTD[165]	USD 38 636,15	Switzerland	N/A	N/A
Tianjin Xishanfusheng International Trading Co. LTD[166]	USD 5 676 586,59	Czech Republic	N/A	Inpromservice LLC NPP Tik LLC
Transyn Scientific LTD[167]	USD 5 722 686,49	Czech Republic	N/A	RIITEK LLC
Qingdao Newland Trading Co. LTD[168]	USD 3 569 643,13	Czech Republic	N/A	Innovative Automation Systems LLC
Nuo Si Machinery Qinhuang Dao Co. LTD[169]	USD 1 314 264,07	Austria	N/A	N/A

[156] Company Registration No.1946565; Establishment date: 01.08.2013
[157] Social Credit Code: 9133010966801818XN; Address: Unit 2, Building 16, Number 489, Hongtai 6th Road, Xiaoshanqu Economic Development Zone, Xiaoshan District, Hangzhou, Zhejiang, PRC; Owners: Wu Yukui (70%), Zhao Xiaohong (30%); Executive board member: Zhao Xiaohong (supervisor); Establishment date: 07.11.2007
[158] Address: China Guangdong, 1005, 10th Floor, Zhongzhihui Bldg., Donghua Road, Huizhou, Guangdong, China; CEO: Fancy Mo; Establishment year: 2017
[159] Address: 504, No.3, Xitou Industrial Zone, Shangfen Community, Minzhi Street, Longhua District, Shenzhen; Elena (Sharikova) Malitckaia (Head of the maternal company Blue Hat LTD); Establishment year: Probably, 2017
[160] Social Credit Code: 91370214794016177Q; Address: No.8 Changbaishan Rd, Qingdao International Airport Industry Park, Qingdao City, Shandong Province, P.R.China; Executive board members (directors): Hao Zhenfang, Pang Zengjiang, Zheng Quanan; Owners: Wang Tongqi (41,30%), Pang Zengjiang (33,80%), Zheng Quanan (25,00%); Establishment date: 28.11.2006
[161] Social Credit Code: 91610131766981455T; Address: Building 18, Science and Technology Enterprise Accelerator, No. 2 Qinling Avenue, Caotang Science and Technology Industry Base, High-tech Zone, Xi'an; Owners: Tang Xiaoan (63,30%), Fan Junlian (27,80%), Li Yong (3,70%), Hao Guojie (3,20%), Wang Jinhu (2%); Executive board members: Huo Xiaowei (Chief of Finance), Fan Junlian (Supervisor); Establishment date: 06.04.2005
[162] Address: No.14, the 4th Ave, TEDA, Tianjin, China; Chairman: Wen Cheng Peng; Establishment year: 1996
[163] Address: 105-2, Furong Middle Third Road, Xishan Economic and Technological Development Zone, Wuxi, China; Establishment year: 2011
[164] Address: #5 Bldg, 3rd Alley 3rd Corner, Yunxing Village, Dabei Rd., Panyu District, Guangzhou, China; General manager: Alex Lee (Li Xiongfeng); Establishment year: 2008
[165] Social Credit Code: 91320903MA1MEX9G34; Address: 1FD, Floor 06, Park Donggaochuang, Nan,Jing 4th Road, Wei 5th Road, Yanlong Subdistrict Office, Yanduqu, Yancheng, Jiangsu, PRC; Owners: Chen Yunlong (50%), Xu Huili (25%), Jin Yuming (25%); Executive Director: Chen Yunlong; Establishment date: 27.01.2016
[166] Address: 300350, Jinnan District, Tianjin, Xianshuigu Town
[167] Company number: 2818207: Address: Chai Wan, Hong Kong, Room 1607, Trend Centre, 29
[168] Address: Baoying Road .Shibei District .Qingdao,China; Establishment year: Probably, 2016
[169] Address: Economic & Technological Development Zone, Qinhu

Shenzhen Biguang Trading Co. LTD[170]	USD 3 944 866,08	Austria	US (OFAC)[171] EU[172] Switzerland[173]	ALLIANCE PRAVO LLC
Shanghai Increase Way Investment & Management Co. LTD[174]	USD 1 837 338,12	Austria	N/A	N/A
Arclm International[175]	USD 6 913 124,29	Austria	N/A	Company ETL LLC
Global MGM LTD[176]	USD 10 903 937,11	Germany	N/A	Engineering Center for Production Equipment LLC
Shanghai Forus Metal Material Co. LTD[177]	USD 6 620 257,52	Germany	N/A	N/A
Most Development LTD[178]	USD 27 410 018,08	Germany	US (BIS)[179] EU[180]	Firm Permanent K&M JSC
Scorpion S Holding Group LTD[181]	USD 5 175 161,21	Germany	N/A	IT TECHNOLOGIEN LLC
Jingbao International Co. LTD[182]	USD 9 203 593,19	Italy	N/A	Micro Terra LLC
China National Chemical Engineering and Construction Corporation Seven LTD[183]	USD 37 739 186,80	Italy	N/A	N/A
Uni Shipping LTD[184]	USD 4 379 335,08	Italy	N/A	N/A
Delta Equipment LTD[185]	USD 13 532 609,60	Italy	N/A	N/A

[170] Registration number: UHR7KDW7CQN1; Address: Guangdong, Shenzhen, 18e, Block B, World Trade S; Establishment year: 2020
[171] https://shorturl.at/JTMTw
[172] https://shorturl.at/nF9l3
[173] https://shorturl.at/aVt3D
[174] 200001, Huangpu District, Shanghai, Unit 2506, 220; Director: Yang Huishuo; Establishment year: 25.06.2007
[175] Address: Rm 1607 Trend Ctr 29-31 Cheung Lee ST Chai Wan, Hong Kong; Establishment date: 26.05.2020
[176] Address: 510095, Guangzhou, Yuexiu District,, Room 3318, No.
[177] Address: Office 1404, 1101 Pudong South Road, Pudong New
[178] Registration number: 2694980 (CR No.); Address: 2–16 Fayuen Street, Office 4, 16/F, Ho King Commercial Center, Hong Kong; 9 Yin Chong Street, 21F, Room 01, Prosper Commercial Building, Hong Kong; Owner and director: Yan Hong; Establishment date: 15.05.2018
[179] https://shorturl.at/FQFlp
[180] https://shorturl.at/W1VfV
[181] Address: 11/F, Capital Centre, 151, Gloucester RD, Wanchai, HK; Establishment year: 2011
[182] Address: Room 803, Easey Commercial Building,253-261, Hennessy Road, HK; Establishment year: 2014
[183] Address: 199 Longdu Southern Road Longquanyi District Chengdu, 610100 China; General Manager: Long Haiyang; Establishment date: 31.10.1964
[184] Address: Hongkong, Flat/Rm 2 ,18/F, Shatin Galleria, No.18 Shan Mei Street, Shatin; Establishment date: 05.01.2009
[185] Addresses: Hong Kong, Causeway Bay, Leighton Road, Leighton OR UNIT 1502, 15/F, CHEVALIER COMMERCIAL CENTRE, 8 WANG HOI ROAD, KLN, HONG KONG; Establishment date: 13.07.2012

Annex II: Biggest Russian importers of CNC machinery (2023, Q1 2024)

