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Disassembling the Russian War Machine: Key Players and Nodes

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Executive Summary

The Russian military-industrial complex (MIC) has expanded in recent years despite the sanctions imposed on Russia, particularly following its 2022 full-scale invasion of Ukraine. Just a few key players continue to drive its expansion, leveraging state funding and supplementary off-budget sources alike to sustain growth. However, the industry faces significant challenges, including soaring funding costs, labor shortages, collapsing arms exports, and sanctions. As a result, the MIC faces pressure on profitability and fails to achieve technological modernization. While Russia has made strides in some areas, it struggles with the rapid pace of innovation required to maintain a competitive edge in modern warfare. In this context, China plays a pivotal role, providing crucial support, especially in areas where Russia's domestic capabilities are lacking, and serving as a key hub for the evasion of export controls, for instance through the transshipment of Western components to Russia.

In this report, we aim to disassemble Russia's war machine by focusing on key players and nodes. ***Section I*** examines the recent evolution of the military-industrial complex and assesses its capacities in light of the demands of the battlefield. ***Section II*** lays out and dissects the various entities that comprise Russia's war machine across important sectors. In ***Section III***, we add a geographical dimension to our analysis and identify the key military industry clusters. Finally, in ***Section IV***, we discuss China's role in supporting the Russian MIC. ***Section V*** concludes with key takeaways and policy recommendations. Future reports in this series will focus on supply chains of military and industrial entities, resources at their disposal, and networks they form.

- **The Russian MIC has undergone a significant transformation, but has struggled to modernize** after emerging from its post-Soviet collapse. It is now dominated by a few large, vertically-integrated conglomerates, Rostec first among them. However, this consolidation has not led to a coherent sector; rather, redundancies and inefficiencies remain. With the demands of Russia's war of aggression against Ukraine now overshadowing any strategic visions for the MIC, this is unlikely to change.
- **Funding has soared since the start of the full-scale war but the MIC is still under pressure.** Russia's MIC receives considerable money from the federal budget, in the form of military and security spending but also, indirectly, through other spending categories and regional budgets. In addition, it relies heavily on loans from Russia's banking system, local capital markets, and arrears vis-à-vis the state. While military expenditures and weapons procurement contracts have skyrocketed since the full-scale invasion, this has not unambiguously improved the financial health of the industry as a whole. The sector faces important challenges due to a collapse of arms exports due to the war, soaring funding costs due to high interest rates, acute labor shortages, and sanctions imposed since 2022.
- **The Russian military industrial complex has kept the war effort supplied for nearly three years.** Russia's invasion of Ukraine has been marked by challenges that have severely undermined its military capabilities. The conflict has exposed chronic equipment shortages and logistical obstacles. While dynamics differ for different types of weaponry, Russia attempts to offset combat losses with a combination of restoring stockpiled equipment, increasing domestic product, and relying on imports to a limited extent. Cooperation with North Korea and Iran helps Russia overcome various shortages—for instance, in artillery shells—and quickly implement new technological solutions.
- **We adopt a novel bottom-up approach that sheds light on MIC financial and legal ties.** By identifying specific entities known to be involved in military production, we establish reference points for querying available datasets, including financial records, employment statistics, procurement contracts, and cargo flows. We then aggregate the entity-level data to construct an extensive network that forms

the analytical foundation of this report. While macro-level information can be partially classified or ambiguous, and direct assessments of military output require on-the-ground intelligence, legal entity data have the advantage of providing a more structured and verifiable source of information.

- **The demands of the battlefield have led to a vast MIC that grows at the expense of the broader civilian economy.** Despite its top-heavy nature and domination by large groups such as Rostec, the sector has not evolved in a centrally-planned or uniform manner. Sanctions and resulting supply chain disruptions have all affected different parts of the sector differently, and older entities still play a more prominent role than newly-established ones. In many cases, production capacities and investments are expanding to support Russia's war of aggression against Ukraine, with companies such as KTRV and Almaz-Antey playing key roles for the supply of weapons to the battlefield. Rosatom and Roscosmos are in essence military enterprises developing nuclear and conventional weapons and delivery systems. Many critical MIC enterprises remain unsanctioned three years into the full-scale invasion.
- **Despite pressure on the industry, the MIC is expanding capacity and long-term investments**, focusing on highly sought-after precision tools, testing equipment, and computer systems. To structure the vast and complex Russian MIC, we group entities and transportation hubs into clusters based on geographical proximity, and identify key clusters by sectors and products. In combination with the analysis of cargo flows, this approach uncovers internal supply chain relationships between entities, as well as external dependencies. Army entities—the demand side of the MIC—are widely distributed throughout the country, while the supply side is more concentrated, especially around Moscow. It also appears to be a critical moment for Russia's MIC, where any easing of the sanctions regime would give a much needed boost to production and modernization. As the big rise in investment in 2022 appears to have slowed down in 2024, Russia's MIC is desperate for new cheap funding and labor.
- **China has become Russia's lifeline as the MIC is highly dependent on imports of intermediate components, particularly high-tech electronics and industrial tools**—many of which fall under export controls since early 2022. With direct supplies from Western countries dropping to essentially zero within weeks of the imposition of the sanctions, China's role has grown dramatically. It facilitates the Russian MIC's access to critical inputs in three ways: Chinese producers provide it with substitutes for those Western goods that it previously relied upon; Chinese factories of Western companies produce goods that eventually reach Russia; and Chinese intermediaries facilitate the transshipment of dual-use goods manufactured in the West. Russia's partnership with China is vital for ensuring that Russia can continue to develop advanced military systems and maintain its military capabilities.
- **With Russia's MIC facing serious challenges, lifting sanctions is the exact wrong strategy.** The Russian military industry is an inefficient, opaque, and corruption-plagued behemoth struggling to be profitable and undergo technological modernization. It has received a temporary boost in the form of soaring funding since the start of the full-scale invasion, but none of its challenges have disappeared. In fact, the war and sanctions have exacerbated them by deteriorating macroeconomic conditions, causing acute labor shortages, and disrupting supply chains for critical inputs. Not surprisingly, the regime is looking for sanctions relief in its initial talks with the US despite the usual rhetoric about the alleged ineffectiveness of these measures. At this time, lifting restrictions would be the exact wrong strategy, allowing the Russian MIC to move beyond its current limitations and improving the military capabilities of a country threatening peace and prosperity in Europe and the rules-based international order.

I. Introduction: Russia's Military Industry and Capacity

Russia's military-industrial complex has undergone a significant transformation over the past 20 years after emerging from its post-Soviet collapse. It is now dominated by a few large, vertically-integrated conglomerates, Rostec first among them. However, this consolidation has not led to a coherent sector; rather, redundancies and inefficiencies remain. With the demands of Russia's war of aggression against Ukraine now overshadowing any strategic visions for the MIC, this is unlikely to change. Funding has soared since the start of the full-scale invasion and the sector receives money from several sources, including the federal budget, the Russian banking sector, and local capital markets. While dynamics differ for different types of weaponry, Russia attempts to offset combat losses with a combination of restoring stockpiled equipment, increasing domestic product, and limited imports.

Key Facts and Trends

After a 15-year collapse accompanying the fall of the Soviet Union, the mid-2000s kicked off what has been called the "renaissance" of Russia's military industry.[1] Then, in 2007, Rostechnologia (later renamed to Rostec) was created by presidential decree to serve as the country's premier, vertically integrated military-industrial complex[2] conglomerate with hundreds of subsidiaries.[3] The creation of Rostec, along with several other state-owned MIC conglomerates, was part bailout, part restructuring. After its one-and-a-half-decade year experiment in privatizing the military sector, Russia was veering back towards its Soviet roots of state control.

Vertical consolidation did not manage to create a coherent, efficient version of a sector full of redundancies, debt-burdened companies, and old equipment.[4] Nonetheless, it has continued unabated. Mergers, acquisitions, and bankruptcies have led the Russian MIC to today's form: a handful of state-owned behemoths that, having gobbled up hundreds of smaller entities, no longer operate in a competitive environment.[5] Our mapping of MIC entities reveals sprawling empires—Rostec first among them—that crowd out (or acquire) any small or medium-sized enterprise that could bring competition to the sector, thereby preserving the status quo.

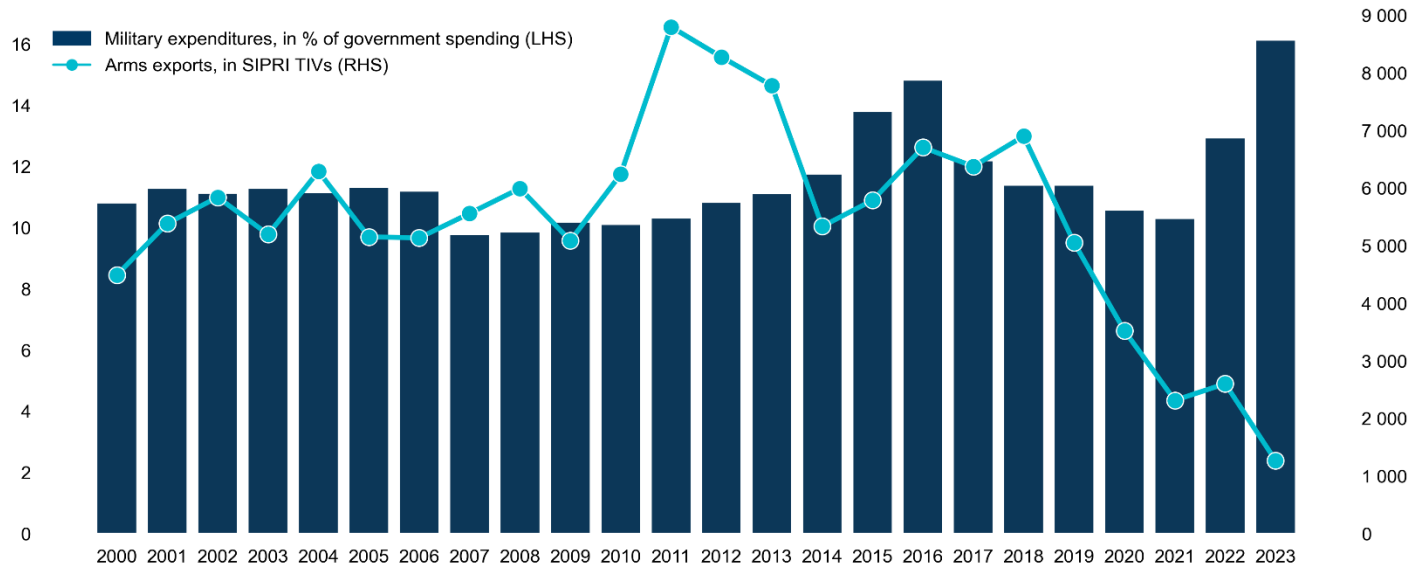
After the shocks of sanctions and ruble depreciation in 2014-2016, the Kremlin actively pushed for two structural changes to the MIC. *First*, it demanded that MIC firms raise their share of civilian production: to 30% in 2030 and 50% in 2030.[6] This was intended to make the MIC more resilient to sanctions and peacetime,[7] as well as create positive spillover effects for the civilian economy.[8] *Second*, it incentivized import substitution in the military sector. The Russian MIC was—and remains[9]—heavily dependent on imported equipment throughout the supply chain. As a general rule, the more complex the product, the more dependent the Russian MIC is on imports.[10] This dependence on foreign components is long-established and embedded in the structure of Russia's post-Soviet

[1] See "Competitiveness of Russia's Defence Industry: Weak but Steady" page 9, National Defence University.
[2] The term defense industrial base (DIB) is often used interchangeably with military-industrial complex (MIC). For the purposes of this series, we have opted to use MIC.
[3] See Putin's order here [ru]
[4] See "Crafting the Russian War Economy" page 10, CNA; See "Competitiveness of Russia's Defence Industry: Weak but Steady" page 8, National Defence University
[5] See "Russia's defense sector: An economic perspective" pages 10-11, Swedish Institute of International Affairs; "Russia's Defense Spending and the Economic Decline" page 65, Susanne Oxenstierna in Journal of Eurasian Studies
[6] See here [ru]
[7] "Another Budget for a Country at War: Military Expenditure in Russia's Federal Budget for 2024 and Beyond" page 15, SIPRI.
[8] See "Russia's defense sector: An economic perspective" page 5, Swedish Institute of International Affairs
[9] See here, page 8 [ru]
[10] See "Lagging Production of Machine Tools and Parts Plagues Russian Military-Industrial Complex," Jamestown Foundation; "Assessing Russian plans for military regeneration" page 45, Chatham House.

MIC.[11] In addition, the regime undertook a concerted—but, ultimately, failed—effort to push back against corruption at the time that spending rose significantly around 2007.

These efforts, however, have not lived up to the Kremlin's lofty expectations.[12] Its dreams of civilian production accounting for half of the MIC have been sacrificed for the front's needs after the start of Russia's full-scale invasion of Ukraine. And in most cases, import substitution has raised costs in military production, further degrading the financial standing of MIC firms, and drained billions of dollars from the federal budget without managing to disentangle supply chains from sanctioning ("*unfriendly*," in the Kremlin's terminology) countries.[13]

Figure 1: Russian military spending and arms exports



Source: SIPRI,[14] KSE Institute

Note: SIPRI TIV is a unique pricing system (trend-indicator value) developed by SIPRI to measure the volume of deliveries of major conventional weapons.[15]

Nonetheless, Russia remains one of the very few countries that can produce the entire spectrum of military equipment[16] and, theoretically, conduct the full range of modern warfare.[17] It also remains one of the world's leading arms exporters, and was an exporter of conventional military equipment of all types during the 2010s, even under Western sanctions following the annexation of Crimea in 2014.[18] In fact, exports are far more lucrative for Russia's MIC than government contracts, and were the linchpin of optimistic growth forecasts in the pre-2022

[11] See here [ru]; "Crafting the Russian War Economy" pages 23-28, CNA
[12] See "Russia's defense sector: An economic perspective" page 5, Swedish Institute of International Affairs; "Assessing Russian plans for military regeneration" pages 45-46, Chatham House; "Crafting the Russian War Economy" pages 23-28, CNA; "The Future of the Russian Military: Russia's Ground Combat Capabilities and Implications for U.S.-Russia Competition" Appendix K, RAND; "Russia's defense sector: An economic perspective" page 10, Swedish Institute of International Affairs; Novaya Gazeta [ru]
[13] See "Competitiveness of Russia's Defence Industry: Weak but Steady" page 48, National Defence University. "Russia's 2024 Budget Shows It's Planning for a Long War in Ukraine," Carnegie Politika [ru]; "Crafting the Russian War Economy" pages 23-28, CNA
[14] See SIPRI Arms Transfers and Military Expenditure databases
[15] See "Sources and methods," SIPRI
[16] See "Crafting the Russian War Economy" page 11, CNA
[17] See "Russia Military Power" page 13, Defense Intelligence Agency
[18] See "Trends in International Arms Transfers, 2023," SIPRI

period.[19] But as military expenditures have skyrocketed[20] to finance the war in Ukraine, exports have fallen off a cliff, threatening Russia's market share abroad (see Figure 1).[21]

Russia's MIC receives funding that extends beyond the official categories for defense and security spending. In addition to direct allocations from the federal budget, other areas such as healthcare, which covers the rehabilitation of military personnel, and infrastructure construction, reflect military priorities.[22] Regional budgets also contribute to funding some of the MIC's needs. Furthermore, Russian MIC companies are increasingly relying on direct lending from banks and bond issuance on local capital markets.[23] Some of these bonds may even be purchased by the Ministry of Finance itself. Another significant potential source of funding comes from company arrears vis-a-vis the government.[24] Finally, individuals are also playing a role in supporting the war effort, with crowdfunding initiatives helping fund projects like drone production.[25]

Now, three years into its full-scale war against Ukraine, the Russian MIC faces three critical challenges. *First*, the sector has been deprived of its most profitable activity: exporting weapons. *Second*, it must operate in unfavorable macroeconomic conditions.[26] Most importantly, the cost of raising funds has risen sharply[27] despite MIC companies' likely access to subsidized lending, as Russia's central bank was compelled to raise interest rates to above 20% in response to persistently high inflation. In addition, the MIC faces acute labor shortages.[28] With such expensive financing and labor—made worse by market-breaking army sign-up bonuses[29] and the post-invasion exodus[30] of human capital from the country—costs have risen along with revenues. *Third,* sanctions have driven up operating costs by disrupting supply chains for MIC producers and by requiring compensating layers of intermediaries engaged in the circumvention of export controls. While sanctions could always be better targeted or enforced, they have had a measurable effect in reducing Russia's ability to source high-priority goods.[31] Previous research has shown the circuitous routes that Russian supply chains are now forced to take.[32] China's role is discussed in more detail in Section IV of this report.

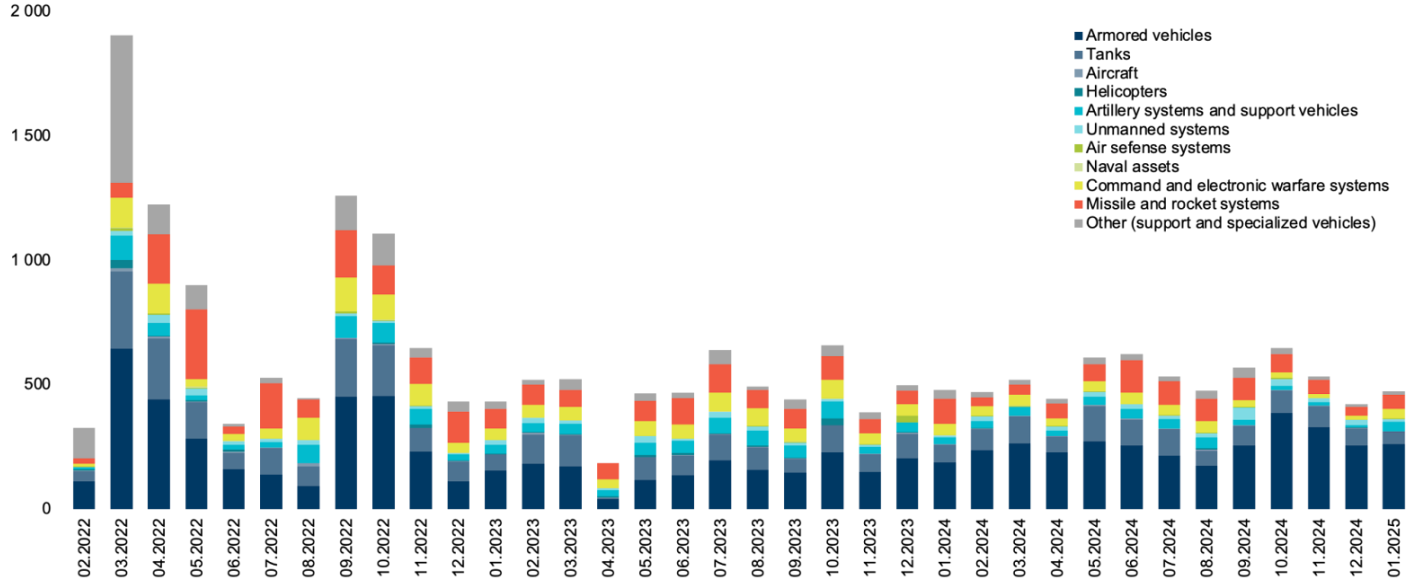
[19] See "Russia's defense sector: An economic perspective" page 13, Swedish Institute of International Affairs; "Rostec 2023 Financial Data Illustrates State of Russian Military-Industrial Complex," Jamestown Foundation
[20] See "Russia's 2024 Budget Shows It's Planning for a Long War in Ukraine," Carnegie Politika [ru]; "Another Budget for a Country at War: Military Expenditure in Russia's Federal Budget for 2024 and Beyond," SIPRI; "The War Tax in Russia," Wilson Center; "The Military Balance 2024," IISS, page 172; "Russian Offensive Campaign Assessment, September 29, 2024," ISW
[21] See "Back in Stock? The State of Russia's Defense Industry after Two Years of the War" page 33, CSIS; "Seller's Remorse: The Challenges Facing Russia's Arms Exports" pages 1-6, CSIS
[22] See "Russia's Unprecedented War Budget Explained," Wilson Center
[23] See "Russia's Hidden War Debt," Navigating Russia
[24] See RBC [ru]
[25] See "Dangerously Smart: Russia's Independent Attack Drone Developers," Forbes
[26] For regular updates on the Russian economy, see KSE Institute's Russia Chartbook, published monthly here.
[27] See Rostec head Sergey Chemezov's ongoing feud with the Russian Central Bank, here [ru]
[28] See "Russia's acute labor shortage," The Bell; "Russia's war economy leaves businesses starved of labour," Financial Times; "Crafting the Russian War Economy" pages 5-8, CNA; "Russia's Military-Industrial Complex Struggles with High Employee Turnover," Jamestown Foundation; "Workforce Shortages Plague Russian Arms Manufacturing," Jamestown Foundation; "Russian Military Keynesianism: Who Benefits from the War in Ukraine?" Russia Matters; Vedomosti [ru]; Vedomosti [ru]; RBC [ru]
[29] See Radio Free Europe-Siberia [ru]; BBC Russian Service [ru]; Meduza [ru]
[30] See "Since the beginning of the war around 650 thousand people left Russia and did not return," The Bell [ru]
[31] See "High-Priority Battlefield Items and Television Sets—How Sanctions Reduced Russians' Access to Goods," Bank of Finland, page 19; "Ore to Ordnance: Disrupting Russia's Artillery Supply Chains" page 65, Open Source Centre and RUSI
[32] See "The Challenges of Export Controls Enforcement," KSE Institute

Current Capacities

Russia's invasion of Ukraine has been marked by challenges that have severely undermined its military capabilities. The war has exposed chronic equipment shortages and logistical obstacles. As a result, Russia has increasingly relied on outdated Soviet-era equipment,[33] even as modern anti-tank weapons, drones, and precision strikes have decimated its armored convoys. High daily casualty rates—estimated at approximately 1,500 soldiers per day[34]—have further eroded operational effectiveness, complicating efforts to replace experienced personnel and maintain unit cohesion.

Visual confirmations indicate that Russia lost nearly 10,000 armored vehicles (including tanks) by the end of January 2025 (see Figure 2). While these losses are significant, the evolving dynamics of a transparent battlefield and the limited operational advantage of heavy armor in modern conflicts temper optimism regarding these figures. Concurrently, Russia is adapting to the new conditions by actively expanding its capacities and increasing the production of both battlefield weapons and those used in terroristic attacks across Ukraine.

Figure 2: Russian equipment losses, in units



Source: Oryx,[35] KSE Institute

Ground Forces

Russia's ground forces have incurred the highest personnel and equipment losses among all military branches. Assault-oriented regiments, crucial for maintaining operational momentum, have been particularly hard-hit. These regiments are often replenished with poorly trained mobilized conscripts, exacerbating concerns over combat readiness. Due to the quality deficit, these forces typically require a substantial numerical and technological advantage to breach Ukrainian defenses. As a result, Russian assaults are heavily dependent on

[33] As one Russian military expert stated: "This is, from an equipment point of view, the last war of the Soviet Union." From "Assessing Russian Weapons Stocks: How Will They Shape the Russo-Ukrainian War in 2025?", The Russia Contingency with Michael Kofman
[34] See "UK chief of defence staff calls on government to spend more on military," BBC. For more on total losses, see "Combat losses and manpower challenges underscore the importance of 'mass' in Ukraine", IISS, and BBC Russian Service [ru]
[35] See "Attack on Europe: Documenting Russian Equipment Losses During the Russian Invasion of Ukraine," Oryx

the availability of armored vehicles—specifically armed personnel carriers (APCs), infantry fighting vehicles (IFVs), and tanks—which have become critical to the success of advances on the battlefield.[36]

Huge equipment losses are confirmed by Oryx, which tracks them based on photographic evidence (see Figure 2). Satellite imagery of Russian military depots further substantiates Oryx data, revealing that Russia currently holds only 47% of its pre-war tank reserves.[37] The imagery also highlights a significant depletion of newer T-90 and T-80 tanks, while a considerable portion of older T-72 and T-64 models remain in stock.[38] Russia's MIC has managed to partially offset these significant losses. According to the Kiel Institute, Russian tank production surged from 123 units in Q4 2022 to 387 in Q2 2024—a 215% increase. This is largely attributed to the refurbishment of aging Soviet-era models, such as the T-62 and T-55.[39] Satellite imagery of Russian military storage facilities corroborates this trend: as of April 2023, 3,911 older tanks were recorded in storage, and by October 2023, 3,529 remained—indicating the restoration and likely redeployment of 382 units for active combat.[40] While the production of modern tanks remains limited, it is estimated that Russia is capable of producing approximately 15 T-90M tanks per month, with these representing a small fraction of overall output.[41]

In the lighter armored vehicle category, Russia's MIC has also managed to replenish its stock. According to the Kiel Institute, production of light armored vehicles increased by 141% between Q4 2022 and Q2 2024, with 1,409 units produced in the second quarter of 2024. Similar to tank production, around 80% of these vehicles are retrofits of older models. Satellite imagery reveals that Russia holds 52% of its pre-war IFV reserves and 45% of its pre-war APC reserves. Despite its reliance on large stockpiles, the Russian MIC appears to also be expanding its production capabilities and optimizing output of modern armored vehicles (e.g., BMP-3 IFV, Typhoon APC), suggesting that Russia may be poised to maintain or even increase production rates.[42]

Artillery

A critical component of the Russian ground forces is their artillery, which plays a pivotal role in supporting infantry advances. The quantitative superiority of both artillery platforms and ammunition is essential to Russia’s war effort. Unlike other equipment in the Russian arsenal, artillery has experienced relatively lower attrition rates (see Figure 2). Additionally, losses tend to decrease with the range of the artillery system—longer-range units are less prone to destruction or capture, reducing the need for high production rates to sustain their numbers.[43] According to the Kiel Institute, in Q2 2024, the Russian MIC produced 112 units of barrel artillery (towed and self-propelled), along with 38 multiple rocket launchers, marking a roughly 150% increase in production compared to Q4 2022.[44] While the Russian MIC has been able to partially offset artillery losses, it has also turned to external sources for replenishment. Specifically, Russia has relied on artillery systems supplied by North Korea, which are compatible with its own Soviet-era systems. Ukraine’s defense intelligence reports that Russia has received over 100 units of various artillery systems from North Korea, including large-caliber self-propelled

[36] See “Assessing Russian plans for military regeneration,” Chatham House
[37] For a more detailed discussion of the relevance of counting tanks in storage, see “Assessing Russian Weapons Stocks: How Will They Shape the Russo-Ukrainian War in 2025?”, The Russia Contingency with Michael Kofman
[38] See “Assessment of Russia’s Military Capabilities on the Eve of 2024,” Ukrainian Security & Cooperation Center
[39] See “Fit for war in decades: Europe’s and Germany’s slow rearmament vis-à-vis Russia,” Kiel Institute
[40] See “Assessment of Russia’s Military Capabilities on the Eve of 2024,” Ukrainian Security & Cooperation Center
[41] See “Assessing Russian plans for military regeneration,” Chatham House
[42] See “Assessment of Russia’s Military Capabilities on the Eve of 2024,” Ukrainian Security & Cooperation Center; “Russian Offensive Campaign Assessment, December 23, 2024,” ISW
[43] See “Assessing Russian plans for military regeneration 2024,” Chatham House
[44] See “Assessment of Russia’s Military Capabilities on the Eve of 2024,” Ukrainian Security & Cooperation Center

artillery and multiple rocket launchers. This external support, alongside domestic production, helps mitigate losses sustained by Russia's artillery forces.[45]

The Russian armed forces have established a baseline firing rate of 10,000 shells per day to maintain offensive capabilities on the battlefield. However, Russia's domestic artillery shell production capacity is estimated to be a maximum of 3.5 million shells per year, meaning that the current firing rate is only barely sustainable. An important factor in this equation is Russia's gradual shift towards increasing the production and use of precision-guided munitions (PGMs), such as the Krasnopol laser-guided artillery shell. These munitions enhance targeting accuracy, thereby improving the overall effectiveness of Russian artillery. Additionally, according to Ukraine's defense intelligence, as of November 2024, North Korea has supplied over 5 million artillery munitions to Russia, further bolstering its shell reserves and augmenting its artillery capabilities.[46]

Navy

At the beginning of 2022, the Russian Navy was one of the largest in the world, comprising numerous surface ships, submarines, and naval aviation. Particular attention was given to the modernization of nuclear-powered ballistic missile submarines, including the Borei-A and Yasen-M classes. The construction of multi-purpose frigates of Project 22350 Admiral Gorshkov, corvettes of Projects 20380 and 20385, and the expansion of amphibious capabilities with new universal landing ships also continued.

Russia's naval modernization has been hindered by combat losses and international sanctions. Sanctions limited access to advanced technologies, complicating ship production and modernization. Additionally, losses in the Black Sea Fleet, including the destruction of the flagship "Moskva" and several other vessels, significantly reduced the combat capability of this operational formation. Shipbuilding remains slow, with few major additions. Since 2022, Russia has introduced one Borey-A submarine, one Buyan-M corvette, and one Alexandrit-class vessel, along with two Project 20380 frigates. Larger surface vessels are being phased out, while smaller frigates like the Gorshkov and Steregushchiy classes are prioritized for global deployments.

Information on losses by the Russian navy are somewhat contradictory: While IISS[47] estimates that Russia has lost almost no ships, Oryx indicates the damage and destruction of 22 vessels across multiple classes.

Airforce

The Russian Air Force includes aviation, anti-aircraft missile, and radio engineering troops, as well as specialized units: reconnaissance, communications, electronic warfare, engineering, and search and rescue. In 2015, the Air Force merged with the Aerospace Defense Forces, forming the Aerospace Forces. Russia continues to modernize its nuclear and conventional weapons, but Western sanctions restrict access to key components, complicating the production of some types of weaponry.[48] As of early 2022, Russia had the second-largest military aircraft fleet in the world and maintained this position in 2024.[49]

Military experts estimate the losses of Russian aviation as insignificant, placing losses at 10% of the total fleet (see Figure 2).[50] The General Staff of the Armed Forces of Ukraine reports[51] that since the start of the full-scale

[45] See "How many ballistic missiles and artillery systems North Korea has supplied to Russia," TSN.ua
[46] See "Fit for war in decades: Europe's and Germany's slow rearmament vis-à-vis Russia," Kiel Institute; "How many ballistic missiles and artillery systems North Korea has supplied to Russia," TSN.ua
[47] See "The Military Balance 2024," IISS
[48] See "The Military Balance 2025," IISS
[49] See "World Air Forces Directory 2025," Flight Global
[50] See "Russian Air Force Has Lost 10 Percent of Fleet in Ukraine," Air & Space Forces Magazine
[51] See Ukrainian General Staff Facebook page for regular updates.

invasion, Russia has lost 369 aircraft and 329 helicopters of various classes, including those damaged at bases on Russian territory. Altogether, Russia manages to maintain the number of combat aircraft at a stable level—2,204 in 2022, 2,096 in 2023, and 2,119 in 2024.[52] The same is true for helicopters, for which the corresponding numbers are 952, 878, and 841. Due to international sanctions, the Russian aviation fleet is currently being replenished almost exclusively through domestic production.[53]

According to official data from Rosstat, the production of aircraft and spacecraft has shown steady growth over the past three years with an average annual growth rate of 18%.[54] However, it is important to note that these figures are reported in Russian rubles, and when adjusted for inflation, the real values are lower. In addition to classic military aircraft, Russia is gradually increasing its production of UAVs. According to a CNN investigation, the primary production facilities for strike UAVs in Russia (Alabuga, in Tatarstan) have expanded their production area by 55%. Citing Ukrainian intelligence sources, CNN reports that in 2023 the plant produced 2,738 Shahed ("Geran") drones. In the first nine months of 2024, this number more than doubled, reaching 5,760 units.[55] As reported by the Russian Ministry of Defense, as of mid-2024, Russian UAV manufacturers had reached a total production capacity of approximately 4,000 drones of all types per day.

[52] See “The Military Balance 2025,” IISS
[53] See “The Military Balance 2025,” IISS
[54] See Rosstat [ru]
[55] See “Russia is intensifying its air war in Ukraine. A secretive factory is ramping up drone production to fuel the offensive,” CNN

II. Russia's Military Industry: Key Players

The demands of the battlefield have led to a vast military-industrial complex that grows at the expense of the broader civilian economy. Despite its top-heavy nature and domination by large groups such as Rostec and their sprawling webs of subsidiaries, the sector has not evolved in a centrally-planned or uniform manner. Sanctions and resulting supply chain shifts have affected parts of the sector differently, and older entities still play a more prominent role than newly-established ones. Still, production capacities are expanding to support Russia's war of aggression. Many enterprises crucial to the armaments production cycle remain unsanctioned three years into the full-scale invasion.

Mapping the Russian MIC

The primary challenge with analyzing Russia's MIC lies in synthesizing fragmented information into a cohesive picture that can overcome confidential and incomplete data. We adopt an innovative bottom-up approach that analyzes companies' financial and legal ties. By identifying specific entities known to be involved in military production, we establish reference points for querying datasets, including financial records, employment statistics, procurement contracts, and cargo flows (see Table 1). We then aggregate the entity-level data to construct an extensive network that forms the analytical foundation of this report (and the ones that will follow in this series). Our focus on financial and legal ties offers key advantages. While macro-level information can be partially classified or ambiguous, and direct assessments of military output require extensive on-the-ground intelligence, legal entity data provide a more structured and verifiable source of information.

Table 1: Data sources

Data	Source
Sector	Single State Register of Legal Entities
Registration date	Federal Tax Service
Assets, revenues, profits	Financial statements submitted to Federal Tax Service
Employment, salaries paid	Federal Tax Service
Geographic location	Geographic coordinates of registered addresses of main offices, branches, and affiliates
Corporate affiliation	Registered founders or administrative entities
Procurement	Contacts published at single information system (EIS) on public procurement
Shipments	Transportation data collected from various sources

This analysis examines the internal structure and connections of the MIC based on a proprietary database of 5,546 companies, including 3,464 active enterprises and 858 army entities. The study encompasses a wide range of sectors, including weapons manufacturing, aviation, explosives production, component manufacturing, maintenance, research and development, as well as associated holdings, IT hubs, and trading entities. Industry knowledge and expertise on the Russian economy guided decisions on sectoral and group-specific inclusions.

An entity's affiliation with the MIC can often be defined due to its sector of activity. For example, it is rather straightforward that a weapons manufacturer should be designated as an MIC entity. But it is much less clear for an IT firm. In the case of the former, we rely on OKVED[56] economic activity codes; for the latter, we use

[56] OKVED [ru] is a hierarchical list of business activities that companies select during their registration.

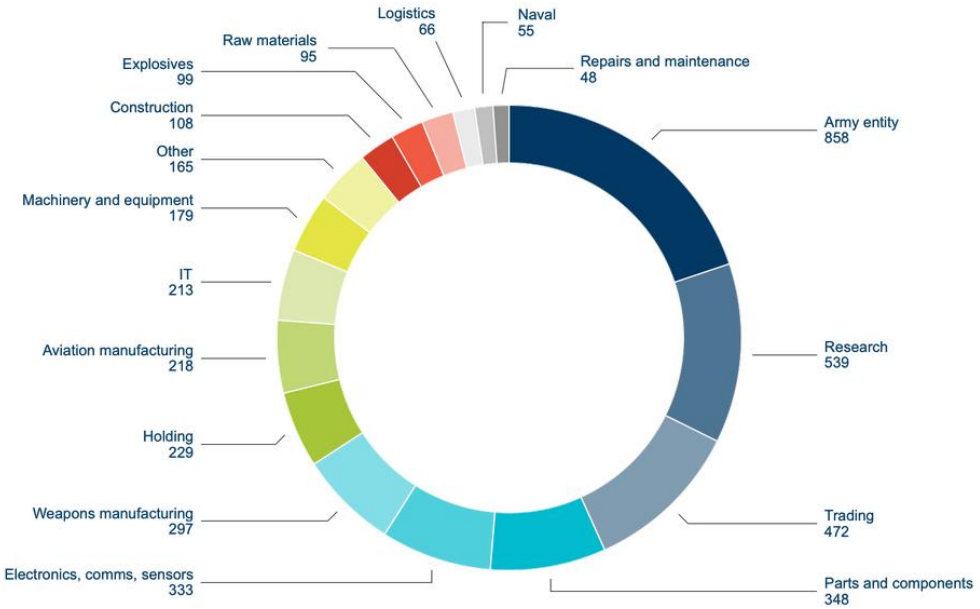
owners' or administrators' legal ties to known MIC entities to trace the firm's affiliation, as well as the customer-supplier relationship visible in the public domain. While this likely leads to an undercount of auxiliary industries, it reduces the false positive rate and avoids overstating the military nature of civilian sectors. Additionally, all entities with activity codes related to security and enforcement agencies, as well as economic, procurement, and logistics subunits of the Russian army were included into our database to fully represent the demand side of the industry. As a rule, our analysis remains considerably closer to a lower bound estimate.

Certain corporate groups, such as the state-owned behemoths Rostec and Almaz-Antey, also warrant additional scrutiny. Firstly, because of their omnipresent involvement in military supply chains, their entities are included[57] in our database, even though they also make civilian products. For example, engine making plants that are Rostec subsidiaries, as well as Kamaz, a Rostec-owned entity that can supply automotive parts, are designated as MIC entities. Secondly, clusters of interrelated, opaque LLCs under the Rostec umbrella are generally considered to be MIC entities, particularly when they operate as suppliers in public contracts.

Sectoral Composition

The Russian military-industrial complex is broadly divided into two parts: the demand side, which is made up of 800+ active army entities and bases, and the supply side, which represents the remaining three quarters of our database (see Figure 3). Army entities are highly dispersed in Russia (see Figure 4), varying significantly across geography and organizational structures, while non-army ones on the supply side are more heavily concentrated in Western regions of Russia (see Figure 5). Disclosure of financial data and public procurement requirements are, naturally, far more opaque for army entities than for other corporations. The supply side of the MIC eventually caught up to the demand side's secrecy, however, with total reported public procurement in our database falling by 65% between 2021 and 2023. Since military expenditures continued to rise, it is safe to say that this decline is attributable not to a fall in production but a shift from public to confidential procurement.

Figure 3: Sectoral composition of MIC entities



Source: Single State Register of Legal Entities, KSE Institute

[57] There are exceptions to this rule. For example, Rostec's Kaliningrad Amber Combine is excluded due to its civilian nature.