Importer name	Total Import Volume (2023, Q1 2023)[186]	Sanctions	Chinese Counterparts[187]
ALLIANCE PRAVO LLC[188]	USD 136 596,54	N/A	Shenzhen Biguang Trading Co. Ltd
ARCTIC LNG 2 LLC[189]	USD 2 512 562,68	US (OFAC)[190] UK[191]	Bomesc Offshore Engineering Company LTD
Ball Beverage Packing LLC Naro Fominsk[192]	USD 6 585 810,20	N/A	Hefei Biopin Import & Export Trading Co. LTD
LLC Company AMG[193]	USD 94 304 226,48	US (OFAC)[194] UK[195]	Ele Technology Co. LTD
Company ETL LLC[196]	USD 722,1	N/A	Arclm International
DATAPRINT LLC[197]	USD 631 435,61	N/A	Huizhou Oleading Technology Co. LTD
Energy Industries LLC[198]	USD 2 012 700	N/A	Yinuo Supply Chain Management Co. LTD
Engineering Center for Production Equipment LLC[199]	USD 8 702 540,82	N/A	Global MGM LTD
Firm Permanent K&M JSC[200]	USD 843 974,96	N/A	Most Development LTD
FOREL LLC[201]	USD 11 593 233,40	N/A	Delta Equipment LTD
Grintech Energy LLC[202]	USD 928 135,48	N/A	Nuo Si Machinery Qinhuang Dao Co. LTD
IIS LLC[203]	USD 21 669,40	N/A	Xi An Lead Metrology Co. LTD
Innovative Automation Systems LLC[204]	USD 12 424,10	N/A	Qingdao Newland Trading Co. LTD
Inpromservice LLC[205]	USD 8 247 014,21	N/A	Tianjin Xishanfusheng International Trading Co. LTD
International Engineering Company LLC [206]	USD 27 750 900	N/A	Semicor Shanghai Eastern Machinery Industrial Corporation LTD
IT TECHNOLOGIEN LLC[207]	USD 779 025,32	N/A	Scorpion S Holding Group Ltd

[186] Trade records
[187] Trade records
[188] ru. ООО "АЛЬЯНС "ПРАВО"; TIN: 7806415758
[189] ru. ООО "АРКТИК СПГ 2"; TIN: 8904075357
[190] https://shorturl.at/WiciX
[191] https://docs.fcdo.gov.uk/docs/UK-Sanctions-List.html
[192] ru. ООО "АУР НАРО-ФОМИНСК"; TIN: 5030041780
[193] ru. ООО "Компания "АМГ"; TIN: 7720821959
[194] https://shorturl.at/npmep
[195] https://docs.fcdo.gov.uk/docs/UK-Sanctions-List.html
[196] ru. ООО "КОМПАНИЯ Е.Т.Л."; TIN: 5045022980
[197] ru. ООО "ДАТАПРИНТ"; TIN: 7722804772
[198] ru. ООО "ЭНЕРДЖИ ИНДАСТРИЗ"; TIN: 7701374173
[199] ru. ООО "Инжиниринговый центр по оснащению производств"; TIN: 7814766333
[200] ru. АО "ФИРМА "ПЕРМАНЕНТ К&М"; TIN: 7735001719
[201] ru. ООО "ФОРЕЛ"; TIN: 5003107897
[202] ru. ООО "Гринтех Энерджи"; TIN: 7714827952
[203] ru. ООО "ИИС"; TIN: 5001091708
[204] ru. ООО "ИННОСИСТЕМС"; TIN: 7714457081
[205] ru. ООО "Инпромсервис"; TIN: 7725702377
[206] ru. ООО "МИК"; TIN: 4501232320
[207] ru. ООО "ИТ ТЕХНОЛОГИЕН"; TIN: 5040073491

JSC Kaliningrad Container Factory[208]	USD 2 375 793	N/A	Shanghai Forus Metal Material Co. LTD
Kifato MK LLC[209]	USD 4 973 160	N/A	Uni Shipping LTD
LLC Periton Engineering[210]	USD 485 850	US (OFAC)[211]	Guangzhou White Sun Intermodal LTD
LLC TED GAS SYSTEMS[212]	USD 35 430	N/A	J Parker Combustion Equipment Jiangsu Co. LTD
LLC Vneshekostil[213]	USD 75 747 047,99	US (OFAC)[214]	Agu Information Technology Co. LTD
			Time Art International LTD
Micro Terra LLC[215]	USD 7 038 274,71	N/A	Jingbao International Co. LTD
Multidata Systems LLC[216]	USD 4 490 000	N/A	Hainan Foreseer Trading Co. LTD
New IT Project LLC[217]	USD 55 192 599,31	US[218] Ukraine[219]	Afox Corporation LTD
NORGAU RUSSLAND LLC[220]	USD 393 764,02	N/A	China US Joint Enterprise Qingdao Leader Metrology Instruments Co. LTD
Osnastik LLC[221]	USD 226 923,40	N/A	Hangzhou Zezheng Machinery Co LTD
PROMINTECH LLC[222]	USD 1 178 735,18	N/A	Z Tech Wuxi Precision Machinery Co. LTD
RESOURSMETPROM LLC[223]	USD 4 313,88	N/A	Shanghai Increase Way Investment & Management Co. LTD
RIITEK LLC[224]	USD 913 714	N/A	Transyn Scientific LTD
SFT LLC[225]	USD 18 036 159,25	US[226] EU[227]	Silver Technology LTD
Siefay LLC[228]	USD 945 726	N/A	Jos Systems LTD
VARUS LLC[229]	USD 216 940,80	N/A	Songwei CNC Machinery Co. LTD
VEZA LLC[230]	USD 56 522,56	N/A	Guangzhou Tofee Electro Mechanical Equipment Co. LTD

[208] ru. АО "КТК"; TIN: 3907009603
[209] ru. ООО "КИФАТО МК"; TIN: 5020047670
[210] ru. ООО "Перитон Инжиниринг"; TIN: 7703426927
[211] https://shorturl.at/ILYiz
[212] ru. ООО "ТЕД ГАЗОВЫЕ СИСТЕМЫ"; TIN: 7708730423
[213] ru. ООО "Внешэкостиль"; TIN: 7724362880
[214] https://shorturl.at/OGQFM
[215] ru. ООО "Микро Терра"; TIN: 9705063479
[216] ru. ООО "Мультидата Системс"; TIN: 7727427013
[217] ru. ООО "Новый Ай Ти Проект"; TIN: 7724338125
[218] https://shorturl.at/EVXBM
[219] https://shorturl.at/vFm7G
[220] ru. ООО "НОРГАУ РУССЛАНД"; TIN: 7727159340
[221] ru. ООО "ОСНАСТИК"; TIN: 7714884301
[222] ru. ООО "ПРОМИНТЕХ"; TIN: 7801312438
[223] ru. ООО "РМП"; TIN: 7722682877
[224] ru. ООО "РИИТЭК"; TIN: 5003120440
[225] ru. ООО "СФТ"; TIN: 7725842590
[226] https://shorturl.at/p73hW
[227] https://shorturl.at/gc6hl
[228] ru. ООО "Сиэфай"; TIN: 9701044115
[229] ru. ООО "ВАРУС"; TIN: 7725679939
[230] ru. ООО "ВЕЗА"; TIN: 7720040225