Figure 4: Geographic locations of army entities

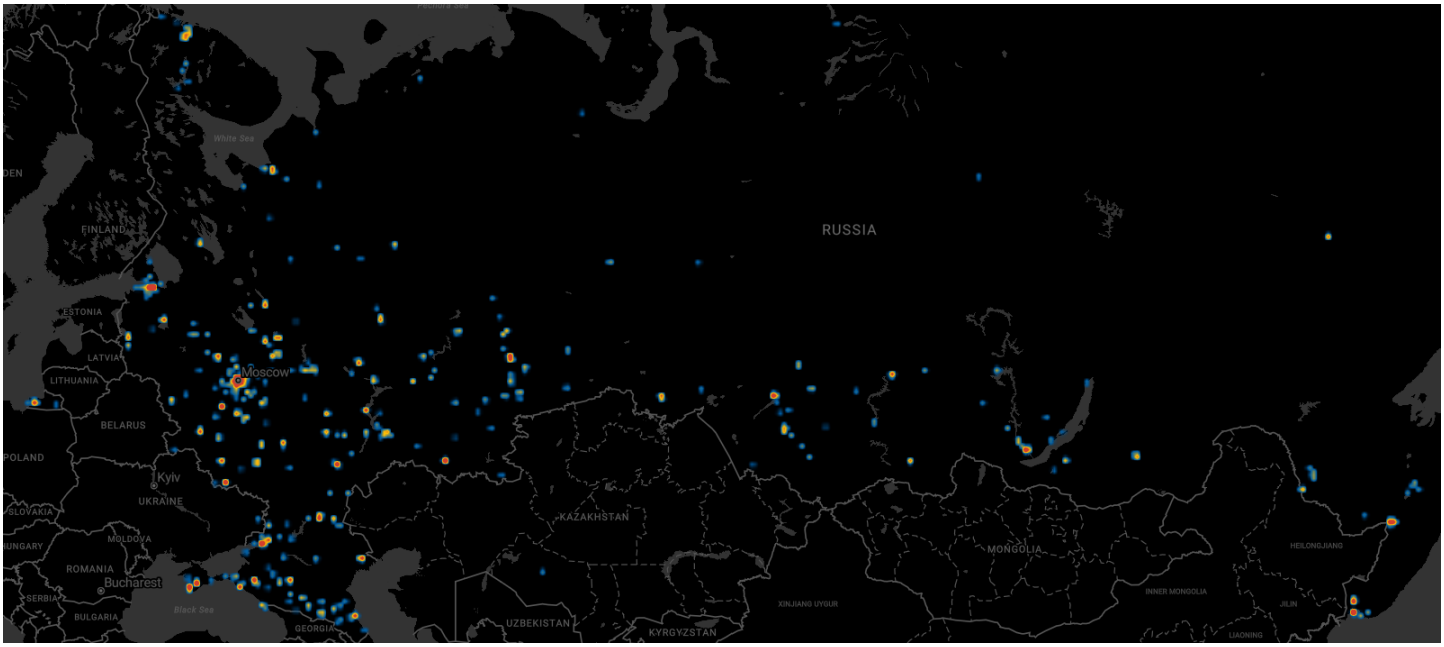
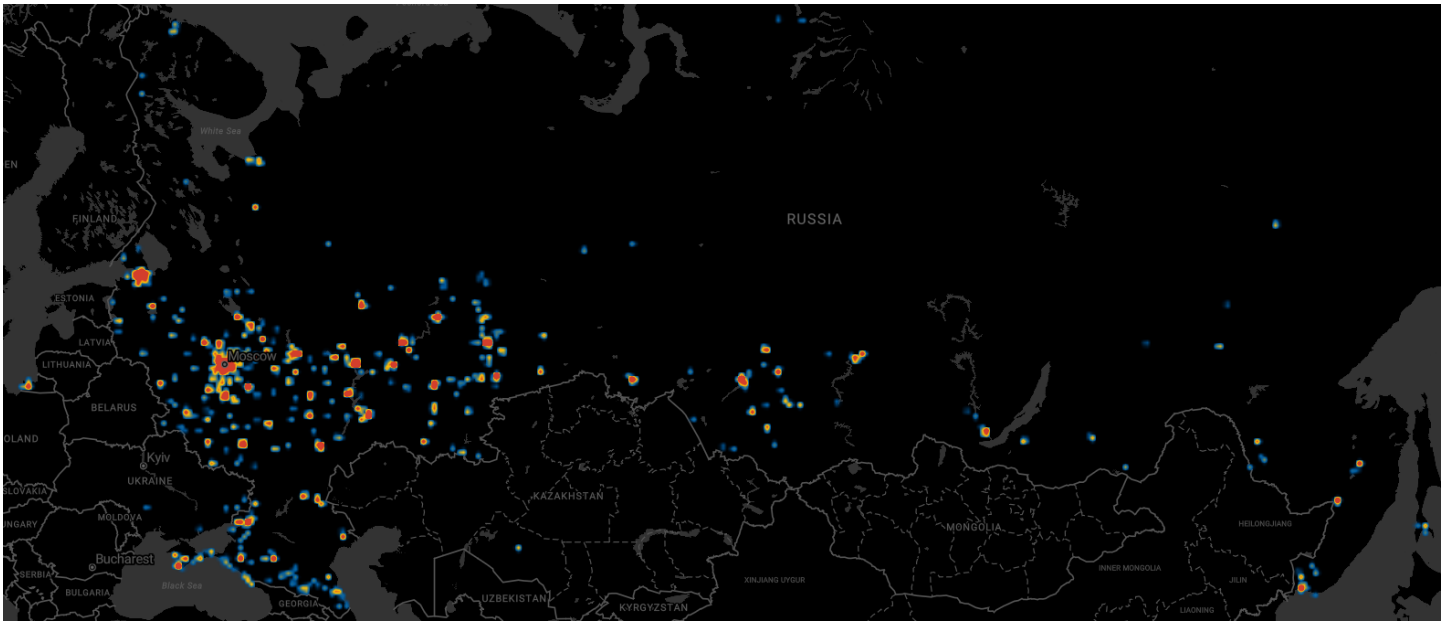


Figure 5: Geographic locations of non-army MIC entities



Source: KSE Institute

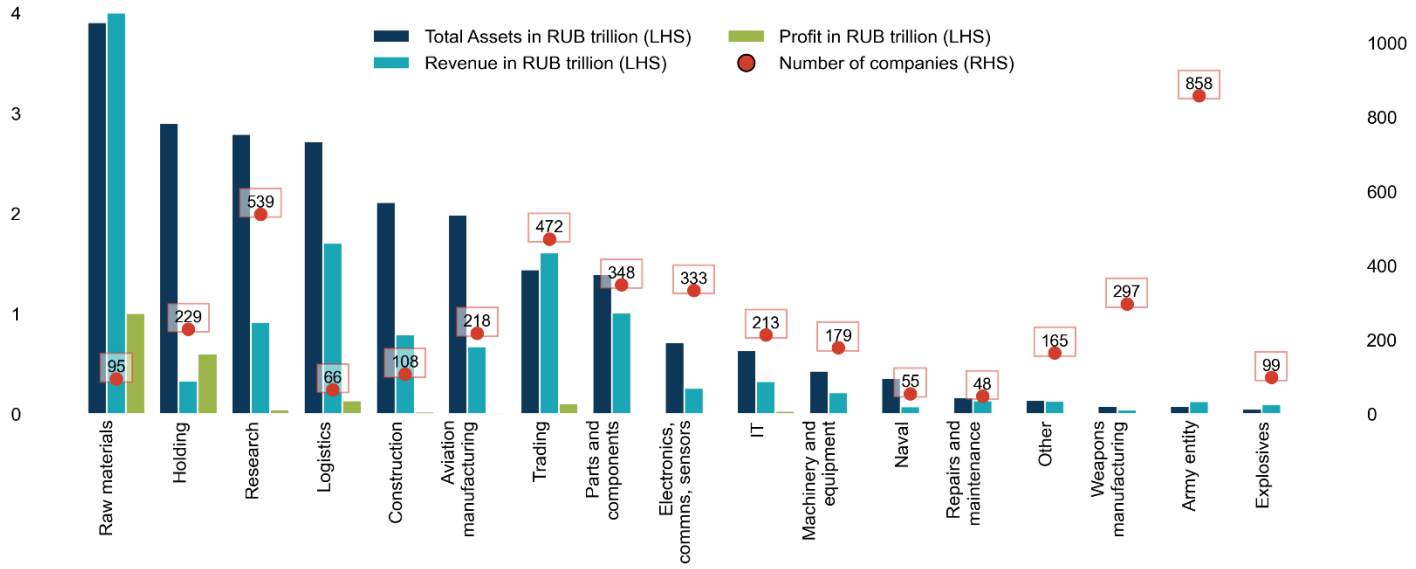
Note: Heatmaps based on density of number of entities.

The supply side is distinctly more concentrated and top-heavier than its customers. In the aviation sector, for example, a mere 13 companies own 85% of assets and are significant players in public procurement. This trend—a concentrated core of influential companies within a broader ecosystem of smaller entities—is far from unique. Weapons manufacturers, trading, and construction companies have concentration ratios[58] between 83% and 87% (see Figures 6 & 7). Holding companies, such as Rostec, consolidate the industry's property rights and

[58] Defined as the percentage of assets in the hands of the top 5% of enterprises.

therefore have high average asset values and the most active participation in procurement. The immense wealth and influence in the hands of a small number of holding companies has significant implications for the overall structure and centralization of the MIC, as well as its vulnerability to sanctions.

Figure 6: Number of entities and financial indicators by sector



Source: Federal Tax Service, KSE Institute

Figure 7: Key indicators by sector (excluding army entities), in rubles

Sector	Public contracts as customer	Public contracts as supplier	Latest assets	Number of companies	Average contracts per company	Average assets per company	% of assets in top 5% of companies	% of assets in corporate groups
Raw materials	71bn	23bn	3,910bn	95	2bn	52,833M	61%	6%
Holding	771bn	97bn	2,903bn	236	21bn	22,676M	76%	84%
Research	1,146bn	340bn	2,795bn	543	5bn	8,816M	66%	68%
Logistics	130bn	29bn	2,724bn	66	6bn	53,405M	62%	45%
Construction	300bn	107bn	2,003bn	109	9bn	25,675M	86%	62%
Aviation manufacturing	598bn	122bn	1,992bn	220	10bn	17,788M	80%	92%
Trading	36bn	42bn	1,441bn	475	1bn	5,057M	83%	12%
Parts and components	110bn	105bn	1,395bn	348	2bn	5,888M	68%	52%
Electronics, comms, sensors	49bn	18bn	715bn	335	1bn	3,070M	67%	34%
IT	93bn	92bn	635bn	214	2bn	4,535M	68%	43%
Machinery and equipment	62bn	16bn	431bn	179	2bn	3,267M	61%	21%
Naval	350bn	63bn	360bn	55	15bn	15,658M	68%	9%
Repairs and maintenance	19bn	9bn	168bn	48	1bn	4,412M	57%	35%
Other	11bn	20bn	138bn	167	1bn	2,007M	71%	60%
Weapons manufacturing	315bn	47bn	79bn	299	3bn	1,270M	87%	36%
Explosives	60bn	0bn	52bn	101	4bn	1,166M	49%	9%
Total	**4,122bn**	**1,130bn**	**21,741bn**	**3490**	**4bn**	**10,742M**	**83%**	**49%**

Source: KSE Institute

Note: Public contracts were gathered over 2014-24. Latest asset numbers are from the most-recent annual financial statements between 2018 and 2023.

As a whole, the Russian MIC remains predominantly focused on heavy industry, while research and electronics companies account for just 16% of the sector's total assets. The MIC-related IT sector is also quite small, despite Russia's large civilian IT industry, accounting for only a negligible proportion of the total. The raw materials sector, which straddles the line between civilian and military, leads in terms of both total assets, total revenues,

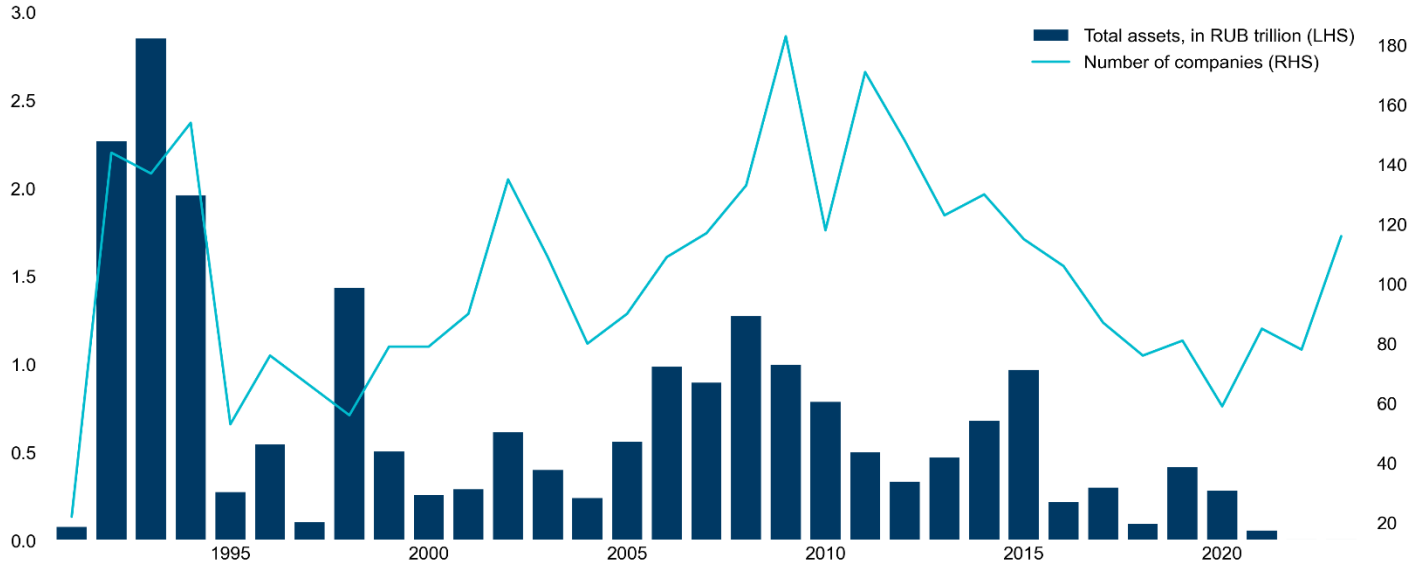
and total profits. In contrast, holding companies[59] and research entities have high asset levels but proportionately lower revenues. It is reasonable to assume that profits of the enterprises are upstreamed and retained at the holdings level. On the other end of the spectrum, electronics, IT, and machinery companies cover a relatively small portion of the overall military-industrial asset base. Weapons manufacturers, naval, and army entities are generally underrepresented in this analysis because their financial statements are classified.

Performing the comprehensive time series financial analysis for the entire military industry is also challenging because the number of MIC companies publishing their financial statements has been decreasing since 2018 (see Appendix Figure 1). Even this limited data, however, point to two trends: a mounting pile of debt in the holdings sector in 2022, and war-driven profits of logistics and construction companies (see Appendix Figure 2). A similar lack of transparency is notable in the employment statistics. Analyzing the subset of companies with available records shows that the MIC has remained competitive on the labor market by offering twice the average market salary, particularly in IT, logistics, and research sectors (see Appendix Figure 5).

New vs. Old Entities

Dividing MIC entities by registration date, we can see that the sector is still dominated by companies that are two to three decades old. The explosive growth of newly incorporated companies in the mid-2000s that accompanied the Kremlin's reform efforts led to a widening of the sector but not necessarily a deepening of it. Of the 4,322 companies that remain active today in the military-industrial complex, the majority—54% of companies representing 76% of the current asset base—were registered before 2010 (Figure 8).

Figure 8: Active MIC companies by registration date and total assets



Source: Federal Tax Service, KSE Institute

The sectors with the highest concentration of assets in pre-2010 companies are: machinery and equipment (91%), aviation (82%), parts and components (79%), and research (70%). IT and electronics are comparatively newer sectors with 43% and 47% of companies by assets registered before 2010, respectively. However, both of these sectors combined represent only 6% of the current assets of all MIC entities.

[59] Entities with activity types such as group asset and financial management, leasing, as well as consulting.

Based on this data, there are five distinct phases of the Russian MIC's evolution. The *Post-Soviet Transformation Period* (1991-1994) saw a chaotic restructuring following the USSR's collapse, marked by a surge in company registrations and asset redistribution, particularly in raw materials enterprises like MMK and Severstal. The *Market Consolidation Period* (1995-2004) brought stabilization, with moderate growth in registrations and a more structured military-industrial framework. A push for *Modernization and Reform* (2005-2011) led to increased company formations and asset expansion, most notably the establishment of the United Aircraft Corporation (*OAK*) in 2006 and Rostec in 2007, as well as a 2009 surge in entity turnover due to military reforms. The *Maturation Period* (2012-2020) signaled structural completion, with slowing registration rates and entrenched industry leaders. Most recently, the *Wartime Adaptation Period* (2021-2024) has driven a resurgence in new registrations, particularly in aviation and UAV production, as the sector adapts to the demands of war and the challenges of international isolation. For instance, Unmanned Technologies LLC, BTM, Horizon-Aero, and KB Valkiria, sanctioned by the US in October 2024, were established in 2022-2023. Out of the 423 registrations in 2021-2024, 46 fall under the Rostec group.

This trajectory highlights the MIC's transformation from post-Soviet disarray to a consolidated and modernized system now pivoting toward wartime production and technological expansion. It remains dominated by the same handful of corporate groups that have swallowed up all competition for the past two decades.

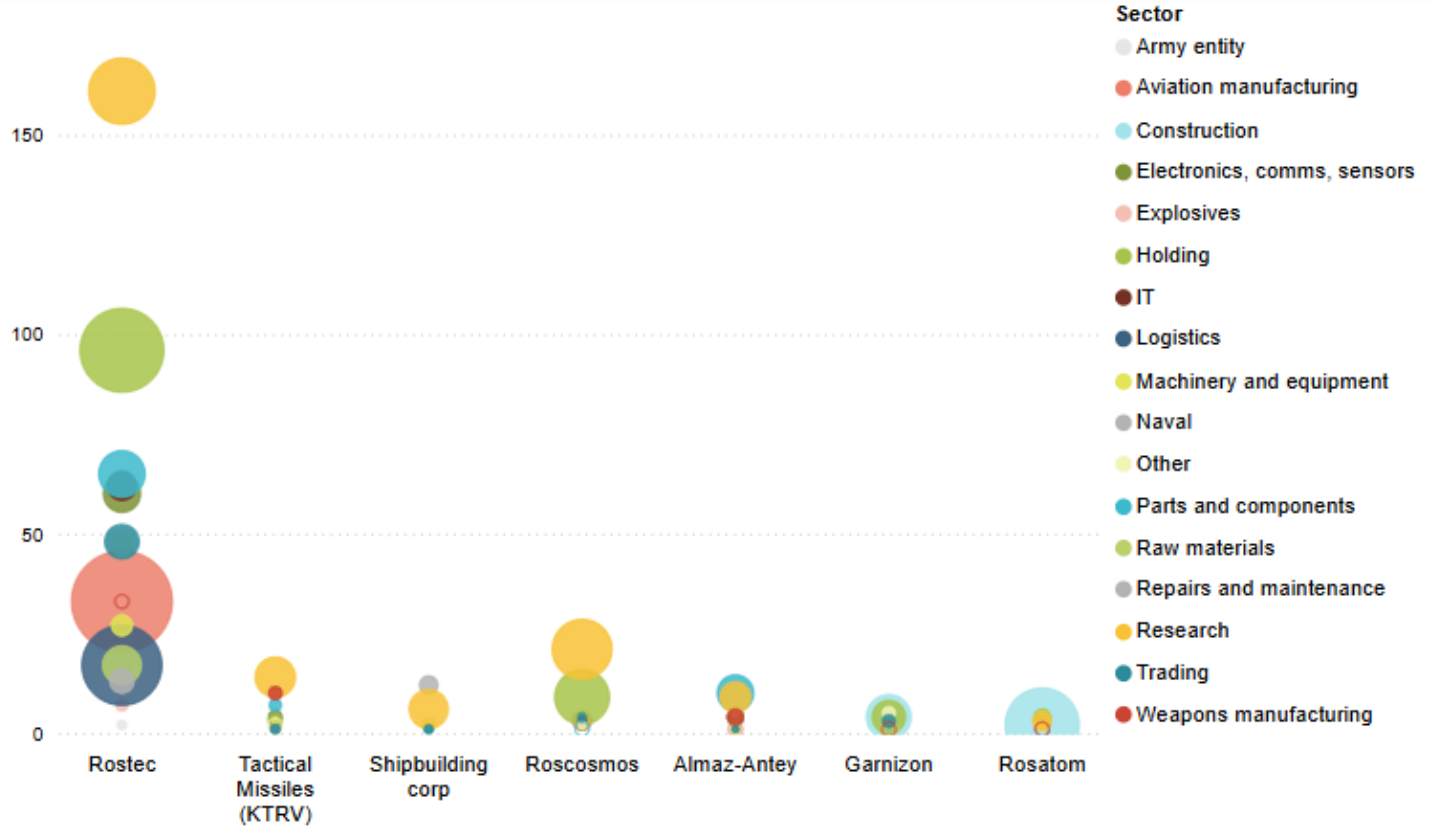
Corporate Groups

The Russian MIC is organized into corporate groups and dominated by a handful of such entities with strong governmental ties. 52% of total assets are concentrated within the top-ten groups, underscoring the oligopolistic nature of the industry. State-owned entities like Rostec, Almaz-Antey, KTRV, Roscosmos, and Rosatom feature prominently, indicating significant state involvement and control over critical sectors (see Figure 9). The largest corporations (e.g., Rostec) are vertically integrated and diversified across multiple sectors. Smaller and more specialized KTRV and Almaz-Antey design and produce missiles, while Yakovlev focuses solely on aviation manufacturing and GUOV specializes in construction. Group OPK and its 182 companies encompass electronics, communications, research and IT sectors, and are led by Roselektronika, Vega, and Sozvezdie. Rosatom and Roscosmos are in essence military enterprises developing nuclear and conventional weapons and delivery systems. Despite the outsized importance of just a few major corporate groups, there is no one-size-fits-all approach to all sectors of the Russian MIC. This diversity suggests a complex ecosystem of interdependent companies, each playing crucial roles in the overall MIC.

Many sectors are highly concentrated. In the weapons manufacturing sector, key players like Almaz-Antey, KTRV, High-Precision Complexes, and Uralvagonzavod dominate. The aviation sector sees major players such as OPK Oboronprom, Yakovlev, and OAK, alongside a mix of large conglomerates and smaller specialized entities. The research sector also shows a high concentration of corporate groups, including Roscosmos and Almaz-Antey. On the other end of the spectrum, the parts, components, and inputs sector has a wide distribution of companies. Ranging from large conglomerates to smaller specialized entities, they collectively make up a complex supply chain network. This can provide resilience, particularly in the face of sanctions, but may also result in a less streamlined, harder to manage sector. The reliance on numerous suppliers, particularly for critical components, raises potential concerns about supply chain disruptions, quality control issues, and bottlenecks. This is especially true for high-tech manufacturing and electronics largely imported from abroad.[60] Forthcoming reports will devote greater attention to the MIC supply chains in Russia.

[60] See "Russia's Military Capacity and the Role of Imported Components," KSE Institute

Figure 9: Assets and number of companies by corporate group, number of entities



Source: KSE Institute

Note: Bubble radius reflects relative size by assets.

Rostec

Founded by presidential decree in 2007, Rostec is a highly diversified conglomerate of over 800 companies that operate across twelve different sectors (see Figures 10 & 11). As the largest corporate group in terms of assets and sectoral spread, it is a crucial player in both civilian and military industries. It has been led by the ex-KGB operative and long-time friend of Vladimir Putin's, Sergey Chemezov, since late 2007. Rostec is, by design, the largest and most influential corporate group in the Russian MIC. As Chemezov informed Putin in August 2023, 90% of all production used in the war effort allegedly comes from Rostec entities, while approximately half of the country's military procurement flows through Rostec.[61] In 2023, Rostec was the seventh largest arms producer in the world based on revenues, behind five US-based companies and one from the UK, and its revenues saw an almost 50% increase vs. the previous year.[62]

Rostec is more diversified now than it was a decade ago. In 2017, Putin ordered the corporation to increase its share of dual-use and civilian production from 25% to 50% by 2025.[63] According to Chemezov, Rostec reached the 45% mark before the full-scale invasion, but has since slid back to 35% due to booming demand for military production.[64] Regardless of the veracity of Chemezov's claims, the civilian and dual-use portion of Rostec does not only diversify its portfolio for peacetime and maintain a pretense of self-sufficiency, but also makes up for

[61] See Kremlin [ru]
[62] See "SIPRI Arms Industry Database," SIPRI. As discussed below, this is partially due to its 2022 revenue decline.
[63] See TASS [ru]
[64] See here [ru]

slim margins on military procurement contracts. With the economy on a war footing, however, there is little room for MIC corporations, including Rostec, to expand their civilian production.[65]

Figure 10: Rostec corporate ties

Source: KSE Institute

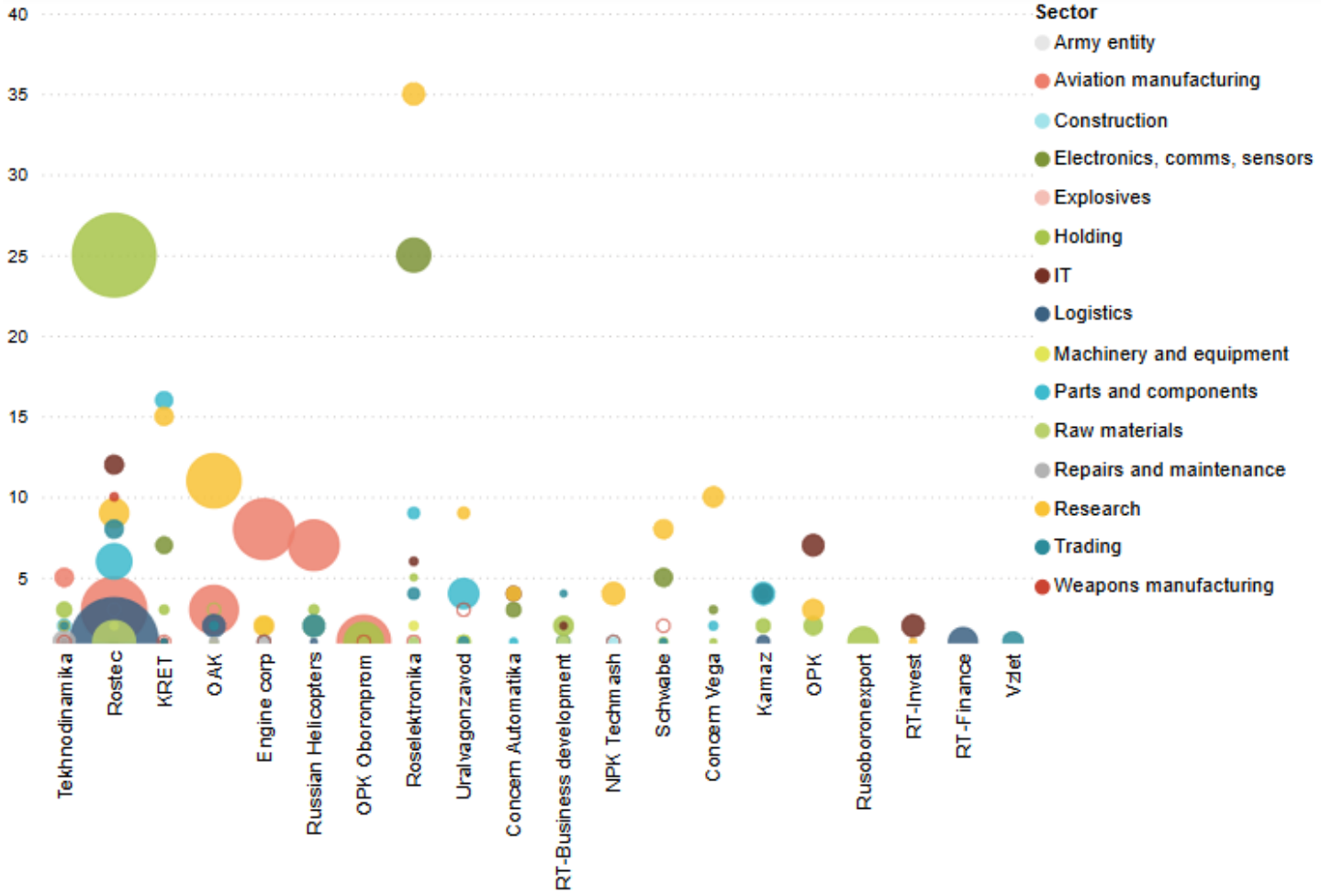
In spite of the newly militarized economy, Rostec's revenues fell in real terms in 2022. Aside from ruble depreciation and increased manufacturing costs associated with sanctions, this was due to a significant loss of arms export revenues.[66] These have traditionally been a source of financial stability for the Russian MIC[67] but have been drastically reduced since February 2022. Counterintuitively, as one expert notes, a lengthy war in Ukraine is not necessarily desirable for Russia's largest arms manufacturer.[68] Massively expanded government contracts may *hurt* Rostec's bottom line if they come at the expense of more lucrative exports.

Another threat to Rostec's business model comes from high interest rates. With an overheating economy and a central bank trying to rein in inflation, interest rates topped 20% in late 2024. In an October 2024 presentation to Russia's Federation Council, Chemezov claimed that most of the military-industrial complex's businesses—a significant proportion of which fall under his purview—have become unsustainable or unprofitable. He warned that it is unprofitable for companies to use debt financing to fund the 60%+ of production costs not covered by a

[65] See Vedomosti [ru]
[66] See "Russia's 2024 Budget Shows It's Planning for a Long War in Ukraine," Carnegie Politika [ru]
[67] See "Russia's defense sector: An economic perspective" page 4, Swedish Institute of International Affairs
[68] "Rostec 2023 Financial Data Illustrates State of Russian Military-Industrial Complex," Jamestown Foundation

contract's advance payments. This problem is particularly acute for companies with long production cycles of a year or more.[69] His pleas for lower interest rates attest to the precarious financial situation that much of the military-industrial complex faces, despite the top-line military expenditures that suggest a booming industry.

Figure 11: Top-20 groups within Rostec, number of entities



Source: KSE Institute

Note: Bubble radius reflects relative size by assets. Some entities are directly owned by the Rostec parent company. They are shown in the chart under "Rostec".

Rostec is represented by 719 active companies in our database, including 164 research institutes, 66 components manufacturers, 65 IT companies, as well as many other sectors. It also contains 92 holding companies, which attests to Rostec's status as a "group of groups". The most significant groups in the Rostec conglomerate include the United Aircraft Corporation (*OAK*), the Engine Corporation (*ODK*), Uralvagonzavod—Russia's largest tank manufacturer, which was brought under the Rostec umbrella in 2016 to avoid bankruptcy[70]—along with Kamaz, the Russian Helicopters group, and Shvabe, an optics group.

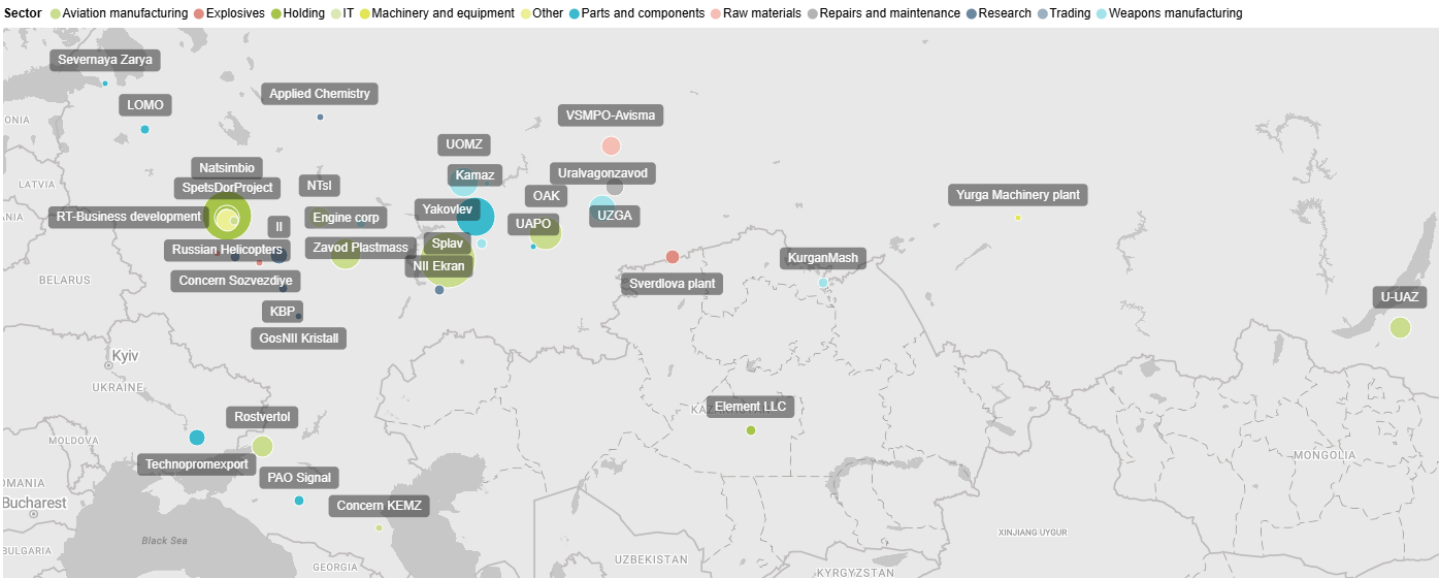
The corporation also controls key research and development assets such as KBP Instrument Design Bureau, as well as entities like Avtomatika, Sozvezdiye, and Vega. Tekhnodinamika and Signal contribute to its innovation efforts. In the critical materials sector, Rostec incorporates VSMPO-Avisma Corporation, the Obninsk enterprise

[69] See here [ru]
[70] See Kommersant [ru]

Tekhnologiya, and Germaniy Corporation. Electronics and sensor development falls under the management of Istok, Pulsar, the Ryazan Metalloceramic Plant (*RZMKP*), the Ryazan Radio Plant, and the Lytkarino Optical Glass Plant (*LZOS*). Additionally, the explosives sector vital to military production is controlled by Rostec, encompassing Sverdlov, Iskra, Aleksin Chemical Plant (*AKhK*), and Tula Gunpowder (*TPZ*).

This vast network of assets allows Rostec to integrate key capabilities across multiple military sectors. It oversees aviation, engines, radio and communications, combat vehicle production, and missile development through KBP, High-Precision Complexes, AAK Progress, and Splav. Artillery production is managed by KBP, Sverdlov, and Uraltransmash, while firearms manufacturing is handled by Tekhmash, Kalashnikov, and TsNIITochmash. Optics manufacturing falls under the Urals Optical-Mechanical Plant (*UOMZ*) and Shvabe, while parts and components are produced by Splav, Reduktor-PM, Ufa Aggregates Plant (*UAPO*), and Tekhnologiya. Electronics development is controlled by Roselektronika and Mikron, among many others.

Figure 12: Selected Rostec locations

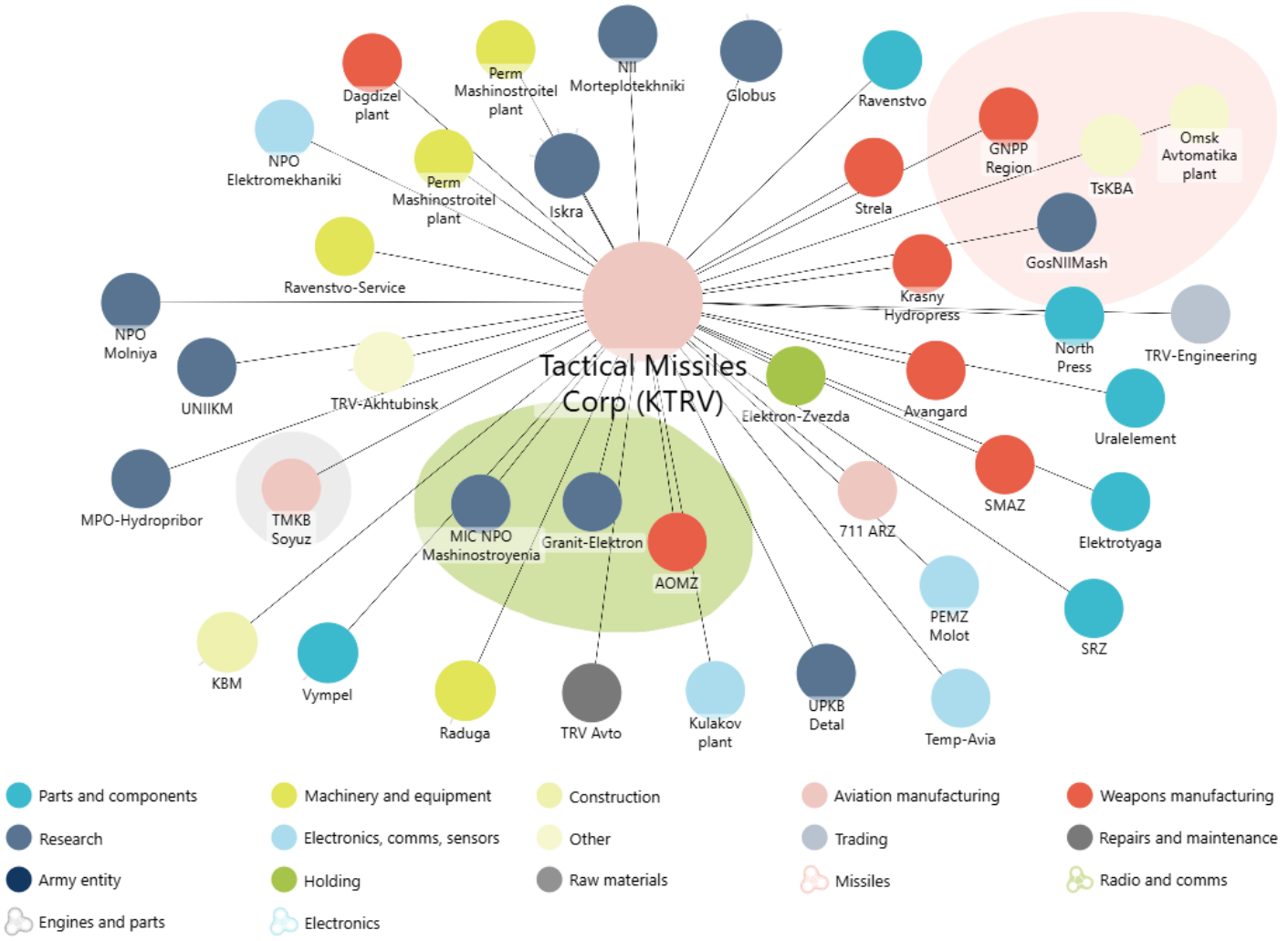


Source: KSE Institute

Given its vast scope, it is unsurprising that Rostec's affiliates operate across Russia and beyond (see Figure 12). The conglomerate has also expanded into occupied territories, integrating the Snizhne Machinery Plant in Ukraine's Donetsk region into ODK and absorbing relevant assets in Crimea into KBP. Rostec is also a dominant player in public procurement. Its subsidiaries, such as Uralvagonzavod and UOMZ, purchase metals, electrical components, and electronic systems, while aviation manufacturers, including the ODK and Yakovlev, procure tools and parts. Research centers and electronics firms like IL, Voskhod, KBP, and Istok focus on acquiring semiconductors and communications equipment.

The conglomerate's vertical integration ensures that critical supply chains remain within the group. In fact, 76% of the contract volumes where Rostec affiliates acted as suppliers were directed to other entities *within* the conglomerate. These encompassed goods, such as engines and components, and financial transactions, including inter-company loans. Beyond internal transactions, Rostec is a major supplier to the Ministry of Defense, providing electronics, helicopters, parts, engines, and missiles. It also fulfills direct contracts to supply army entities, reinforcing its role as the backbone of Russia's MIC. Altogether, Rostec consolidates control over crucial military production sectors, ensuring sustained military capabilities and supply chain stability.

Figure 13: KTRV corporate ties by sector and product



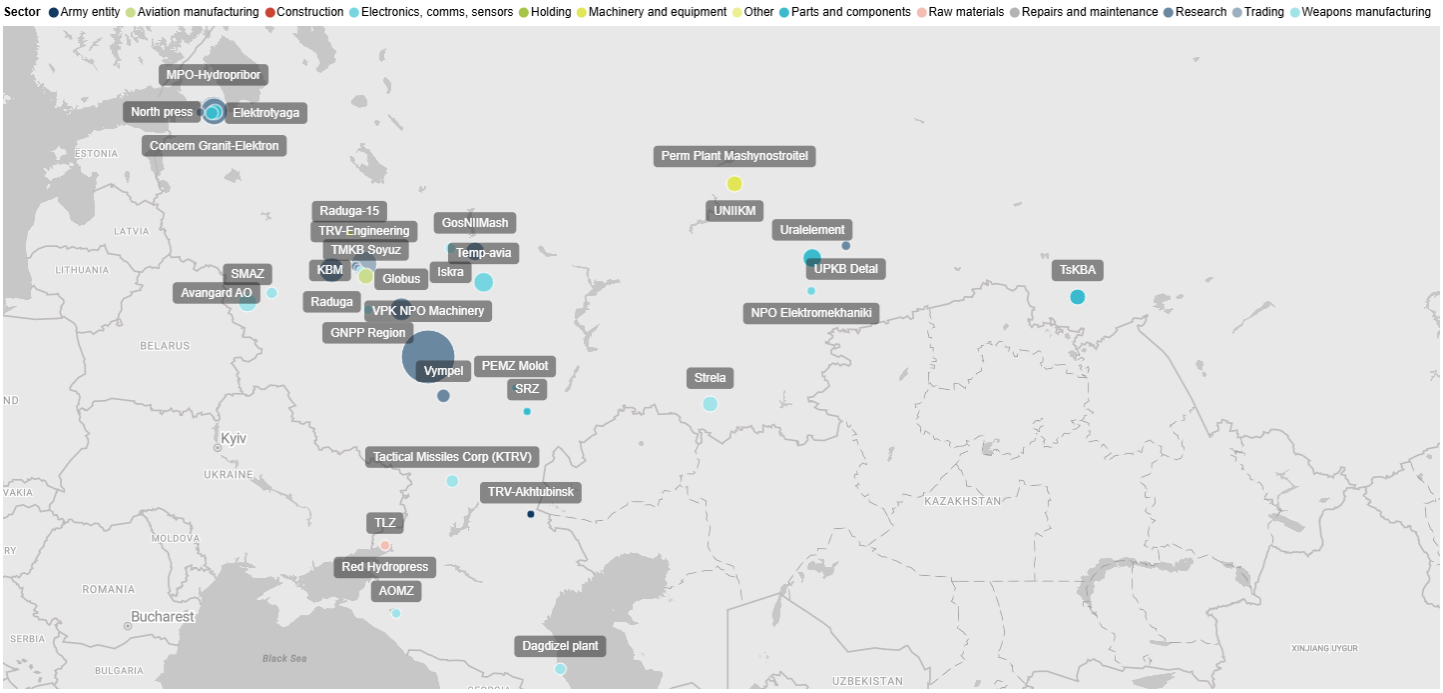
Source: KSE Institute

Tactical Missiles Corporation (*KTRV*)

The Tactical Missiles Corporation (*KTRV*) is a leading defense conglomerate specializing in the development and production of high-precision missiles. It consists of 51 affiliated companies in our database, including 14 research institutes, ten weapons manufacturers, and seven component producers, all working together to support its extensive production capabilities (see Figure 13). The corporation's product portfolio includes air-to-air, air-to-surface, and air-to-ship missiles, along with torpedoes and guided bombs. KTRV is a central player in the Russian MIC, integrating research, production, and strategic contracts across its extensive network of subsidiaries to maintain and advance the aggressor's high-precision weaponry capabilities.