Annex III: Connections of Russian importers of CNC machinery to Russia's MIC

Importer name	Historical defense contracts *(prior to February 24,2022)*[231]	Recent defense contracts *(Q4 2023-Q1 2024)*[232]	Total Amount of Defense Contracts *(Q4 2023-Q1 2024)*[233]
Company AMG LLC[234]	АО "ГОС МКБ "ВЫМПЕЛ" ИМ. И.И. ТОРОПОВА" (TIN: 7733546058)[235]	АО "АВИААГРЕГАТ" (TIN: 6319031396)[236]	USD 17 106 783
	ПАО "НПП "ИМПУЛЬС" (TIN: 7717022177)	АО "НПП "АЛМАЗ" (TIN: 6453119615)[237]	USD 1 778 898
	АО "ФНПЦ"НИИ ПРИКЛАДНОЙ ХИМИИ" (TIN: 5042120394);	АО "163 БТРЗ" (TIN: 2340020470)	USD 569 508
	АО "ВНИИ "СИГНАЛ" (TIN: 3305708964)		
	АО "НПО "ПРИБОР" ИМЕНИ С.С. ГОЛЕМБИОВСКОГО" (TIN: 7726700943)		
ALLIANCE PRAVO LLC[238]	N/A	ПАО "НПО "СТРЕЛА" (TIN: 7103028233)	USD 5 783,56
		АО "КОНЦЕРН "СОЗВЕЗДИЕ" (TIN: 3666127502)	USD 9 262,42
		АО "СКБ МО РФ" (TIN: 5024076350)	USD 1 306,48
ARCTIC LNG 2 LLC[239]	N/A	АО "ОДК-АВИАДВИГАТЕЛЬ" (TIN: 5904000620)	USD 624,99
Ball Beverage Packing LLC Naro Fominsk[240]	N/A	N/A	N/A
Company ETL LLC[241]	N/A	АО "МИКРОН" (TIN: 7735007358)	USD 11 397,87
		АО "НПП "АЭРОСИЛА" (TIN: 5045002261)	USD 7 072,94
DATAPRINT LLC[242]	N/A	АО "КУРСКИЙ ЭЛЕКТРОАППАРАТНЫЙ ЗАВОД" (TIN: 4629003691)	USD 3 127
Energy Industries LLC[243]	АО "АДМИРАЛТЕЙСКИЕ ВЕРФИ" (TIN: 7839395419)	ФГУП "КОМБИНАТ "ЭЛЕКТРОХИМПРИБОР" (TIN: 6630002336)	USD 151 750,57
	ФГУП "КОМБИНАТ "ЭЛЕКТРОХИМПРИБОР" (TIN: 6630002336)		
	ПАО "ДНПП" (TIN: 5008000322)		
	АО "ВПК "НПО МАШИНОСТРОЕНИЯ" (TIN: 5012039795)		
Engineering Center for Production Equipment LLC[244]	N/A	АО "ПРОТОН-ПМ" (TIN: 5904006044)	USD 763 201,56
		ФГУП "КОМБИНАТ "ЭЛЕКТРОХИМПРИБОР" (TIN: 6630002336)	USD 563 331,33
		АО "ЗАСЛОН" (TIN: 7826092350)	USD 318 102,43
	АО "КОНЦЕРН "МОРИНСИС - АГАТ" (TIN: 7720544208)	АО "ОКБ КП" (TIN: 5029150262)	USD 908 754,34
		АО "ПО "УОМЗ" (TIN: 6672315362)	USD 4 953,36

[231] https://www.list-org.com/
[232] Business records available to the ESCU
[233] Business records available to the ESCU
[234] ru. ООО "Компания "АМГ"; TIN: 7720821959
[235] Designer and manufacturer of aviation weapons: air-to-air and air-to-surface guided missiles, etc
[236] Manufacturer of landing gear for military aircraft
[237] Manufacturer of ultra-high-precision electronic equipment for military aviation
[238] ru. ООО "АЛЬЯНС "ПРАВО"; TIN: 7806415758
[239] ru. ООО "АРКТИК СПГ 2"; TIN: 8904075357
[240] ru. ООО "АУР НАРО-ФОМИНСК"; TIN: 5030041780
[241] ru. ООО "КОМПАНИЯ Е.Т.Л."; TIN: 5045022980
[242] ru. ООО "ДАТАПРИНТ"; TIN: 7722804772
[243] ru. ООО "ЭНЕРДЖИ ИНДАСТРИЗ"; TIN: 7701374173
[244] ru. ООО "Инжиниринговый центр по оснащению производств"; TIN: 7814766333

Firm Permanent K&M JSC[245]		АО "ОБУХОВСКИЙ ЗАВОД" (TIN: 7811144648)	USD 2 124,28
FOREL LLC[246]	N/A	N/A	N/A
Grintech Energy LLC[247]	N/A	N/A	N/A
IIS LLC[248]	N/A	N/A	N/A
Innovative Automation Systems LLC[249]	N/A	АО "НПО "СПЛАВ" ИМ. А.Н. ГАНИЧЕВА" (TIN: 7105515987)	USD 94,101.16
Inpromservice LLC[250]	N/A	ПАО "КАМАЗ" (TIN: 1650032058)	USD 13 260
International Engineering Company LLC [251]	N/A	N/A	N/A
IT TECHNOLOGIEN LLC[252]	N/A	ПАО "КАМАЗ" (TIN: 1650032058)	USD 18 221,19
		АО "ММЗ "АВАНГАРД" (TIN: 7743065177)	USD 2 258,44
JSC Kaliningrad Container Factory[253]	N/A	N/A	N/A
Kifato MK LLC[254]	N/A	N/A	N/A
LLC Periton Engineering[255]	N/A	ПАО "ЧКПЗ" (TIN: 7449006184)	USD 11 015 846
		АО "ТУЛАТОЧМАШ" (TIN: 7106002829)	USD 7 927,3
		АО "ДЕДАЛ-НВ" (TIN: 7716132924)	USD 402 365,5
LLC TED GAS SYSTEMS[256]	N/A	N/A	N/A
LLC Vneshekostil[257]	N/A	N/A	N/A
Micro Terra LLC[258]	N/A	АО "КОНЦЕРН "НПО "АВРОРА" (TIN: 7802463197)	USD 285 983
		ООО "НПФ ВИДАР" (TIN: 9718053407)	USD 25 948
Multidata Systems LLC[259]	N/A	N/A	N/A
New IT Project LLC[260]	N/A	ФГУП "НПП "ГАММА" (TIN: 7728044373)	USD 72 323,75
		ООО "НПП "ОПТОН" (TIN: 7714963433)	USD 23 034,25
	АО "ПО "СЕВМАШ" (TIN: 2902059091)	АО "ЦНИИ "БУРЕВЕСТНИК" (TIN: 5259075468)	USD 601 170,03

[245] ru. АО "ФИРМА "ПЕРМАНЕНТ К&М"; TIN: 7735001719
[246] ru. ООО "ФОРЕЛ"; TIN: 5003107897
[247] ru. ООО "Гринтех Энерджи"; TIN: 7714827952
[248] ru. ООО "ИИС"; TIN: 5001091708
[249] ru. ООО "ИННОСИСТЕМС"; TIN: 7714457081
[250] ru. ООО "Инпромсервис"; TIN: 7725702377
[251] ru. ООО "МИК"; TIN: 4501232320
[252] ru. ООО "ИТ ТЕХНОЛОГИЕН"; TIN: 5040073491
[253] ru. АО "КТК"; TIN: 3907009603
[254] ru. ООО "КИФАТО МК"; TIN: 5020047670
[255] ru. ООО "Перитон Инжиниринг"; TIN: 7703426927
[256] ru. ООО "ТЕД ГАЗОВЫЕ СИСТЕМЫ"; TIN: 7708730423
[257] ru. ООО "Внешэкостиль"; TIN: 7724362880
[258] ru. ООО "Микро Терра"; TIN: 9705063479
[259] ru. ООО "Мультидата Системс"; TIN: 7727427013
[260] ru. ООО "Новый Ай Ти Проект"; TIN: 7724338125

NORGAU RUSSLAND LLC[261]	АО "НПП "ТОРИЙ" (TIN: 7728328640)	АО "ОДК" (TIN: 7731644035)	USD 225 456,68
	АО "КБП" (TIN: 7105514574)		
	АО "ВОТКИНСКИЙ ЗАВОД" (TIN: 1828020110)	ПАО "ИМПЕРАТОРСКИЙ ТУЛЬСКИЙ ОРУЖЕЙНЫЙ ЗАВОД" (TIN: 7107003303)	USD 206 781,65
	АО "ОБУХОВСКИЙ ЗАВОД" (TIN: 7811144648)		
Osnastik LLC[262]	АО "ОКБ "ЭЛЕКТРОАВТОМАТИКА" (TIN: 7805326230)	ООО "АЛАБУГА МАШИНЕРИ" (TIN: 1674003000)	USD 22 552
		АО "ОКБ "ЭЛЕКТРОАВТОМАТИКА" (TIN: 7805326230)	USD 10 007
		АО "ВОМЗ" (TIN: 3525023010)	USD 6 869
PROMINTECH LLC[263]	АО "КБП" (TIN: 7105514574)	АО "ВОМЗ" (TIN: 3525023010)	USD 350 100,97
	ФГУП "ПО "ОКТЯБРЬ" (TIN: 6612001971)		
	АО "ПО "СЕВМАШ" (TIN: 2902059091)	ПАО "ИМПЕРАТОРСКИЙ ТУЛЬСКИЙ ОРУЖЕЙНЫЙ ЗАВОД" (TIN: 7107003303)	USD 651 951,98
	АО "СЕВЕРНЫЙ ПРЕСС" (TIN: 7806337732)		
	АО "ВОМЗ" (TIN: 3525023010)	СПБ ОАО "КРАСНЫЙ ОКТЯБРЬ" (TIN: 7830002462)	USD 190 900,78
	АО "ЦС "ЗВЕЗДОЧКА" (TIN: 2902060361)		
	АО "ВОТКИНСКИЙ ЗАВОД" (TIN: 1828020110)		
RESOURSMETPROM LLC[264]	N/A	N/A	N/A
RIITEK LLC[265]	N/A	АО "НИЦЭВТ" (TIN: 7726019325)	USD 2 010 812,87
		ПАО "КАМАЗ" (TIN: 1650032058)	USD 117 784,29
SFT LLC[266]	АО "ФНПЦ "ТИТАН-БАРРИКАДЫ" (TIN: 3442110950)	ООО "АЭРОСКАН" (TIN: 5603045794)	USD 9 242 197,28
	АО "ПК "АХТУБА" (TIN: 3443048328)	АО "МКБ "ИСКРА" (TIN: 7714288059)	USD 1 839 407,14
		СПБ ОАО "КРАСНЫЙ ОКТЯБРЬ" (TIN: 7830002462)	USD 3 897 582.31
Siefay LLC[267]	N/A	N/A	N/A
VARUS LLC[268]	АО "ФНПЦ "ПО "СТАРТ" ИМ. М.В. ПРОЦЕНКО" (TIN: 5838013374)	ПАО "ОДК-УМПО" (TIN: 0273008320)	USD 1 284 345,46
	ПАО "ОДК-УМПО" (TIN: 0273008320)		
	АО "ОДК-СТАР" (TIN: 5904100329)		
	АО "БЭМЗ" (TIN: 3255517577)	АО "НПК "КБМ" (TIN: 5022039177)	USD 1 602,78
	АО "ММЗ" (TIN: 1200001885)		
VEZA LLC[269]	АО "ММП ИМЕНИ В.В. ЧЕРНЫШЕВА" (TIN: 7733018650)	ФГУП "КРЫЛОВСКИЙ ГОСУДАРСТВЕННЫЙ НАУЧНЫЙ ЦЕНТР" (TIN: 7810213747)	USD 70 958
	АО "РКЦ "ПРОГРЕСС" (TIN: 6312139922)	ООО "ССК "ЗВЕЗДА" (TIN: 2503032517)	USD 129 965
	АО "КОРПОРАЦИЯ "СПУ-ЦКБ ТМ" (TIN: 7722775458)	АО "НПП "ИСТОК" ИМ. ШОКИНА" (TIN: 5050108496)	USD 53 025

[261] ru. ООО "НОРГАУ РУССЛАНД"; TIN: 7727159340
[262] ru. ООО "ОСНАСТИК"; TIN: 7714884301
[263] ru. ООО "ПРОМИНТЕХ"; TIN: 7801312438
[264] ru. ООО "РМП"; TIN: 7722682877
[265] ru. ООО "РИИТЭК"; TIN: 5003120440
[266] ru. ООО "СФТ"; TIN: 7725842590
[267] ru. ООО "Сиэфай"; TIN: 9701044115
[268] ru. ООО "ВАРУС"; TIN: 7725679939
[269] ru. ООО "ВЕЗА"; TIN: 7720040225

Annex IV. Dependence of Chinese CNC industry on foreign technologies

Product	Key Players and Jurisdictions *(Shares of Chinese market)*	Total Non-Chinese Shares *(Chinese Dependency On Foreign Components)*	Total US Shares *(Chinese Dependency On US Components)*
Industrial software			
CAD (Computer-Aided Design)	Dassault Systèmes (France), Siemens (Germany), PTC (USA), Autodesk (USA) (>90%)	90%	>90%
CAE (Computer-Aided Engineering)	ANSYS (USA), Siemens (Germany), ALTAIR (USA), MSC Software (USA) (unspecified)	N/A	N/A
PLM (Product Life Management)	Siemens (Germany) (25-30%), PTC (USA) (20-25%), Dassault Systèmes (France) (25-30%)	77.5%	20-25%
MES (Manufacturing Execution System)	Siemens (Germany) (10-15%), Rockwell (USA) (5-10%), Honeywell (USA), General Electric (USA)	35%	15-20%
Control Instrument			
Small PLCs (Programmable Logic Controllers)	Siemens (Germany) (30-35%), Mitsubishi (Japan) (10-15%), Omron (Japan) (5-10%), Schneider (France), Rockwell (USA), Panasonic (Japan), Delta (Taiwan) (30-40% combined)	90%	5-10%
Medium/Large PLCs	Siemens (Germany) (50-55%), Mitsubishi (Japan) (10-15%), Rockwell (USA) (5-10%), Schneider (France) (5-10%), Omron (Japan), Delta (Taiwan) (10-20% combined)	100%	5-10%
DCS (Distributed Control System)	Siemens (Germany), Yokogawa (Japan), ABB (Sweden, Switzerland), Schneider (France) (30-40%), Emerson (USA) (15-20%), Honeywell (USA) (5-10%)	65%	20-30%
CNC Systems	FANUC (Japan) (35-40%), Mitsubishi (Japan) (10-15%), Siemens (Germany) (5-10%)	57.5%	N/A
IPCs (Industrial PCs)	Advantech (Taiwan) (40-45%), Beckhoff (Germany) (10-15%), Kontron (Germany), B&R (Austria), Siemens (Germany), ADLINK (Taiwan) (20-30% combined)	85%	N/A
HMIs (Human-Machine Interface)	Siemens (Germany) (25-30%), Pro-face (Japan) (5-10%), Schneider (France) (5-10%), Omron (Japan), Mitsubishi (Japan), Beijer Electronics (Sweden), Delta (Taiwan) (35-45% combined)	55%	N/A