A number of its subsidiaries focus on specialized technologies. The Azov Optics Plant (*AOMZ*) is responsible for manufacturing optical and spectral devices, while Granit-Elektron, the Central Design Bureau of Automatics (*TsKBA*), and MIC NPO Mashinostroyenia develop radio and communication systems. Vympel produces passive radio countermeasures, as well as missiles and aircraft components. Meanwhile, the Omsk Avtomatika Plant specializes in missile homing heads and radar warning systems, further strengthening KTRV's technological base.

Figure 14: KTRV locations



Source: KSE Institute

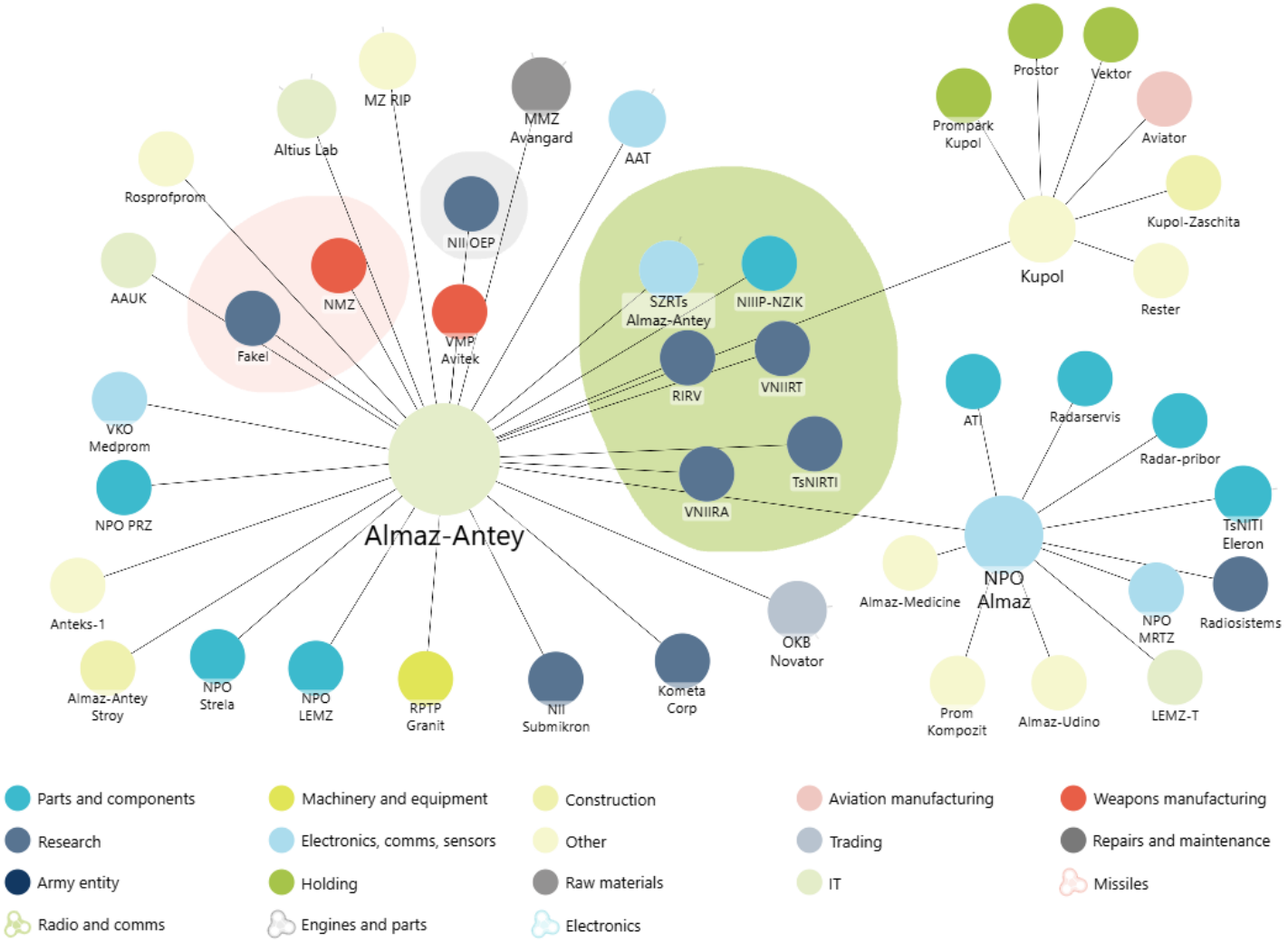
Most key entities are located in the Moscow region (see Figure 14). KTRV has a naval warfare group located in St. Petersburg, including Naval Underwater Weapons Plant Hydropribor (*MPO Hydropribor*), Granit-Elektron, and North Press plant. The Smolensk region hosts Avangard, a weapons maker, and a branch of Raduga design bureau. The Azov Sea area hosts the Azov Optics Plant and a Krasny Hydropress plant. KTRV's Saratov Radio plant is notably located near the Engels airbase, home to strategic bombers that routinely attack civilian targets and infrastructure in Ukraine.

Beyond its role as a manufacturer, KTRV is also an active public buyer in the public procurement sphere, having signed contracts worth 269 billion RUB as a customer. Its purchases are often tools and machinery, components, and metal, with Hydropribor, Strela, and Vympel serving as the most active buyers. As a supplier, KTRV plays a key role in various strategic sectors. Through MIC NPO Mashinostroyenia, it provides research services to Roscosmos. The North Press plant supplies radio and navigation equipment to Granit-Elektron, ensuring the continued development of advanced electronic warfare and communication systems. Additionally, the corporation provides weapons and maintenance services directly to the Ministry of Defense through its 711 Aviation Repair plant (*711 ARZ*) and Hydropribor.

Almaz-Antey

Almaz-Antey is a major military-aerospace conglomerate comprising 47 companies in our database, including ten component manufacturers, nine research institutes, and four weapons producers. Within the group, the parent entity Almaz-Antey, alongside Obukhov Plant, VMP Avitek, and Avangard, are responsible for weapons manufacturing. Key component producers include Almaz, Kupol, and Strela, while research and development is led by Kometa Corporation, Fakel, and OKB Novator (see Figure 15). Through its extensive network of production, research, and support facilities, Almaz-Antey maintains a strong position within Russia's military-industrial complex, delivering critical capabilities in missile weaponry and military communications.

Figure 15: Almaz-Antey corporate ties by sector and product



Source: KSE Institute

While the majority of Almaz-Antey's subsidiaries are concentrated in Moscow, the group also has a notable presence in St. Petersburg, where the Obukhov Plant and a branch of Strela operate. Additional branches of Novator and Kupol are situated in the Volgograd region, specifically in Akhtubinsk and Znamensk, with affiliated companies extending to Yekaterinburg and Novosibirsk, reflecting a geographically diverse industrial footprint.

The corporation specializes in integrated missile systems, surface-to-air missiles, and ground-based air defense platforms. Its radio and communications sector produces air defense radar stations, automated control systems, ground surveillance radars, and command and control stations. Supporting this production, the Moscow Radio Technic Plant (*NPO MRTZ*) enhances material processing capabilities, while the Opto-Electronics Machinery Institute (*NII OEP*) supplies specialized tools and parts. Beyond its core manufacturing and research activities, Almaz-Antey provides radio equipment and software to the government for air traffic control and the Ministry of Defense. It also holds a military security services contract with Roscosmos, reinforcing its role in the military and aerospace industries. Additionally, around 22% of the group's supplier contracts involve internal transactions, indicating a moderate level of vertical integration.

Roscosmos and Rosatom

Roscosmos and Rosatom are prime examples of military enterprises that are better known for their byproducts in the civilian sector. **Rosatom**, Russia's State Atomic Energy Corporation, encompasses numerous subsidiaries involved in both civilian nuclear energy and military applications. There are a number of notable entities within Rosatom contributing to military-related activities. OKBM Afrikantova, for example, specializes in nuclear engineering, designing reactors for nuclear submarines, icebreakers, and floating nuclear power plants. The Zelenogorsk Electrochemical plant was established to produce highly enriched uranium for the Soviet nuclear weapons program. Mining and Chemical Combine (*GKhK*) was founded in 1950 to produce plutonium for weapons; this facility is located in the closed city of Zheleznogorsk. The Elemash plant produced bombs and other munitions before and during World War II, and later manufactured pure uranium for nuclear weapons and fuel elements for nuclear power plants. Rosatom has not been directly sanctioned, but some of its subsidiaries as well as senior Russian nuclear industry executives have been.

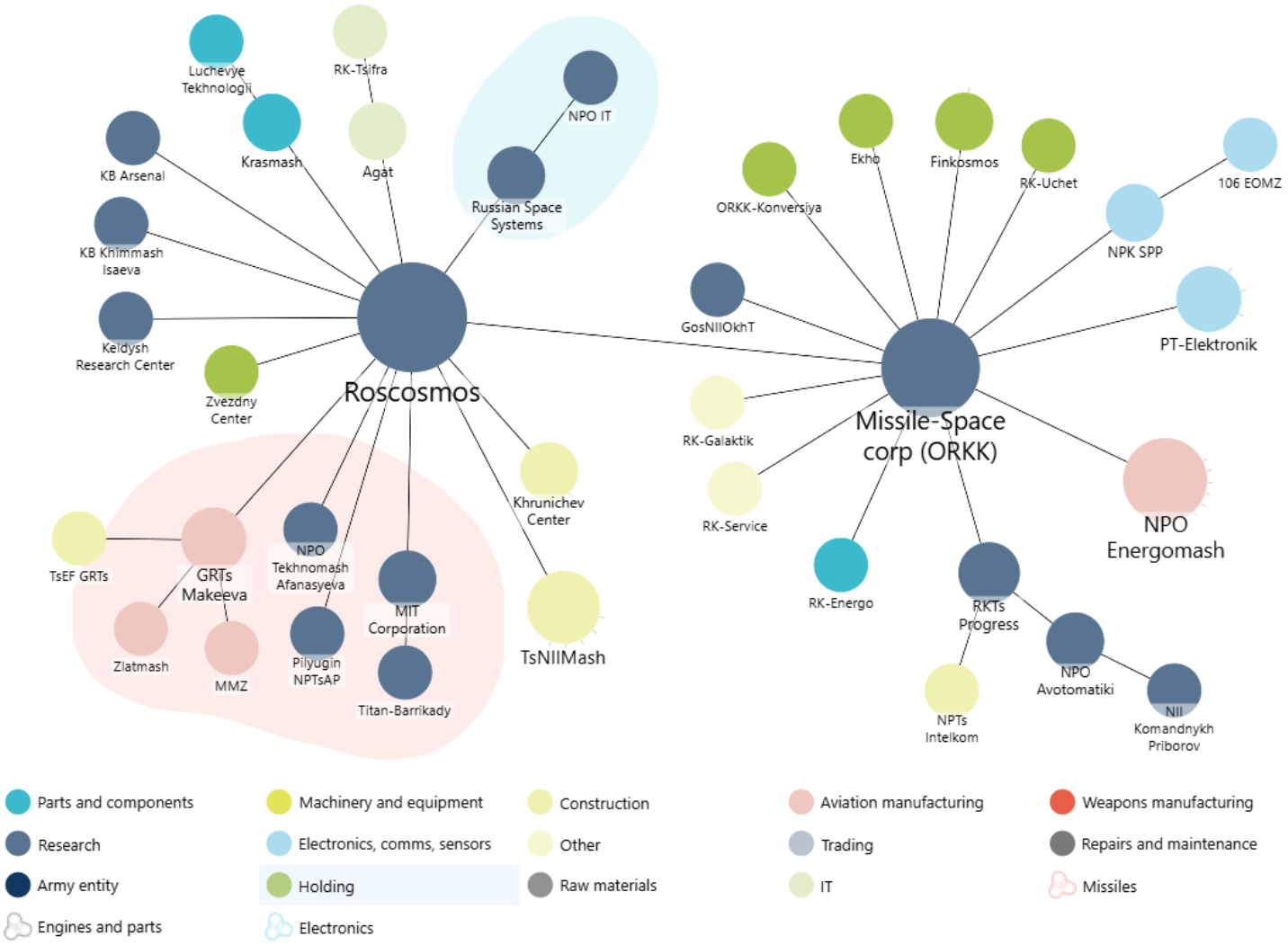
Rosatom has also been directly involved in the occupation of Ukraine's Zaporizhzhia Nuclear Power Plant, exercising effective control over the facility since March 2022.[71] Further, human rights advocates and investigative journalists collected evidence of Rosatom aiding and abetting the abductions and torture of Zaporizhzhia Nuclear Power Plant staff and Enerhodar residents.[72] These activities underscore Rosatom's significant role in Russia's military-industrial complex, extending beyond its civilian nuclear energy endeavors.

Roscosmos, Russia's State Corporation for Space Activities, oversees a vast network of subsidiaries engaged in both civilian and military aerospace endeavors. Several key entities within Roscosmos contribute significantly to military applications. Krasmash in Krasnoyarsk produces R-29RMU Sineva and R-29RMU2 Layner submarine-launched ballistic missiles, integral components of Russia's naval strategic forces. The Pilyugin NPTsAP specializes in developing guidance, navigation, and flight control systems for ballistic missiles, space launch vehicles, and spacecraft. Serving as a primary research and analytical center for Roscosmos, the Central Research Institute of Machine Building (*TsNIIMash*) conducts comprehensive studies ranging from conceptual design to flight testing of missile and space technology. GRTs Makeeva, Titan-Barrikady, and Zlatmash are several other entities that participate in development of missiles of various ranges, from tactical and short-range to intercontinental (see Figure 16).

Until recently Roscosmos conducted procurement primarily through public contracts, which differs from most other MIC sectors. In May 2024, however, the Russian Duma allowed Roscosmos to conduct confidential procurement processes. This brings Roscosmos closer in line with the Russian security apparatus, which, along with any other government procurer under sanctions, is required by law to conduct procurements confidentially. This was enacted with the explicit[73] intention of protecting Roscosmos from sanctions. While some of Roscosmos' subsidiaries are sanctioned by the US and EU, Roscosmos itself remains unsanctioned.

[71] No later than March 11th, 2022, Rosatom employees arrived at the Zaporizhzhia nuclear facility in order to take operational control of the plant. On March 12th, 2022, the Russian military units occupying the facility declared that the plant "was now a Rosatom station, and it no longer belonged to Ukraine… the nuclear power plant must operate in accordance with Rosatom decrees." See "Invaders seize Zaporizhzhia power plant and claim it is part of Rosatom," Ukrainska Pravda
[72] For further details see "In A Nuclear Prison: How Rosatom Turned Europe's Largest Nuclear Power Plant into a Torture Chamber and How Can the World Stop It," Truth Hounds
[73] See here [ru]

Figure 16: Roscosmos corporate ties by sector and product



Source: KSE Institute

Procurement Data

Public procurement data are shrouded in a veil of secrecy that obscures the amounts, participants, and products of many contracts. With the available information, however, we can conclude that the MIC has expanded its capacity and long-term investments. In the process, it has focused on highly sought-after precision tools, testing equipment, and computer systems. Below, we present important trends and take a closer look at the procurement of specific entities within the MIC as well as with regard to select products.

Overview and Trends

After the defense financing funds are allocated to programs and budgets, they are made available to the state companies. In turn, these companies use the public procurement procedure to secure their inputs. These contracts are publicly available, which enables us to harness the data about customers, products or services bought, and suppliers. To inform our analysis, we reviewed procurement contracts of MIC entities over 2014 to

2024. Disclosure rules changed in 2018, leading to a decrease in the share of contracts with publicly disclosed suppliers; since 2022, many military-industrial contracts are no longer publicly available (see Figure 17).

Figure 17: MIC procurement contracts, in ruble trillion

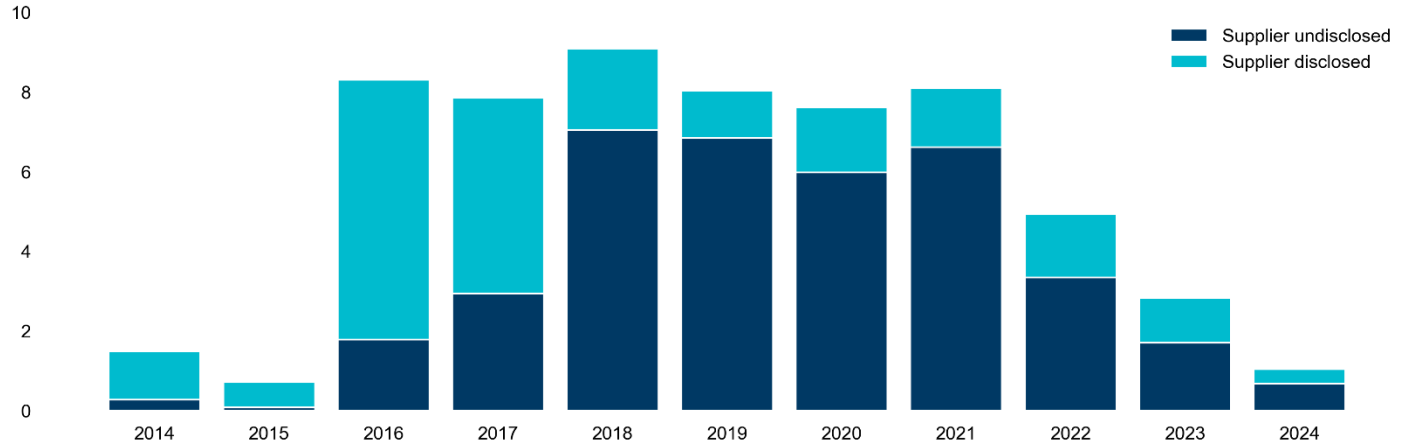
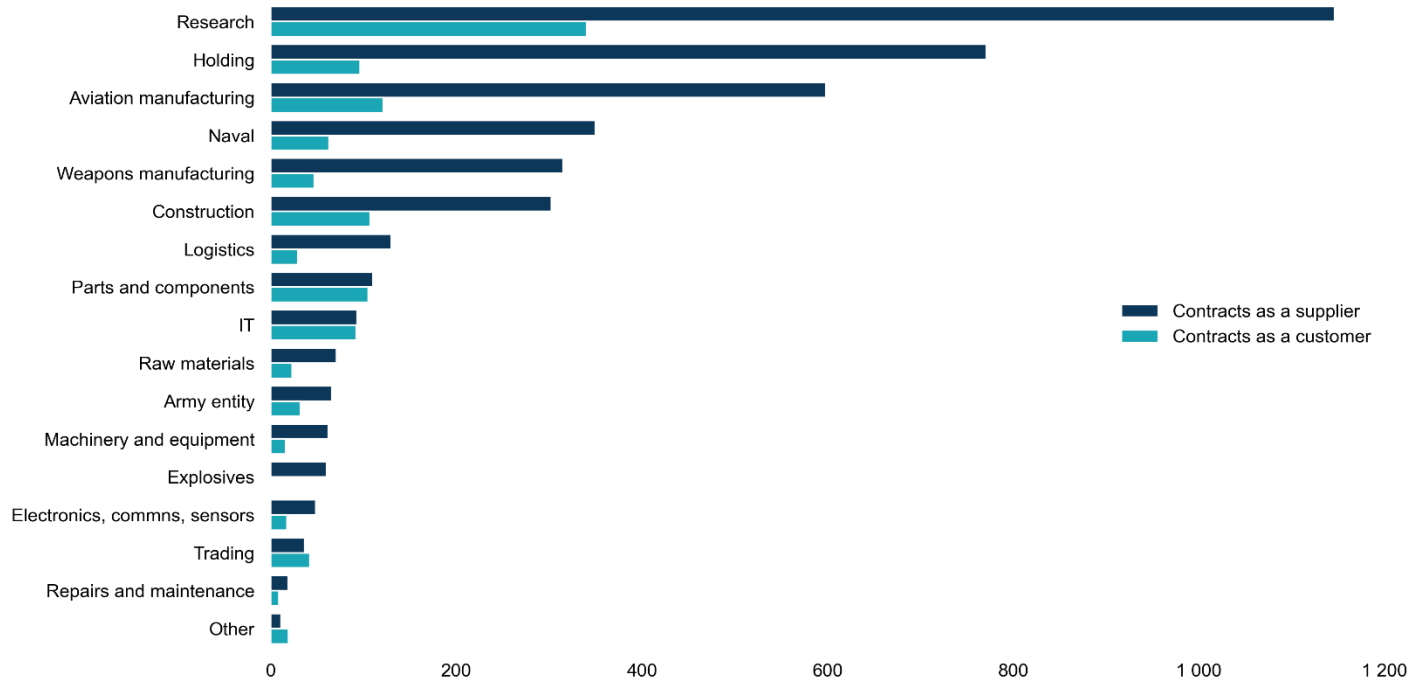