Automation Equipment			
Machine Vision Systems	Cognex (USA) (15-20%), Keyence (Japan) (15-20%), SICK (Germany), Omron (Japan) (35-45% combined)	52.5%	15-20%
Fibre Lasers	IPG (USA) (42%), nLight (USA) (5%), Coherent (USA) (5%)	52%	52%
Instrument			
Spectrometers	Agilent (USA), Thermo Fisher (USA), Perkin Elmer (USA), Shimadzu (Japan), Persee (USA)	N/A	N/A
Tensile Testers	Instron (USA), MTS (USA), Zwick (Germany), Shimadzu (Japan)	N/A	N/A
Roundness Testers	Taylor Hobson (UK), Mahr (Germany), Hommel (Germany), Mitutoyo (Japan), Accretech (Japan), TESA (Switzerland)	N/A	N/A
Metallurgical Microscopes	Olympus (Japan), Zeiss (Germany), Leica (Germany), Nikon (Japan)	N/A	N/A
Motor, drive and electrical components			
AC Servo Systems	Mitsubishi (Japan) (10-15%), YASKAWA (Japan) (10-15%), Panasonic (Japan) (5-10%), Delta (Taiwan) (5-10%), Siemens (Germany), Omron (Japan), Schneider (France), B&R (Austria), SANYO DENKI (Japan) (60%)	65%	N/A
Linear Motors	Sodick (Japan) (5-10%), HIWIN (Taiwan), YASKAWA (Japan), Yokogawa (Japan) (75% combined)	80-85%	N/A
Low-voltage VFDs	ABB (Switzerland) (20-25%), Siemens (Germany) (15-20%), Schneider (France) (5-10%), Danfoss (Denmark), Delta (Taiwan), Mitsubishi (Japan), YASKAWA (Japan), Rockwell (USA), Vertiv (USA) (35-45% combined)	62.5%	5-10%
Middle/High-voltage VFDs	ABB (Switzerland) (10-15%), Siemens (Germany) (5-10%), Vertiv (USA)	25-30%	N/A
Push Buttons and Indicator Lamps	Schneider (France) (25-30%), Siemens (Germany) (10-15%), IDEC (Japan) (5-10%), ABB (Switzerland), Fuji Electric (Japan) (50% combined)	90-100%	N/A
Contactors	Schneider (France) (25-30%), Siemens (Germany) (10-15%), ABB (Switzerland), Eaton (USA), Fuji Electric (Japan) (55% combined)	55%	N/A

Relays	Schneider (France) (20-30%), Omron (Japan) (15-20%), Weidmüller (Germany) (5-10%), ABB (Switzerland), IDEC (Japan), and others (30-40% combined)	55%	N/A
Sensor			
Rotary Encoders	TAMAGAWA (Japan) (15-20%), Heidenhain (Germany) (15-20%), Baumer (Switzerland) (5-10%), Pepperl+Fuchs (Germany), Nemicon (Japan), Omron (Japan), ELCO (Germany), Kübler (Germany), Koyo Electronics (Japan), SICK (Germany) (50-55% combined)	57.5%	N/A
Optical Linear Encoders	Heidenhain (Germany) (50-55%), Renishaw (UK) (25-30%), FAGOR (Spain) (15-20%)	92.5%	N/A
Displacement Sensors	Keyence (Japan) (30-35%), Panasonic (Japan) (5-10%), Balluff (Germany), Banner (USA), SICK (Germany), Omron (Japan) (55-65% combined)	50%	N/A
Photoelectric Switches	Keyence (Japan) (25-30%), Omron (Japan) (15-20%), Panasonic (Japan) (10-15%), SICK (Germany) (10-15%), Banner (USA), Pepperl+Fuchs (Germany), Balluff (Germany) (35-40%)	57.5%	N/A
Proximity Switches	Omron (Japan) (20-25%), Balluff (Germany) (15-20%), Pepperl+Fuchs (Germany) (5-10%), Keyence (Japan), SICK (Germany) (50%)	50%	N/A
RFID	Pepperl+Fuchs (Germany) (10-15%), Balluff (Germany) (5-10%), SICK (Germany) (5-10%)	30-35%	N/A
Safety Sensors	SICK (Germany) (15-20%), Omron (Japan) (10-15%), Keyence (Japan) (5-10%), Banner (USA) (5-10%), Panasonic (Japan)	37.5%	N/A
Precision Components			
Reducers	Nabtesco (Japan) (15-20%), Harmonic Drive (Japan) (10-15%), Sumitomo (Japan) (5-10%), Nidec-Shimpo (Japan), SEW Eurodrive (Germany), ALPHA (Germany) (50-60% combined)	50%	N/A

Bearings	Schaeffler (Germany), SKF (Sweden), Minebea (Japan), NTN (Japan), NSK (Japan), JTEKT (Japan), TIMKEN (USA), NACHI (Japan) (70% combined)	70%	N/A
Hydraulic Components	Bosch Rexroth (Germany), Kawasaki (Japan), Parker Hannifin (USA), KYB (Japan), Danfoss (Denmark)	N/A	N/A
Pneumatic Components	SMC (Japan) (30-35%), AirTAC (Taiwan) (20-25%), FESTO (Germany) (10-15%)	67.5%	N/A
Linear Guides	HIWIN (Taiwan) (78%), NSK (Japan), Bosch Rexroth (Germany), IKO (Japan), Ewellix (Sweden), Schaeffler (Germany), PMI (Taiwan)	80%	N/A

Annex V. Dependence of Chinese CNC Producers on Cooperation with Sanctions Coalition members

Member of the sanctions coalition	Connected Chinese CNC producer	Type of connection
Japan	Neway CNC Equipment Suzhou Co. Ltd[270]	Usage of bearing from NSK.[271]
	Sino Machinery Co. Ltd[272]	Collaboration with research institutions on R&D.[273]
	Haitian Precision Machinery (Hong Kong) Co. Ltd[274]	Usage of technology from DAINICHI and NIIGATA[275][276] as well as machinery from SNK, Okuma, Mitsubishi, Sumiju,Mazak, TOYO[277].
	Ningbo Oturn Machinery Co. Ltd[278]	Usage of CNC operating systems from Mitsubishi and FANUC, as well as collaboration with both brands on R&D.[279]
	Guangzhou KDT Machinery Co. Ltd.[280]	Usage of high-quality parts from Japan [281].
	Jinan Senfeng Laser Technology Co. Ltd[282]	Business partnership with SMC Corporation via US subsidiary[283], as well as usage of components from THK.[284][285]
	HSG Laser Co. Ltd[286]	Research center in Chiba[287], as well as subsidiary in Japan and partnerships with SANYO DENKI, Panasonic, SMC.[288]
	Ningbo Blin Machinery Co. Ltd[289]	Usage of CNC operating systems from Fanuc.[290]
	Ningbo Sky Master Precision Machinery Co. Ltd[291]	Import of testing and processing equipment from the Japan.[292]
	Jinan Bodor CNC Machine Co. Ltd. [293][294]	Separate branch.[295]
	Shenzhen Sowin Precision Machine Tool Co. Ltd. [296]	Usage of advanced technological facilities from Mitsubishi Heavy Industries, OKUMA, SIGMA (field dynamic balancing instrument[297]), as well as 0i-TF software from FANUC.[298][299][300]