Figure 18: MIC procurement contracts by sector, in ruble billion



Source: Single information system (EIS) on public procurement, KSE Institute

These changes in disclosure standards over time provide context around the varying levels of financial transparency observed across the sector. Still, looking at historical data we can make assessments and draw conclusions about customer-supplier relationships and enterprises within the military industrial orbit. Analyzing top customers and suppliers of each entity reveals lasting economic ties which are likely unaffected by the change in disclosure rules. Despite the lack of full financial transparency, breaking the contract volume down by sector highlights their roles in the industry (see Figure 18). The top customer sectors in the dataset include research, holding, aviation, naval, and weapons manufacturing sectors. Notably, research institutes emerge as

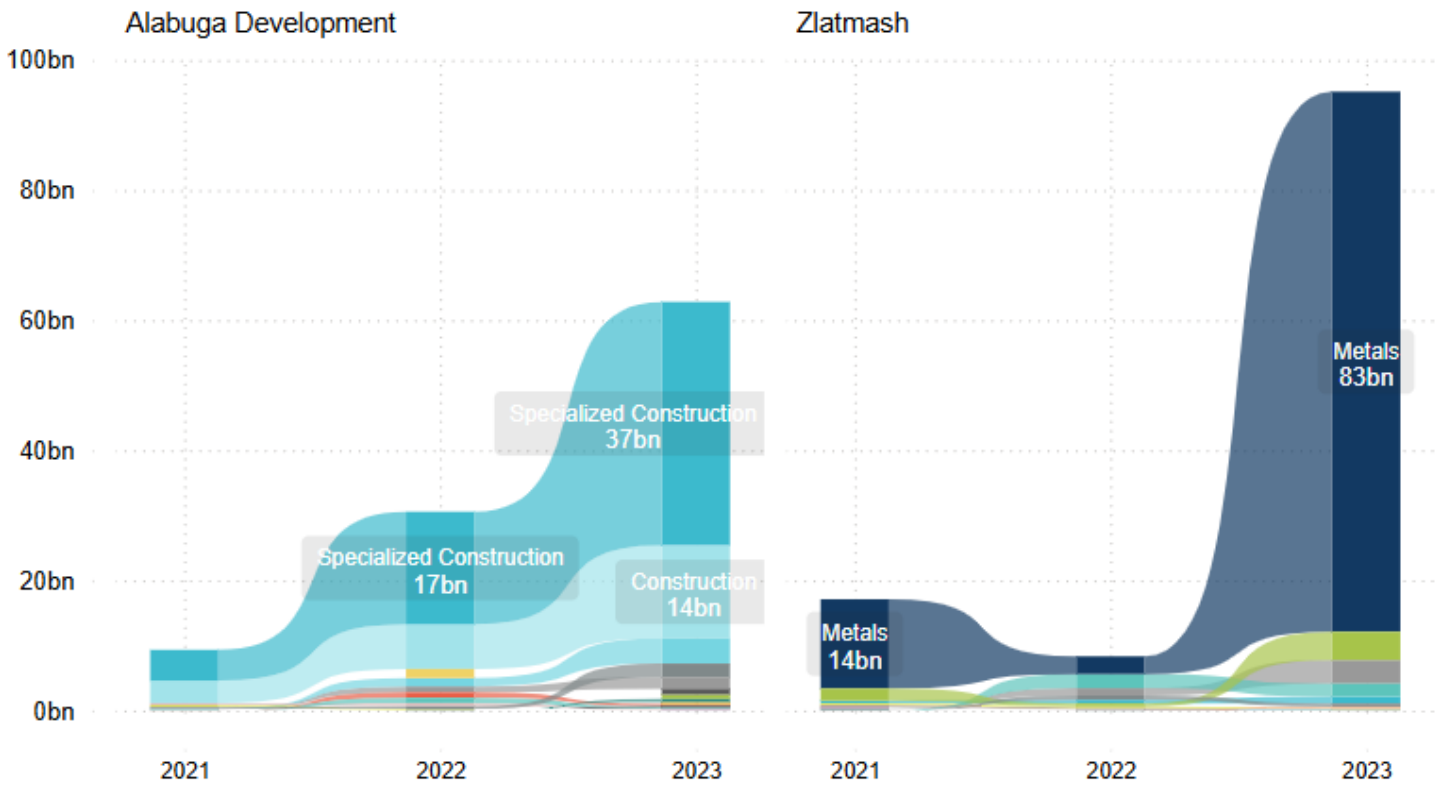
key players, leading as both major customers and suppliers in terms of contract volume. Sectors with the next highest volumes as suppliers are aviation, construction, parts and components, and IT.

Within sectors, the specializations and roles of each company can be judged by the balance of customer contracts volume versus supplier contracts volume. For example, within the research sector, RKK Energiya, NPO Lavochkina, RKTs Progress, and TsNIIMash have disproportionately much higher supplier amounts marking them as key players in the Roscosmos-Rosatom supply chains. In the aviation sector, the Kazan Helicopter plant emerges as a key supplier to the National Guard, Ministry of Defense, and Ministry of Emergency Response. In the naval sector, the Baltic plant is the main supplier. Major suppliers within the weapons manufacturing sector are UOMZ, Uraltransmash, and the Obukhov plant.

Company-Specific Procurement

MIC companies have been increasingly excluded from transparent procurement procedures starting in 2022 when the publicly available contracts volume declined by 39%, with a further 43% decrease in 2023. Despite the compromised high-level industry information availability, disaggregating the data by detailed product types and by each MIC company allowed us to isolate combinations of buyers and goods that demonstrated dramatic increases in 2023. As a result, we obtained a number of cases that are symptomatic of the larger trends in the military industry, even though the majority of purchasing information is classified (see Figures 19 & 20).

Figure 19: Procurement of select product categories by Zlatmash and Alabuga,[74] in rubles



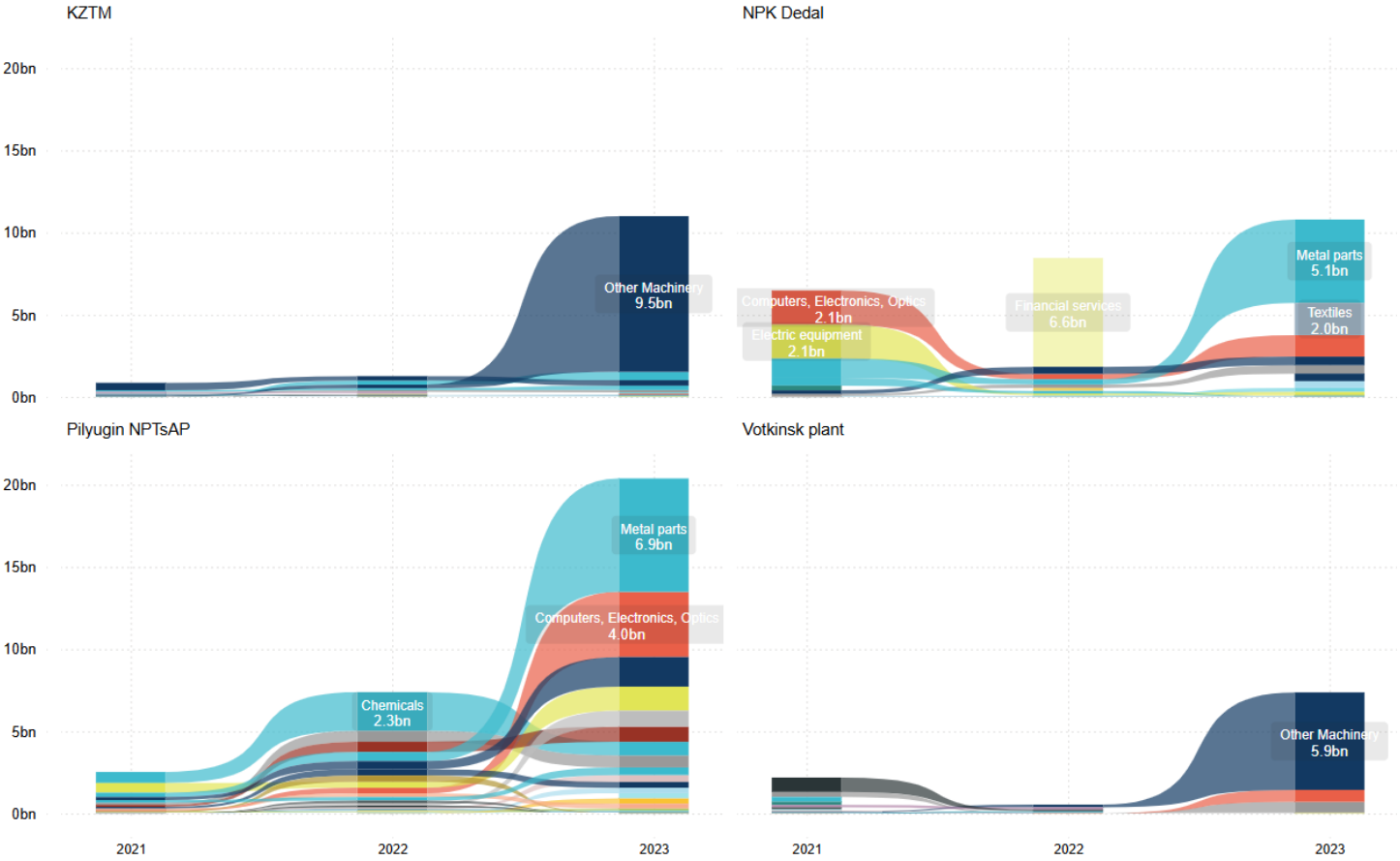
Source: Single information system (EIS) on public procurement, KSE Institute

[74] Procurement for Alabuga is conducted by Alabuga Development, whereas production is distributed across the entire group.

Zlatmash is a key enterprise that creates firearms and a collection of missile applications: ballistic missiles for submarines and various spaceship engines. It demonstrates dramatic increases in materials procurement, with metals purchases surging from 3 to 87 billion rubles between 2022 and 2023, particularly in colored metals and aluminum. Mineral products procurement also expanded significantly, increasing from 0.5 to 4 billion rubles over the same period, suggesting substantial production capacity expansion.

Procurement patterns by Alabuga—the producer of Iranian-designed Shahed drones—indicate sustained physical expansion, with specialized construction and building purchases growing from 8 billion rubles in 2021 to 54 billion in 2023. Their machinery procurement focuses on industrial lifting, loading equipment, and air ventilation systems, suggesting new production facility development.

Figure 20: Procurement of select products by KZTM, Pilyugin NPTsAP, NPK Dedal and Votkinsk Plant, in rubles



Source: Single information system (EIS) on public procurement, KSE Institute

Kazan Precision Machines Plant *(KZTM)*, a producer of a wide spectrum of detonators, charges, and explosive materials, demonstrates significant investment in manufacturing capabilities, with metal cutting precision machines procurement increasing from 0.2 to 9.4 billion rubles between 2022 and 2023. The Pilyugin NPTsAP—a key aerospace industry supplier that makes guidance, navigation, and flight control systems for ballistic missiles, space launch vehicles, and spacecraft—also shows an increased focus on precision manufacturing capabilities. Metalworking tools procurement grew from 0.5 to 7 billion rubles between 2022 and 2023, while radio equipment and testing tools increased from 0.3 to 4 billion rubles. As we will show in Section IV, these tools and components are overwhelmingly supplied by China.

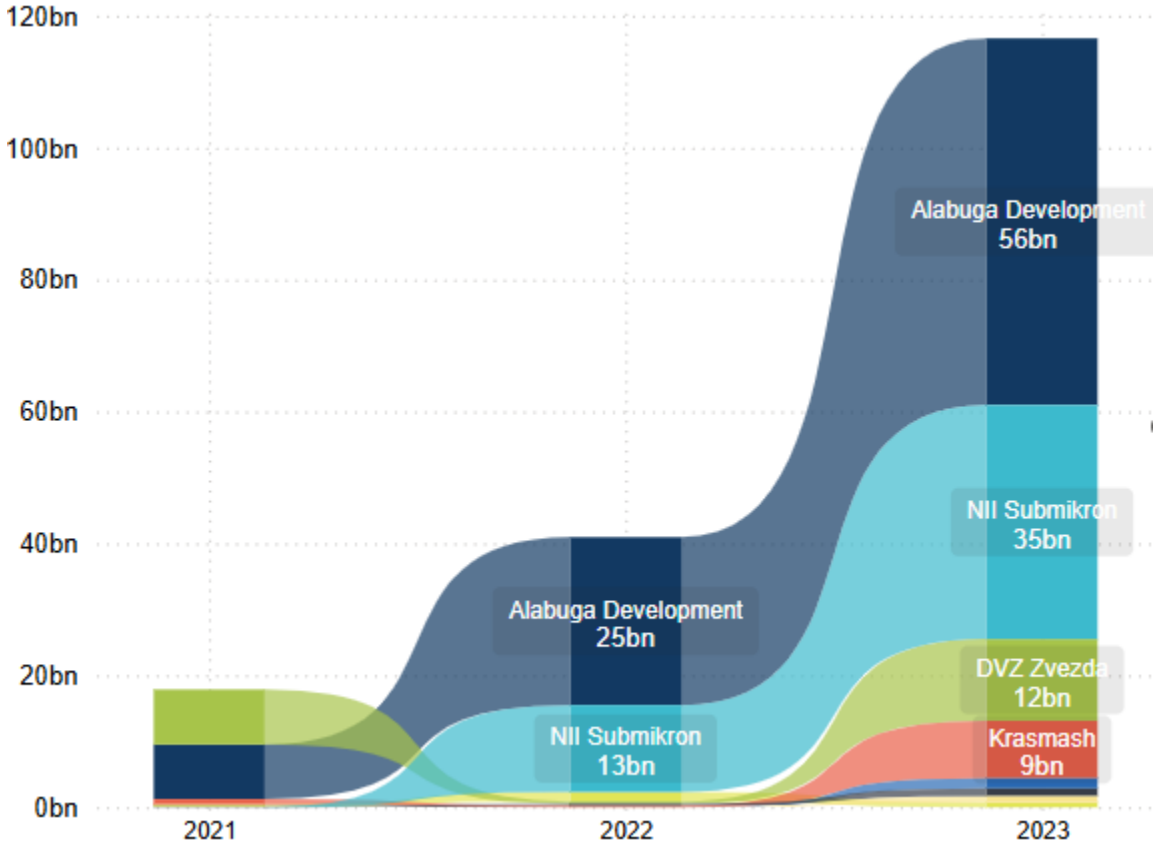
NPK Dedal, a subsidiary of Rosatom, is an enterprise engaged in the design and production of systems for protection of strategically important and high-risk military facilities. It shows growth in the procurement of structural components, with metallic constructions procurement increasing from 0.3 to 5 billion rubles between 2022 and 2023, and metals procurement growing from 0.5 to 2.2 billion rubles over the same period.

Nizhny Tagil Metal Testing Institute is a subsidiary of the State Munitions Testing company with clear ties to the military industry. The company began its purchasing activity in Q3 2023. Its main contracted items include vibration and pressure sensing equipment, metal testing equipment, and video cameras for a total of over 1 billion rubles for the 2nd half of 2023. The procurement records of the Votkinsk plant, a supplier of tactical and ballistic missiles, suggest a modernization of production capabilities, with specialized equipment and industrial crane purchases increasing from 0.1 to 6 billion rubles (2022 vs. 2023), complemented by increased investment in testing equipment.

Procurement in Select Categories

The analysis of construction procurement reveals significant capacity expansions at select enterprises (see Figure 21). 20 military-industrial companies contracted new industrial and specialized premises construction in 2022-2023. Notable examples include Shahed drone maker Alabuga's $550 million[75] investment (115% increase in 2023 vs. 2022), aviation systems and command centers maker Submikron's $350 million expansion (169% increase), missiles producer Krasmash's dramatic increase from $2.4 to $90 million, and the DVZ Zvezda submarine plant's growth from $3.7 to $65 million.

Figure 21: Construction-related procurement by select MIC companies, in rubles



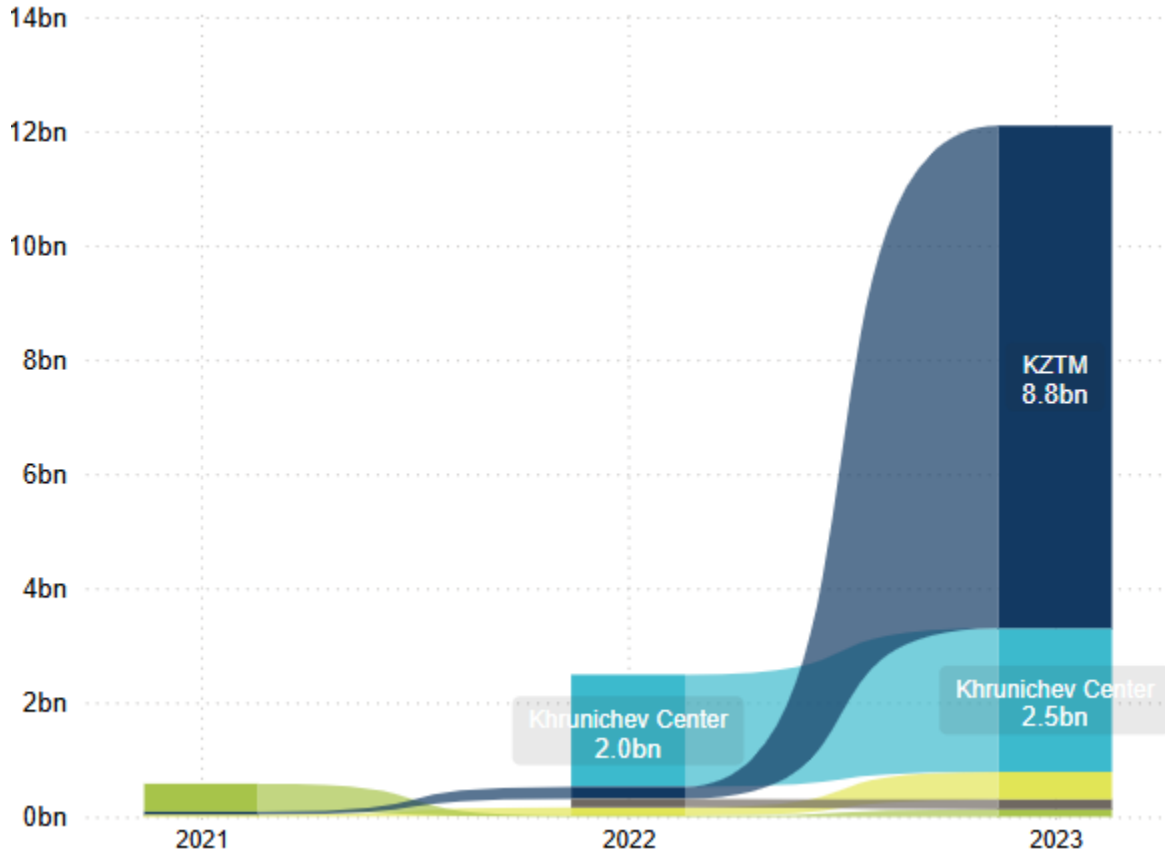
[75] USD volumes are calculated at February 2025 rates.

Source: Single information system (EIS) on public procurement, KSE Institute

The demand for precision metalworking machines, including laser cutting, CNC systems, welding equipment, and other high-precision tools, experienced a significant rise in 2023 (see Figure 22). Companies with the largest increase in this category are KZTM, Khrunichev State Research and Production Space Center (*GKNPTs Khrunichev*), Analitpribor, and the Pilyugin NPTsAP. The Khrunichev Center—under the Roscosmos umbrella—takes part in the production of ballistic missiles and launch vehicles. Analitpribor is a producer of sensor equipment for Strategic Command Centers Corporation, Rosatom, and the DVZ Zvezda naval plant.

The collective increase in precision metalworking tool acquisitions highlights a need for enhanced production capabilities to support Russia's military aggression. These procurement cases and patterns reveal capacity expansions at several key facilities, particularly in precision manufacturing, electronics, and physical infrastructure. This pattern is likely mirrored across the industry, but not visible in the data due to wartime disclosure exceptions. The significant increases in construction spending suggest long-term commitments to expanded capabilities alongside the focus on precision tools, testing equipment, and computer systems.