[270] http://www.newayvalve.com/46/
[271] https://www.machinetools.com/ru/brands/neway#:~:text=For%20machine%20process%20machining
[272] https://www.sinocncmachine.com/
[273] https://www.sinocncmachine.com/aboutus.htm
[274] https://haitianprecision.com/en/
[275] https://ritm-magazine.com/sites/default/files/pdf-magazine/rhythm_of_machinery_8_2017.pdf
[276] https://www.machinetools.com/en/brands/hision
[277] https://www.machinetools.com/en/brands/hision
[278] https://oturncnc.com/
[279] https://kamimtex.com/upload/iblock/471/katalog_obrabatyvayshih_cenrov_OTURN_VMC.pdf
[280] https://en.kdtmac.com/
[281] https://bit.ly/3y2YhUC
[282] https://www.sfcnclaser.com/about-us.html
[283] https://www.senfenglaserusa.com/about/#:~:text=high-end%20equipment-,R&D,-and%20production%20enterprise
[284] https://bit.ly/3Sclz1p
[285] https://bit.ly/3zMVcbX
[286] https://www.hsglaser.com/pages/about/#company
[287] https://bit.ly/3Lu34BO
[288] https://bit.ly/4d8vzAS
[289] http://blincnc.com/
[290] https://bit.ly/4clYwDn
[291] http://www.skymaster.com.cn/Page_index_id_149.htm
[292] http://www.skymaster.com.cn/Page_index_id_149.htm
[293] https://bit.ly/3Y4KRCl
[294] https://bit.ly/3W71XNf
[295] https://utechcnc.com/wp-content/uploads/2022/08/Bodor-All-Series-Machine_2022.06.pdf
[296] https://bit.ly/4bNmxbg
[297] https://bit.ly/3LsHZYk
[298] https://bit.ly/46cFTVS
[299] https://bit.ly/46i3SDh
[300] https://bit.ly/3YajKG2

	Gweike Tech Co. Ltd.[301]	Usage of components from YASKAWA[302303], PANASONIC[304305], SMC[306307], NSK[308].
Germany	Neway CNC Equipment Suzhou Co. Ltd[309]	Usage of high advanced process equipment from Strarragheckert.[310]
	Sino Machinery Co. Ltd.[311]	Collaborates with research institutions on R&D.[312]
	Ningbo Oturn Machinery Co. Ltd[313]	Usage of CNC operating systems from Siemens[314315316317], as well as collaboration with German Xizi for R&D and lean manufacturing[318].
	Jinan Senfeng Laser Technology Co. Ltd.[319]	R&D Center established in 2018[320], as well as business partnership with Siemens via US subsidiary.[321]
	HSG Laser Co. Ltd[322]	European headquarters located in Germany[323], as well as business partnership with KUKA, Precitec, Wittenstein, Siemens, Beckhoff, and Rexroth.[324]
	Ningbo Blin Machinery Co. Ltd[325]	Collaboration with German specialists[326327328], as well as usage of CNC operating systems from Siemens (Germany). [329330331332333]
	Ningbo Sky Master Precision Machinery Co. Ltd[334]	Comprehensive strategic partnership with German company KRAFT[335], collaboration with German R&D team, as well as import of German testing and processing equipment.
	Jinan Bodor CNC Machine Co. Ltd. [336337]	Separate branch.[338]
	Gweike Tech Co. Ltd.[339]	Usage of components from Precitec[340], Trumpf[341].

[301] https://www.gweikecnc.com/
[302] https://bit.ly/3zJWcgV
[303] https://bit.ly/3LsIeCI
[304] https://bit.ly/3LsZ1W7
[305] https://bit.ly/3Se1ese
[306] https://bit.ly/4cLoaY6
[307] https://bit.ly/3Sen8vw
[308] https://bit.ly/4faaCr2
[309] http://www.newayvalve.com/46/
[310]https://www.machinetools.com/ru/brands/neway#:~:text=For%20machine%20process%20machining
[311] https://www.sinocncmachine.com/
[312] https://www.sinocncmachine.com/aboutus.htm
[313] https://oturncnc.com/
[314] https://bit.ly/3Wd3Tnt
[315] https://bit.ly/3W8heNU
[316] https://bit.ly/3W8SOnl
[317] https://bit.ly/3ydK3jP
[318] https://kamimtex.com/upload/iblock/471/katalog_obrabatyvayshih_cenrov_OTURN_VMC.pdf
[319] https://www.sfcnclaser.com/about-us.html
[320] https://www.sfcnclaser.com/about-us.html
[321] https://www.senfenglaserusa.com/about/#:~:text=high-end%20equipment-,R&D,-and%20production%20enterprise
[322] https://www.hsglaser.com/pages/about/#company
[323] https://www.hsglaser.com/pages/about/#company
[324] https://bit.ly/4d8vzAS
[325] http://blincnc.com/
[326] https://bit.ly/4dpcbjd
[327] https://bit.ly/3Y9X0Ge
[328] https://bit.ly/4f4EKDX
[329] https://bit.ly/3WtkXHg
[330] https://bit.ly/4d5MXG7
[331] https://bit.ly/4bNKI9E
[332] https://bit.ly/4bUk9iN
[333] https://bit.ly/3Yertmx
[334] http://www.skymaster.com.cn/Page_index_id_149.htm
[335] http://www.skymaster.com.cn/Page_index_id_149.htm
[336] https://bit.ly/3Y4KRCl
[337] https://bit.ly/3W71XNf
[338] https://utechcnc.com/wp-content/uploads/2022/08/Bodor-All-Series-Machine_2022.06.pdf
[339] https://www.gweikecnc.com/
[340] https://bit.ly/4f4Iwx7
[341] https://bit.ly/4d9B02r

Taiwan	Neway CNC Equipment Suzhou Co. Ltd[342]	Usage of components from HINWIN.[343]
	Sino Machinery Co. Ltd[344]	Collaboration with research institutions on R&D.[345]
	Zhejiang Zhenhuan CNC Machine Tool Co. Ltd.[346]	Research and development center in Taiwan.[347][348][349]
	Jinan Senfeng Laser Technology Co. Ltd[350]	Usage of components from DELTA.[351] [352]
	Ningbo Blin Machinery Co. Ltd[353]	Research and development center in Taiwan[354], as well as usage of CNC operating systems from SYNTEC.[355]
	Shenzhen Sowin Precision Machine Tool Co. Ltd. [356]	Usage of advanced technological facilities from Jiande.[357][358][359]
	Gweike Tech Co. Ltd.[360]	Usage of components from HIWIN[361], DELTA[362][363][364], AirTAC[365].
US	Neway CNC Equipment Suzhou Co. Ltd[366]	Subsidiary in Houston, Texas for marketing and sales in oil, petrochemical, chemical, pipeline, and power industries.[367][368][369][370]
	Haitian Precision Machinery (Hong Kong) Co. Ltd.[371]	Usage of technologies of American American company Cincinnati Incorporated[372][373];
	Jinan Senfeng Laser Technology Co. Ltd[374]	Branch in Los Angeles, California, opened in 2014, as well as business partnership with IPG Photonics (Marlborough, Massachusetts) [375][376].
	HSG Laser Co. Ltd[377]	North American headquarters located in the US[378], as well as partnership with IPG Photonics