Figure 22: Procurement of metalwork equipment by select MIC companies, in rubles



Source: Single information system (EIS) on public procurement, KSE Institute

Sanctions Coverage

Many entities remain unsanctioned by the US and EU despite their participation in the Russian MIC (see Figure 23), most notably Roscosmos and Rosatom. In the research sector, key assets not under sanctions include RKK Energiya and VNIIEM corporation—both suppliers of Roscosmos and Rosatom. Proton-PM and Zlatmash

deserve to be sanctioned from the aviation sector due to their critical importance, as well as the NAZ Automotive plant (*AZ NAZ*)—a key supplier of the MoD in the parts and components sector. There are many other examples of a misalignment between companies' role in the MIC and (missing) sanctions coverage.

A few corporate groups within Rostec, particularly in weapons manufacturing, have had most of their entities sanctioned (see Figure 24). These include Uralvagonzavod, Russian Helicopters, High-Precision Complexes, and ODK. Roselektronika, KRET, OAK, Shvabe, and Tekhnodinamika all have large numbers of entities untouched by sanctions. This creates a risk that the MIC companies continue to operate and have access to international markets. Beyond Rostec, while most of KTRV's assets are under sanctions, most of Almaz-Antey's are not. Notably unsanctioned entities under the Almaz-Antey umbrella are the Kometa corporation (a supplier of the MoD), UOMZ, and several naval enterprises.

Sectorally, weapons manufacturers are most likely to be sanctioned by the US and EU. While weapons manufacturing is generally the sector most unambiguously belonging to the MIC, it is hardly the only one. Despite oft-professed desires to crack down on dual-use goods shipments to Russia,[76] the West has partially failed to sanction the very entities that purchase these dual-use goods for military ends.

Figure 23: Sanctions status of MIC entities by sector, number of entities

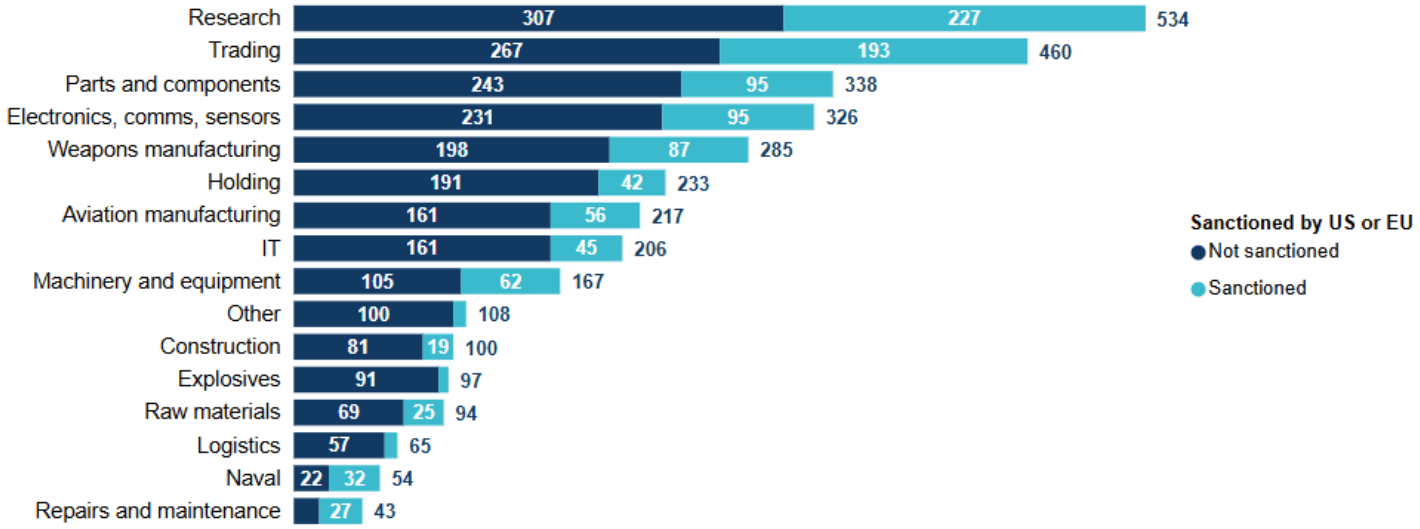
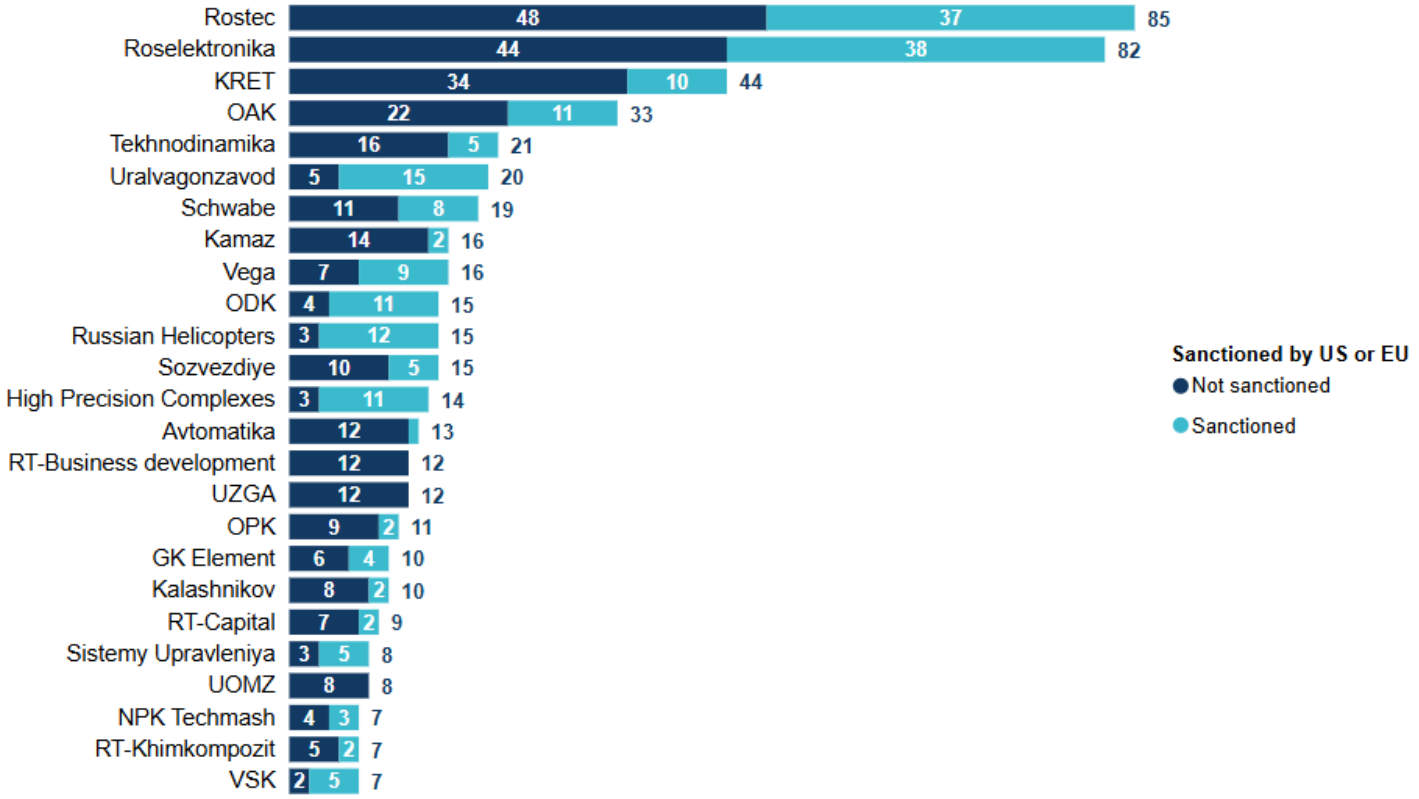


Figure 24: Sanctions status of key corporate groups within Rostec, number of entities

[76] See "Treasury Disrupts Russia's Sanctions Evasion Schemes," U.S. Department of the Treasury



Source: KSE Institute

Note: Some entities are directly owned by the Rostec parent company. They are shown in the chart under "Rostec".

III. Russia's Military Industry: Key Nodes

Army entities representing the demand side of the Russian military-industrial complex are widely distributed throughout the country, while the supply side is more concentrated, especially in the Central Federal District. To structure the vast and complex Russian MIC, we group entities and transportation hubs into clusters based on geographical proximity, and identify key clusters by sectors and product categories. In combination with the analysis of cargo flows, this approach uncovers internal supply chain relationships between entities, as well as external dependencies.

Regional Distribution

Russia is divided into eight administrative units called federal districts (see Figure 25). In decreasing order of population, they are: Central, Volga, Southern, Siberian, Northwestern, Ural, North Caucasian, and Far Eastern federal districts. The Central Federal District, centered around Moscow, is the richest and most influential federal district in the military-industrial complex. It has the highest concentration of holding companies, trading arms, and research facilities. Some sectors are spread out across multiple federal districts. Aviation-focused companies, for example, are spread across the Central, Volga, and Siberian Federal Districts. Weapons and components manufacturers are primarily located in the Volga, Northwestern, and Urals Federal Districts.

Considering the number of entities and their total assets, it becomes clear that the military-industrial complex is led first and foremost by the Central Federal District (see Figure 26). While there is certainly a degree of artificial inflation in the center—companies legally registered in Moscow are not always physically operating there—we address this by focusing on concrete logistical connections, for which we create clusters.

Figure 25: Russian federal districts

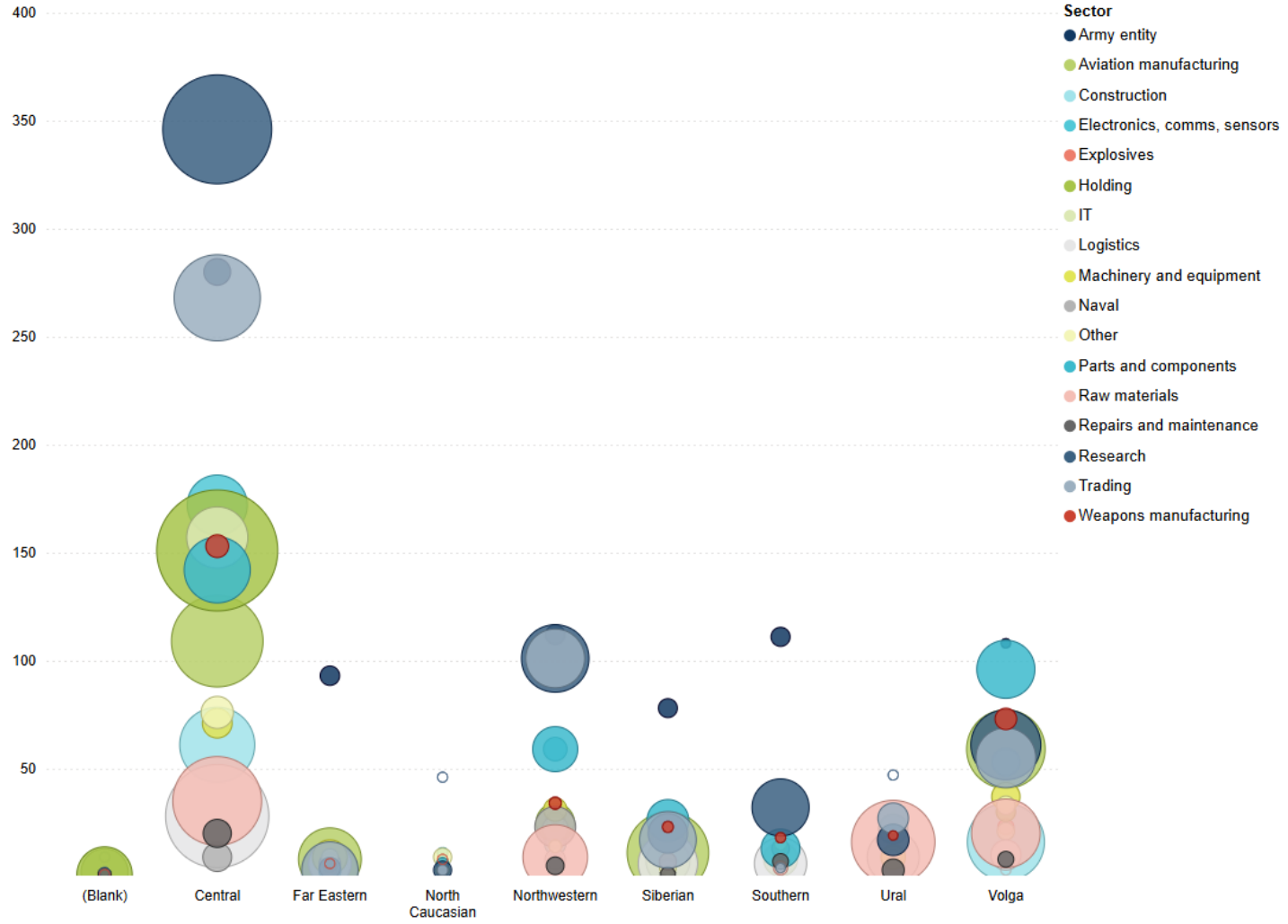
Source: Jamestown Foundation[77]

[77] "Russian Federal Districts as Instrument of Moscow's Internal Colonization," Jamestown Foundation

The Volga and Northwestern Federal Districts play an important secondary role in particular sectors but they do not match the depth or breadth of the Central Federal District. In terms of the number of entities in each region, the Central Federal District has three times as many entities as the next largest (Volga) region. On the other side of the spectrum, the North Caucasian Federal District is easily the least important for the military-industrial complex. The North Caucasus holds only 96 entities—46 of which are army entities.

Outside of the center, federal districts tend to have regions that are specialized in particular sectors. Within the Volga district, for example, the Samara region has a disproportionately high number and size of explosives manufacturers. Kemerovo oblast in Siberia also stands out for explosives. Tatarstan in the Volga district has an unusually high number of IT companies serving the military industrial complex. Finally, the navy-related manufacturers are concentrated in the Northwestern district, particularly in St. Petersburg and Arkhangelsk.

Figure 26: MIC companies by region, number of entities



Source: KSE Institute

Note: Bubble radius reflects relative size by assets. Companies with missing federal district are located in Donetsk and Luhansk regions of Ukraine, which are occupied and have been illegally annexed by Russia.

Creating MIC Clusters

We have undertaken a comprehensive clustering exercise to better understand the geographic relationships between MIC companies, their branches, and the transportation points they use. The clustering approach has one key advantage: it ties logistical flows to areas. This is necessary because Russian MIC companies often hide their imports and shipments behind logistics companies, which makes them difficult to trace. Indeed, our shipments dataset contains a number of hidden parties that obscure military consignors and consignees. The physical flows of goods and their origin and destination points, on the other hand, are clear, and we use the clustering approach to connect these shipping hubs to the legal structure of MIC entities defined in the previous section. In addition, companies in close proximity to one another are often in their locations for economic reasons. We explore intra-cluster logistics more in a forthcoming report in this series.

Clusters were created in a multi-step process. *First*, we manually reviewed a sample of shipping data to identify the primary cargo hubs and associations between specific companies and the transportation points they rely on as consignors or consignees. This manual review process yielded 117 initial clusters linking companies and shipping points. *Second*, using these manually curated clusters as inputs, we applied the OPTICS clustering algorithm to the full population of 6,078 MIC companies (including regional branch locations) and 3,353 shipping points and transportation hubs. The clustering parameters were tuned to account for the economic sector of each company, as certain industries such as raw materials and manufacturing naturally have stronger ties to transport infrastructure compared to sectors like electronics and IT.

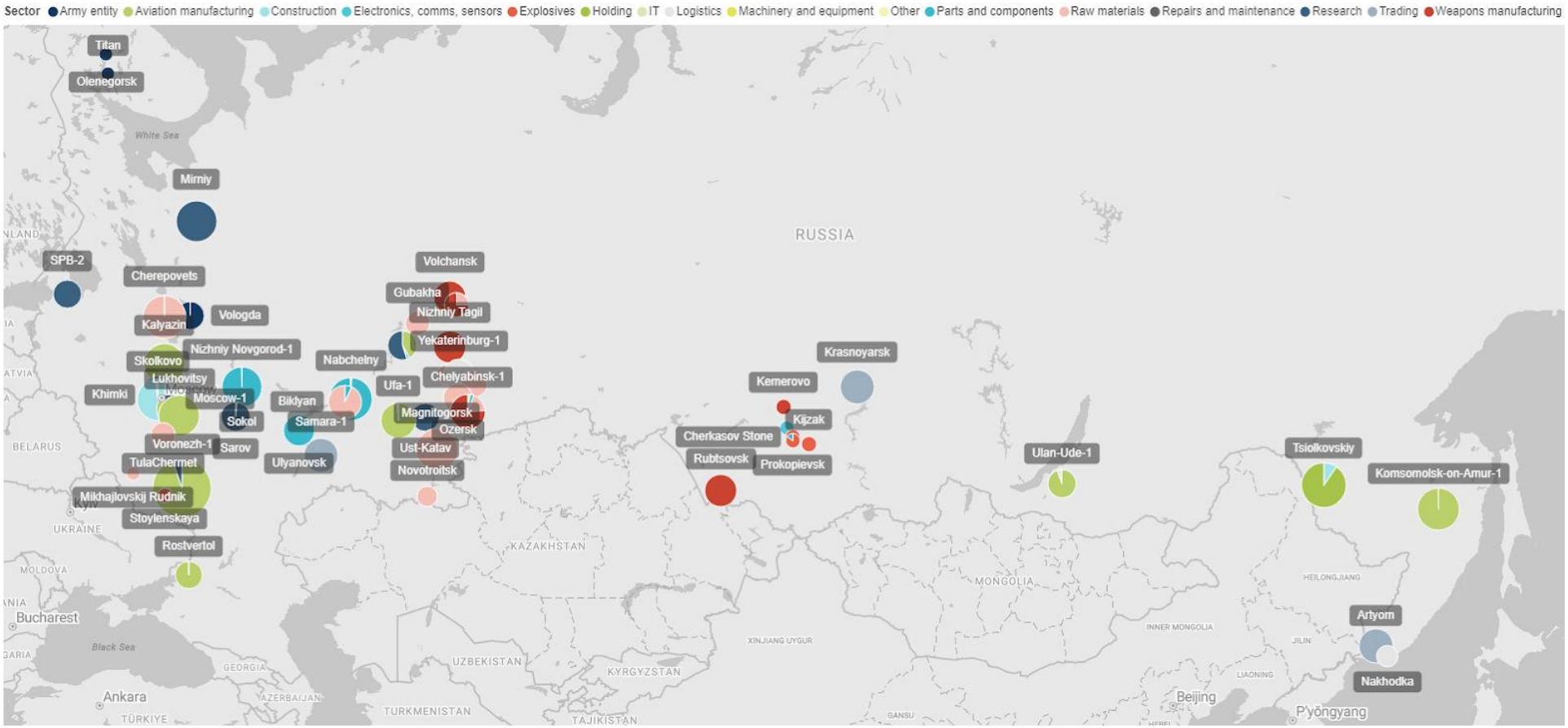
The end result of this exercise is 692 geographical clusters that encompass 1,492 companies and branches, as well as 972 shipping points. By ranking these clusters based on the cargo tonnage of the MIC companies and their participation in procurement contracts, we identify priority clusters. For example, the top 113 clusters account for 82% of all cargo traffic and 92% of procurement contracts. For a map of the 50 most important clusters, see Figure 27. This granular, spatially-oriented analysis provides valuable insights into the logistical backbone supporting Russia's MIC. The identification of these key clusters, representing the most strategically important nodes in the network, offers crucial intelligence for understanding supply chain dynamics, transportation chokepoints, and the relative importance of different regional concentrations of MIC activity.

Clusters Overview

Clusters in the Russian military-industrial complex bring together companies from various sectors, integrating critical functions such as manufacturing, research, logistics, and raw material supplies into cohesive ecosystems that are intended to enhance efficiency and drive innovation (see Table 2).