[342] http://www.newayvalve.com/46/
[343]https://www.machinetools.com/ru/brands/neway#:~:text=For%20machine%20process%20machining
[344] https://www.sinocncmachine.com/
[345] https://www.sinocncmachine.com/aboutus.htm
[346] https://en.zmat.com/single/contacts
[347] https://bit.ly/3SeORwl
[348] https://bit.ly/3y6fXyP
[349] https://faggioni.cl/wp-content/uploads/2019/09/b89e3c_0cf5bbb9eecf48b39b2dbd44485472b3.pdf
[350] https://www.sfcnclaser.com/about-us.html
[351] https://bit.ly/3LvoX3s
[352] https://bit.ly/4bUjVrX
[353] http://blincnc.com/
[354] https://bit.ly/3Sc6TPI
[355] https://bit.ly/4cLeDR2
[356] https://bit.ly/4bNmxbg
[357] https://www.sowincnc.com/page_72/#md1
[358] https://bit.ly/4bQbT3m
[359] https://bit.ly/3WtsoxO
[360] https://www.gweikecnc.com/
[361] https://bit.ly/3W7Bsal
[362] https://bit.ly/3LvoX3s
[363] https://bit.ly/3WclsUI
[364] https://bit.ly/3Lw17F0
[365] https://bit.ly/4cG6CN8
[366] http://www.newayvalve.com/46/
[367] http://www.newayvalve.com/46/#:~:text=In-,2009,-%2C%20Neway%20opened%20an
[368] https://bit.ly/3zNCReL
[369] https://www.techspex.com/builders/neway-cnc(11617)
[370] https://bit.ly/4cXfhuq
[371] https://haitianprecision.com/en/
[372] https://ritm-magazine.com/sites/default/files/pdf-magazine/rhythm_of_machinery_8_2017.pdf
[373] https://www.machinetools.com/en/brands/hision
[374] https://www.sfcnclaser.com/about-us.html
[375] https://bit.ly/3LAwApf
[376] https://www.sfcnclaser.com/about-us.html
[377] https://www.hsglaser.com/pages/about/#company
[378] https://www.hsglaser.com/pages/about/#company

	Jinan Bodor CNC Machine Co. Ltd.[379][380]	Branch in the US.[381]
	Gweike Tech Co. Ltd.[382]	Usage of components from nLight and IPG Photonics.[383]
Switzerland	Neway CNC Equipment Suzhou Co. Ltd[384]	Usage of high advanced process equipment from SIP and Kellenberger.[385]
	Jinan Senfeng Laser Technology Co. Ltd[386]	Business partnership with ABB via US subsidiary.[387]
	HSG Laser Co. Ltd[388]	Partnership with Stäubli.[389]
	Jinan Bodor CNC Machine Co. Ltd.[390][391]	R&D center in Switzerland allowing further access to Western technologies.[392][393][394]
	Gweike Tech Co. Ltd.[395]	Usage of components from Raytools.[396]
France	Jinan Senfeng Laser Technology Co. Ltd[397]	Business partnership with Schneider Electric via US subsidiary.[398]
	HSG Laser Co. Ltd[399]	Partnership with Schneider Electric.[400]
	Gweike Tech Co. Ltd.[401]	Usage of components from Schneider.[402][403]
Italy	Neway CNC Equipment Suzhou Co. Ltd[404]	Subsidiary covering Southern Europe and North Africa.[405]
	Guangzhou KDT Machinery Co. Ltd.[406]	Research and development center and production base in Rimini, Italy.[407][408]
South Korea	Guangzhou KDT Machinery Co. Ltd.[409]	Established of a modern R&D and testing center through technological cooperation with South Korean partners[410], as well as usage of high-quality parts from South Korea[411].
	Jinan Bodor CNC Machine Co. Ltd.[412][413]	Separate branch.[414]

[379] https://bit.ly/3Y4KRCl
[380] https://bit.ly/3W71XNf
[381] https://utechcnc.com/wp-content/uploads/2022/08/Bodor-All-Series-Machine_2022.06.pdf
[382] https://www.gweikecnc.com/
[383] https://bit.ly/4bTmE50
[384] http://www.newayvalve.com/46/
[385]https://www.machinetools.com/ru/brands/neway#:~:text=For%20machine%20process%20machining
[386] https://www.sfcnclaser.com/about-us.html
[387] https://www.senfenglaserusa.com/about/#:~:text=high-end%20equipment-,R&D,-and%20production%20enterprise
[388] https://www.hsglaser.com/pages/about/#company
[389] https://bit.ly/4d8vzAS
[390] https://bit.ly/3Y4KRCl
[391] https://bit.ly/3W71XNf
[392] https://www.systemy-laserowe.pl/images/pdf/Bodor-Laser-Katalog.pdf
[393] https://bit.ly/3W20xmY
[394] https://bodorasia.wordpress.com/wp-content/uploads/2016/11/why-choose-bodor.pdf
[395] https://www.gweikecnc.com/
[396] https://bit.ly/4bOIIhj
[397] https://www.sfcnclaser.com/about-us.html
[398] https://www.senfenglaserusa.com/about/#:~:text=high-end%20equipment-,R&D,-and%20production%20enterprise
[399] https://www.hsglaser.com/pages/about/#company
[400] https://bit.ly/4d8vzAS
[401] https://www.gweikecnc.com/
[402] https://bit.ly/3Wpgt4i
[403] https://bit.ly/4cMo0jd
[404] http://www.newayvalve.com/46/
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[406] https://en.kdtmac.com/
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[408] https://bit.ly/3Y8YKzf
[409] https://en.kdtmac.com/
[410] https://bit.ly/4f5NYQt
[411] https://bit.ly/3y2YhUC
[412] https://bit.ly/3Y4KRCl
[413] https://bit.ly/3W71XNf
[414] https://utechcnc.com/wp-content/uploads/2022/08/Bodor-All-Series-Machine_2022.06.pdf

UK	Ningbo Sky Master Precision Machinery Co. Ltd[415]	Import of testing and processing equipment from the UK.[416]
	Shenzhen Sowin Precision Machine Tool Co. Ltd. [417]	Usage of RENISHAW laser interferometers. [418]
Canada	Jinan Bodor CNC Machine Co. Ltd. [419][420]	Separate branch.[421]
Australia	Jinan Senfeng Laser Technology Co. Ltd[422]	Usage of ANCA software.[423][424]
Sweden	Neway CNC Equipment Suzhou Co. Ltd[425]	Usage of bearings from SKF[426]
Spain	Neway CNC Equipment Suzhou Co. Ltd[427]	Usage of high advanced process equipment from ZAYER.[428]
Netherlands	Neway CNC Equipment Suzhou Co. Ltd[429]	Subsidiary managing marketing and sales in Western, Central, and Eastern Europe, and Scandinavia.[430]

[415] http://www.skymaster.com.cn/Page_index_id_149.htm
[416] http://www.skymaster.com.cn/Page_index_id_149.htm
[417] https://bit.ly/4bNmxbg
[418] https://www.sowincnc.com/page_77/#md1:~:text=Strict%20Testing%20Procedure
[419] https://bit.ly/3Y4KRCl
[420] https://bit.ly/3W71XNf
[421] https://utechcnc.com/wp-content/uploads/2022/08/Bodor-All-Series-Machine_2022.06.pdf
[422] https://www.sfcnclaser.com/about-us.html
[423] https://en.wikipedia.org/wiki/ANCA_(company)#:~:text=in%20Melbourne%2C-,Australia,-.
[424] https://bit.ly/3xSo2XT
[425] http://www.newayvalve.com/46/
[426]https://www.machinetools.com/ru/brands/neway#:~:text=For%20machine%20process%20machining
[427] http://www.newayvalve.com/46/
[428]https://www.machinetools.com/ru/brands/neway#:~:text=For%20machine%20process%20machining
[429] http://www.newayvalve.com/46/
[430] http://www.newayvalve.com/46/#:~:text=office%20in%20The-,Netherlands,-in%202011.The

Annex VI. Use of foreign CNC controllers by Chinese participants of Metalloobrabotka trade fair (Moscow 2023)

Chinese CNC machine (brand & model)	Foreign CNC controller	Details	Video Proof Link
Tengzhou Borui CNC Machine Tool Co. LTD (Unspecified model 1)	GSK (Chinese)	Company may cooperate with Siemens and FANUC, but no official information on purchasing Western controllers.	https://youtu.be/RyDQLRd2MhU?si=NN6jyRZ2yPIYiBI8&t=43
Tengzhou Borui CNC Machine Tool Co. LTD (Unspecified model 2)	FANUC	Company may cooperate with Siemens and FANUC, but no official information on purchasing Western controllers.	https://youtu.be/RyDQLRd2MhU?si=QT-XEslu_mlc7qRF&t=46 https://youtu.be/RyDQLRd2MhU?si=1l-Q77swgtQgVBwl&t=70
Conprofe (SEV500-5Axis)	Siemens	Company may cooperate with Siemens, Mitsubishi, and FANUC, implying dependence on Western CNC technologies.	https://youtu.be/9o6v229rxLo?si=ytX_HFG8upNgcbwl&t=213
Dyno Seiki (DV-50)	FANUC	No website or substantial information available, making it unclear if dependent on Western technologies.	https://tm.aliyun.com/detail/cf39_73389595_7
Blin (BL-V8S)	FANUC	No official partnership information, but suggests cooperation with German companies, indicating possible dependence on Western technologies.	https://youtu.be/9o6v229rxLo?si=gESKVO4DK4dTKg3k&t=2061
Shandong Linyi Jinxing Machine Tool Co., Ltd. (Unspecified model)	Siemens	Cooperates with various CNC control technology producers, not dependent on specific Western producers.	https://youtu.be/CWx7ZVSnANI?si=AClo3JlugnNVN3Tw&t=134
Deed (HTC-550M)	FANUC	No partnership information, but strategic cooperation with German Rottler CNC manufacturer suggests some dependence on Western technologies.	https://youtu.be/CWx7ZVSnANI?si=lI66FzSaj8Z5lGaf&t=148
Kunming Machine Tool (KIMI A-4P)	FANUC	Partners with various CNC manufacturers (FANUC, Siemens, Mitsubishi), indicating	https://smart-lab.ru/blog/909504.php

		dependence on Western CNC technologies.	https://bpk-spb.ru/manufacturers/kunming-machine-tool/
Dekay (Y-3122)	Bosch Rexroth	Usual controller is Bosch Rexroth, but no official partnership information with Western CNC manufacturers, suggesting possible dependence.	https://smart-lab.ru/blog/909504.php#gallery_topic_909504-27
			https://www.nbdekay.cn/html/en/products/125.html
CATO (CBS500C)	CATO (China)	No partnership with Western CNC manufacturers, exclusively uses Chinese controllers.	https://youtu.be/9o6v229rxLo?si=WYzRr0Jnca4eBWxU&t=282
			http://en.catocnc.com/news/1.html
Kede CNC Co Ltd (Uni.5 600UT)	Chinese panel	Made specifically for the Russian market. No partnership information with Western CNC manufacturers.	https://unimatic.ru/company/partners/unimatic-uni-5/
			https://youtu.be/9o6v229rxLo?si=QEokIdFwTZuw2pGh&t=642
IronMac (Unspecified model)	HCNC (China)	International company, may use Western technologies but no confirming information available.	https://www.stanki.ru/manufacturer/ironmac/
			https://youtu.be/9o6v229rxLo?si=R08z9e3JP3kEBpNY&t=2089

Annex VII. Use of foreign CNC controllers by Chinese participants of Metalloobrabotka trade fair (Moscow 2024)

Chinese CNC machine	Foreign CNC controller	Details	Video Proof Link
Stanza	Mitsubishi	Common brand of Russian Promoil CNC service company and unspecified Chinese manufacturers.	https://youtu.be/YR_sfzQjfc4?si=tibf5UVoWTDakURy&t=242
	FANUC		https://youtu.be/YR_sfzQjfc4?si=MFfRR4jg3LcDmgDJ&t=434
	Siemens		https://youtu.be/YR_sfzQjfc4?si=KLedQ2-pEIUSJkq0&t=271
Z-MaT	FANUC	Three machines with FANUC controllers.	https://youtu.be/YR_sfzQjfc4?si=QW2yITT59_dUbGrK&t=1244
			https://youtu.be/YR_sfzQjfc4?si=ya2jdSPNnThx45AD&t=1295
			https://youtu.be/YR_sfzQjfc4?si=Y4WTH6P_h4dnwmwu&t=1302
Tordos	Siemens	Presented with Siemens panel. Almost no information about the brand.	https://youtu.be/YR_sfzQjfc4?si=7-mFrGdGAJx2naMM&t=4949
Sunshine (Kolmach)	Siemens	EMU630 presented with Siemens panel.	https://youtu.be/YR_sfzQjfc4?si=pJS4YEz6fvo20ZRz&t=6200
Sowin	FANUC	Presented with FANUC control panel. Catalogue shows most machines operate under FANUC panels.	https://youtu.be/YR_sfzQjfc4?si=pil4gEzj-4VP51Hc&t=6534
Yourongxi.i	FANUC	VMC1160 presented with FANUC controller. Small brand with no information.	https://youtu.be/YR_sfzQjfc4?si=r-s1Lze9MmyTKMGN&t=6855
Spitzen	Siemens/FANUC	Manufacturer information unclear, possibly Chinese. Most machines equipped with Siemens or FANUC controllers. Official website suggests other parts may be of Western origin.	https://youtu.be/YR_sfzQjfc4?si=-01vCJ-0UMHdAOsC&t=6761
			https://www.stanki.ru/manufacturer/spitzen/
Bison	HCNC 840 (Chinese)	VMU63 equipped with Chinese HCNC 840 panel. Little information about the manufacturer.	https://youtu.be/YR_sfzQjfc4?si=AWEOcv-f49nLxcp5&t=1428