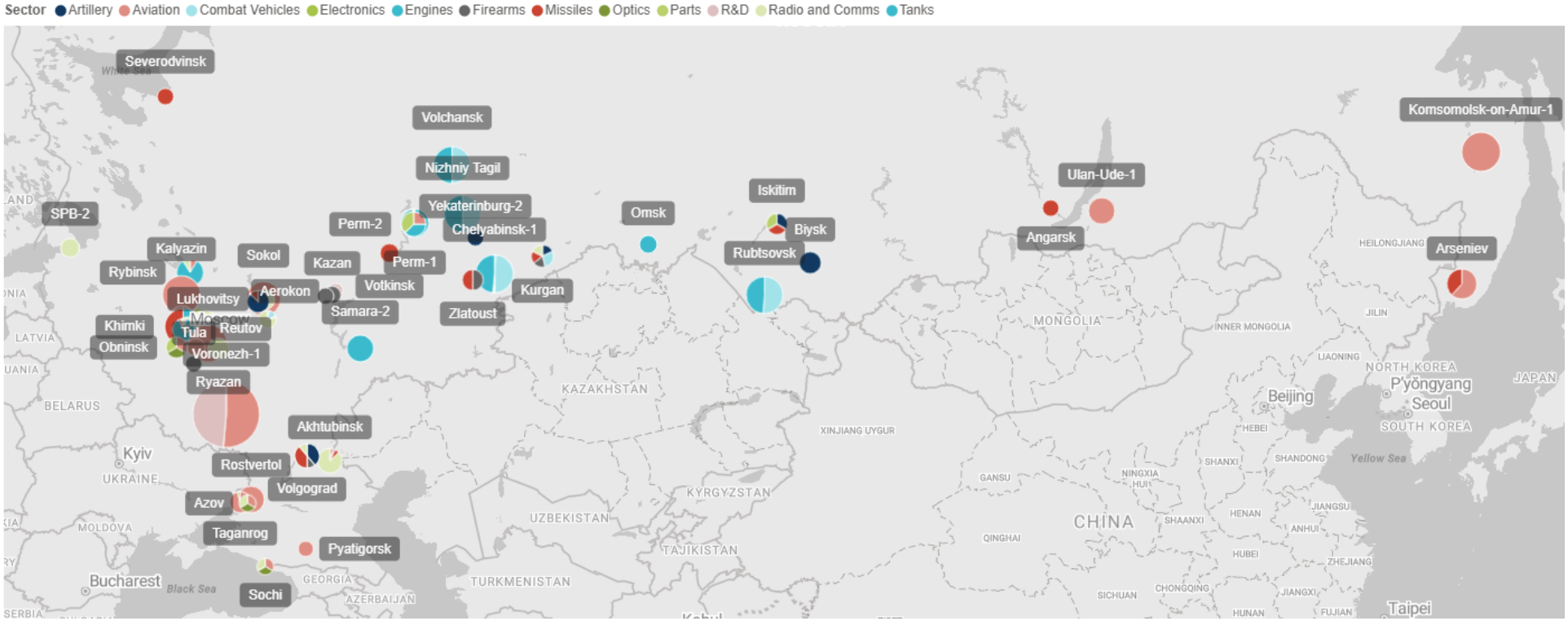
The top *aviation clusters* include Voronezh, Komsomolsk-on-amur, Lukhovitsy, Kalyazin, Sokol, Voskresensk, Ufa, Moscow, Rostvertol, Ulan-Ude. These not only house aviation manufacturing facilities belonging to companies like ODK, U-UAZ, and OAK but also include research and component production assets. Key contributors in these locations include NPO Energomash, New Instrumental Solutions (NIR), and the special materials center of the Kurchatov Institute, ensuring a comprehensive aviation production ecosystem.

Figure 27: Top-50 MIC clusters by shipments tonnage and contracts



Source: KSE Institute

Figure 28: Clusters map by product categories



Source: KSE Institute

Table 2: Key clusters and entities by sector

Sector	Key clusters	Key entities
Aviation	Voronezh, Komsomolsk-on-amur, Lukhovitsy, Kalyazin, Sokol, Voskresensk, Ufa, Moscow, Rostvertol, Ulan-Ude	Yakovlev, OAK, ODK, Kazan Helicopter plant, U-UAZ, Rostvertol, AAK Progress, Proton-PM, MMP Chernyshov, Zlatmash
Weapons	Chelyabinsk, Nizhny Tagil, Rubtsovsk, Volchansk, Kemerovo, Serov, Yekaterinburg, Novosibirsk, Barnaul, Kurgan	Uralvagonzavod, UOMZ, Uraltransmash, Almaz-Antey, SMZ, Obukhov plant, KZTM, PSZ, Votkinsk plant, Splav, Kurganmashzavod, Perm Gunpowder, BPZ, Kamensk plant
Research	Mirniy, Khimki, Nizhny Tagil, Sarov, Surgut, Ust-Katav, St. Petersburg, Angarsk, Voronezh, Perm	Reshetnev, RKK Energiya, NPO Lavochkina, RKTs Progress, RKS, TsNIIMash, Tupolev, NIKIET, Nuclear Center, GKNPTs Khrunichev, NPK SPP, Rubin, KBP, NPO Energomash, MIC NPO Mashinostroyenia, Omsktransmash, LII Gromova, Vympel, KBM, Titan-Barrikady, OKB Novator
Explosives	Stoylenskaya, Kijzak, Prokopievsk, Pavlovsk, Biysk, Kazan, Dzerzhinsk	Sverdlov plant, Elektrokhimpribor, Iskra, Kazan Gunpowder Plant, Aleksin chemical plant (AKhK), Tekhmashservis, Tula Gunpowder, KKhZ, Promsintez, Znamya, Azottekh
Naval	Severodvinsk, Silikatnaya, Bolshoi Kamen, Kholmsk, Morozova, Yaroslavl	Atomflot, Baltic plant, Yantar, VSZ, Zelenodolsk plant, Zvezdochka, Sevmash
Raw materials	Cherepovets, Magnitogorsk, Chelyabinsk, Tula, Nizhnekamsk, Kamensk-Uralsiy, Novotroitsk, Revda	Mayak, Severstal, MMK, T Plus, Lebedinsk plant, Tulachermet, ChEMK, ONPP Technology Romashyna, Voskhod
Parts and components	Nabchelny, Chelyabinsk, Nizhny Novgorod, Ulyanovsk, Prokopievsk, Angarsk	Kamaz, AZ NAZ, UAZ, NPO Almaz, Technopromexport, TVZ, OKBM Afrikantova, GRPZ, Kupol
Machinery and equipment	Chelyabinsk, Perm, Yekaterinburg, Bolshoi Kamen, Krasnoyarsk	DVZ Zvezda, Iskra, Yurga Mashzavod, Uralmash, Livgidromash, EPK Saratov, Stankostroyeniye
Repairs and maintenance	Yeysk, Kazan, Spassk, Gatchina	UZGA, 123 ARZ, Spark, AFS, 121 ARZ, NARZ, ODK-Service

Weapons manufacturing is concentrated in several major clusters, including Chelyabinsk, Rubtsovsk, Nizhny Tagil, Volchansk, Kurgan, Perm, Kamensk-Shakhtinsky, and Votkinsk. These hubs incorporate both industrial enterprises and military units, with Kamensk-Shakhtinsky hosting two such entities. Leading manufacturers such as Uralvagonzavod, KBP Instrument Design Bureau, Splav, Kurganmashzavod, Perm Gunpowder Plant, and the Votkinsk Plant operate across these locations. The clusters also encompass vital raw material suppliers like

the Chelyabinsk Electrometallurgy Plant (*ChEMK*), Kamensk Fiber, and Chelyabinsk Forge and Press Plant (*ChKPZ*), ensuring a stable and convenient supply chain for the production of military hardware.

Raw materials clusters, unsurprisingly, dominate in terms of tonnage due to their reliance on extensive logistic infrastructure. Cherepovets and Magnitogorsk are the two largest suppliers of raw materials to the military industry, playing a crucial role in sustaining production needs across different sectors.

Logistics clusters are equally vital, with Yekaterinburg standing out as a key hub, home to the CIT Terminal company and an economic department of the Ministry of Defense. Another major logistics partner of the military, FIT, is located in the Moscow region, where it shares a cluster with a naval enterprise, DVMP, ensuring efficient transport and distribution networks for military supplies.

The *explosives industry* is centered around the clusters of Biysk, Kazan, Dzerzhinsk, and Kotovsk. Biysk combines the Biysk Oleum Plant with multiple weapons manufacturers, while Dzerzhinsk is home to the Sverdlov Plant, two army entities—Impulse and Mekhanika—and the GosNIIMash research institute. Kazan hosts Kazanorgsintez, one of Russia's largest chemical companies, along with the state-owned Kazan Gunpowder Plant (*KGKPZ*). Meanwhile, the Kotovsk cluster includes the TPZ gunpowder plant and a Ministry of Defense representative office, reinforcing its role as a critical center for explosive materials production.

Research institutions frequently share clusters with industrial enterprises, fostering innovation and direct application of technological advancements. Kurgan, for instance, is home to a branch of the KBP Instrument Design Bureau and the Special Construction Machinery Bureau (*SKBM*), situated near weapons manufacturers such as Kurganmashzavod and Kurganpribor, along with a military unit. In Volgograd, the research hubs of Titan-Barrikady and KBP operate alongside weapons producers like Volgograd Tractor Plant (*VgTZ*) and Specialized Machinery and Metallurgy (*NAO SMM*), as well as the Povolzhsk Ball Bearings Plant (*PPZ*). The Mirnyi cluster hosts a branch of the space research center RKTs Progress and NPO Novator, further demonstrating the integration of research into military and aerospace production.

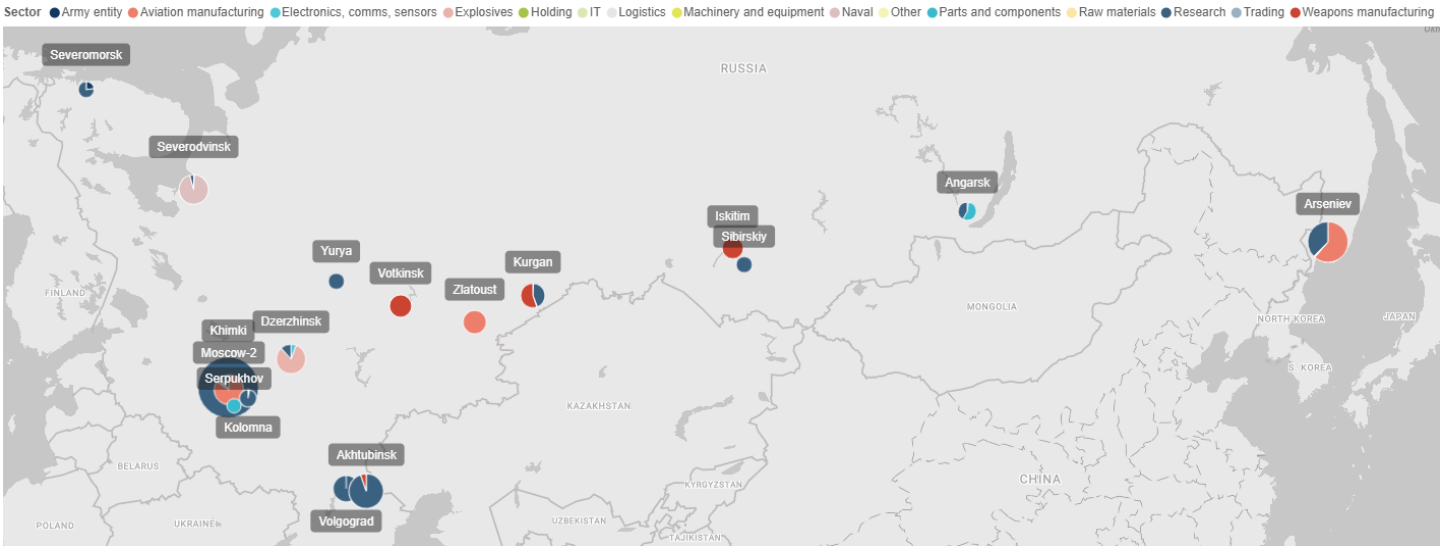
By combining industrial, research, logistics, and raw material production assets, these clusters create a highly interconnected network that strengthens military and aerospace manufacturing.

Key Products

Analyzing the products of the military industry adds another dimension to cluster analysis, allowing for a deeper understanding of how manufacturing, research, and component production interconnect. Our product database links MIC companies with the specific product types and models they manufacture, based on publicly available data such as company descriptions and news reports. This dataset encompasses a subset of 264 entities across 26 product categories, including artillery, combat vehicles, electronics, engines, firearms, materials, missiles, optics, parts, radio and communications, tanks, and UAVs. While not exhaustive, the dataset offers a tangible look into how the MIC turns its inputs into weapons that are used on the battlefield in Ukraine.

Missile production, for instance, spans 33 companies, comprising 16 research institutes, ten manufacturing enterprises, and various component, electronics, and machinery producers. These companies operate within 16 distinct clusters, including Volgograd, Kurgan, Iskitim, Arseniev, Kolomna, Akhtubinsk, Votkinsk, Zlatoust, Severomorsk, Dzerzhinsk, Moscow, Angarsk, Severodvinsk, Sibirskiy, Yurya, and Serpukhov (see Figure 29).

Figure 29: Clusters involved in design and production of missiles by sector



Source: KSE Institute

Several key clusters stand out for their concentration of missile-related production. In the Novosibirsk region, Iskitim hosts two weapons manufacturers: the Novosibirsk Artificial Fiber Plant (*NZIV*) and a branch of Splav, contributing to missile technology and weapons development. Arseniev, located in the Vladivostok region, features a mix of aviation and military enterprises, including Progress Aviation Company (*AAK Progress*), the machinery manufacturer Askold, materials supplier VR Foundry, and a branch of the Mil and Kamov aviation manufacturers. Kolomna in the Moscow region plays a significant role in the industry, housing the Mashinostroyenia Construction Bureau (*NPK KBM*) alongside tools manufacturer Stankotekh, both of which contribute to the precision engineering required for missile and military technologies. Akhtubinsk in the Volgograd region is another critical hub, bringing together three research centers—OKB Novator, the Ramensk Machinery Construction Bureau (*RPKB*), and Vympel—alongside three branches of weapons manufacturers: KTRV, Bazalt, and GNPP Region, forming a well-integrated research and development ecosystem.

One of the most strategically important clusters, Votkinsk in the Izhevsk region, is home to the renowned Votkinsk Plant, a key producer of different types of ballistic missiles, tactical missile systems such as the Iskander, and the Start system, which is used for launching commercial satellites into orbit. Similarly, the Zlatoust cluster in the Chelyabinsk region hosts the Zlatmash plant, specializing in firearms manufacturing alongside missile applications, including submarine-launched ballistic missiles and spacecraft propulsion systems. In the northernmost segment, the Severomorsk cluster plays a crucial role in strategic military produciton. It is home to another branch of OKB Novator, which operates alongside seven army entities, including the Northern Fleet's strategic command, strengthening the region’s role in advanced missile technology and naval warfare.

Analysis of clusters by product group, each with a unique mix of research institutions, production facilities, and military infrastructure, illustrates how the military industry’s production is deeply integrated into the broader military ecosystem (see Figure 28 on page 38 & Table 3). Their interconnectivity is supposed to ensure the development of advanced weaponry, supporting both strategic and tactical capabilities across various domains.

Table 3: Key clusters and entities by product group

Product group	Key clusters	Key entities
Artillery	Chelyabinsk, Yekaterinburg, Biysk, Iskitim, Kurgan, Dzerzhinsk, Volgograd	KBP, Sverdlov plant, Splav, Titan-Barrikady
Combat vehicles	Chelyabinsk, Nizhny Tagil, Rubtsovsk, Volchansk, Kurgan, Arzamas, Perm	Uralvagonzavod, Kurganmashzavod, AMZ
Engines	Chelyabinsk, Perm, Samara, Rybisnk, Moscow, Khimki	ODK-Saturn, ODK-Kuznetsov, MMP Chernyshov, Energomash, ODK-Star
Firearms	Zlatoust, Volgograd, Kurgan, Kazan, Zelenodolsk, Tula, Kovrov, Akhtubinsk	KBP, Kazan Gunpowder, POZiS, Zlatmash, TPZ
Materials	Verkhnyaya Salda, Perm, Safonovo, Moscow	Perm Gunpowder, Avangard, VILS, VSMPO-Avisma
Missiles	Khimki, Angarsk, Arseniev, Iskitim, Kurgan, Volgograd, Moscow, Severodvinsk, Zlatoust, Votkinsk, Dzerzhinsk, Kolomna	KBP, Votkinsk plant, Zlatmash, Titan-Barrikady, OKB Novator, Splav, NPK KBM, AAK Progress, Ratep, KTRV, Vympel
Radio and communications	Akhtubinsk, Reutov, Vladimir, Arzamas, Ryazan, Moscow, Nizhny Novgorod, St. Petersburg, Rybinsk, Azov, Volgograd	KBP, NNIIRT, Ratep, MIC NPO Mashinostroyenia, Vympel, KTRV
Tanks	Chelyabinsk, Rubtsovsk, Nizhny Tahil, Volchansk, Omsk	Uralvagonzavod, Omsktransmash, ChTZ-Uraltrak

Cargo Flows

Overlaying cargo flow analysis onto the map of military-industrial clusters adds another powerful dimension to the assessment, revealing critical supply chain relationships within the military sector. By tracing material and component movements between key production hubs, this approach provides insights into logistical dependencies and manufacturing processes, even when direct data on procurement is unavailable.

For instance, the primary tank production clusters—Rubtsovsk, Volchansk, and Omsk—serve as major recipients of essential raw materials (see Figure 30). Analyzing flows into these clusters highlights their key suppliers. All three receive steel from Magnitogorsk, home to the MMK steelworks, while Rubtsovsk additionally sources steel from Severstal in Cherepovets. Manganese compounds, crucial for steel production, are supplied to Rubtsovsk from the Magnezit Group in the Chelyabinsk region. The movement of vehicles from the Nizhny Tagil cluster to Volchansk likely represents intra-company transfers of unfinished components between branches of Uralvagonzavod. Additionally, an unspecified flow from Arseniev in the Vladivostok region to Omsk is particularly notable, as its counterparties remain undisclosed, suggesting it may include imports from China.

Examining outbound flows further clarifies the final destinations of finished products (see Figure 31). The most significant outflow from Omsk is an unspecified shipment to the Kamensk-Shakhtinsky and Gukovo clusters near the Ukrainian border. The volume surged from 1,900 thousand tons in 2022 to 20,000 tons in 2023, reinforcing the assumption that these transfers involve combat machinery from the Omsktransmash plant being moved toward the frontlines. Similar patterns emerge with "other machinery" shipments from Rubtsovsk, which are routed to Kamensk-Shakhtinsky and the Rostvertol helicopter plant in the Rostov region, further indicating military-related transfers. In addition to machinery outputs, Rubtsovsk also sends scrap ferrous metals to metallurgical plants in Magnitogorsk and Asha, likely for reprocessing and reuse in new production cycles.

Figure 30: Main MIC cargo flows to Rubtsovsk, Volchansk, and Omsk Clusters, 2023

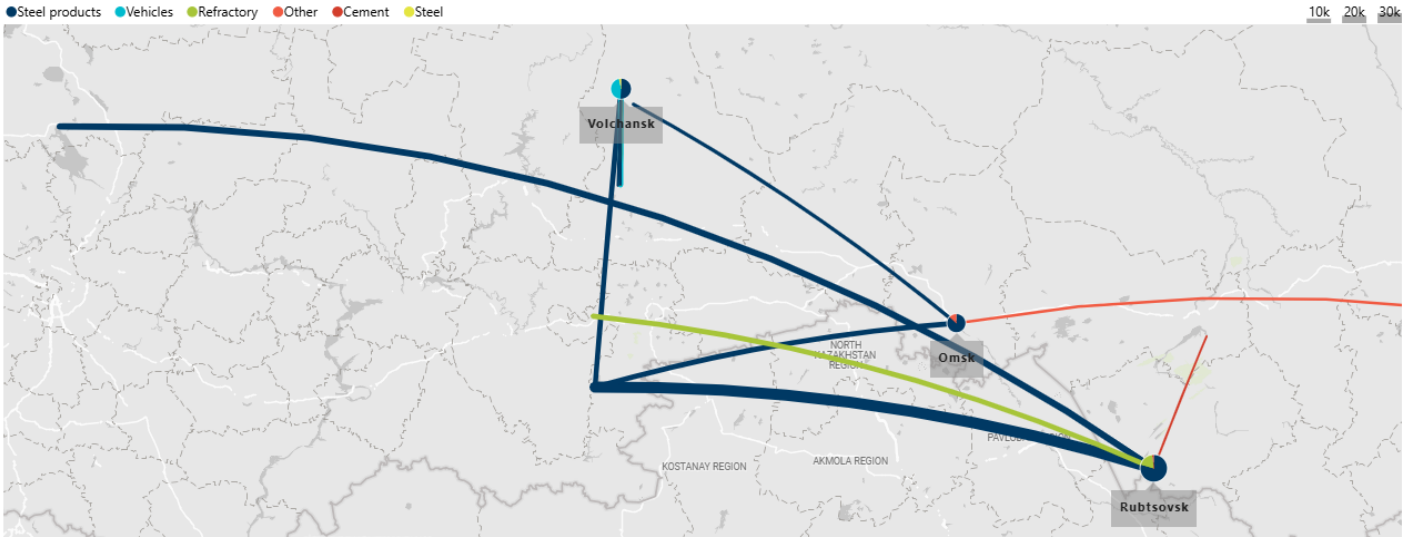
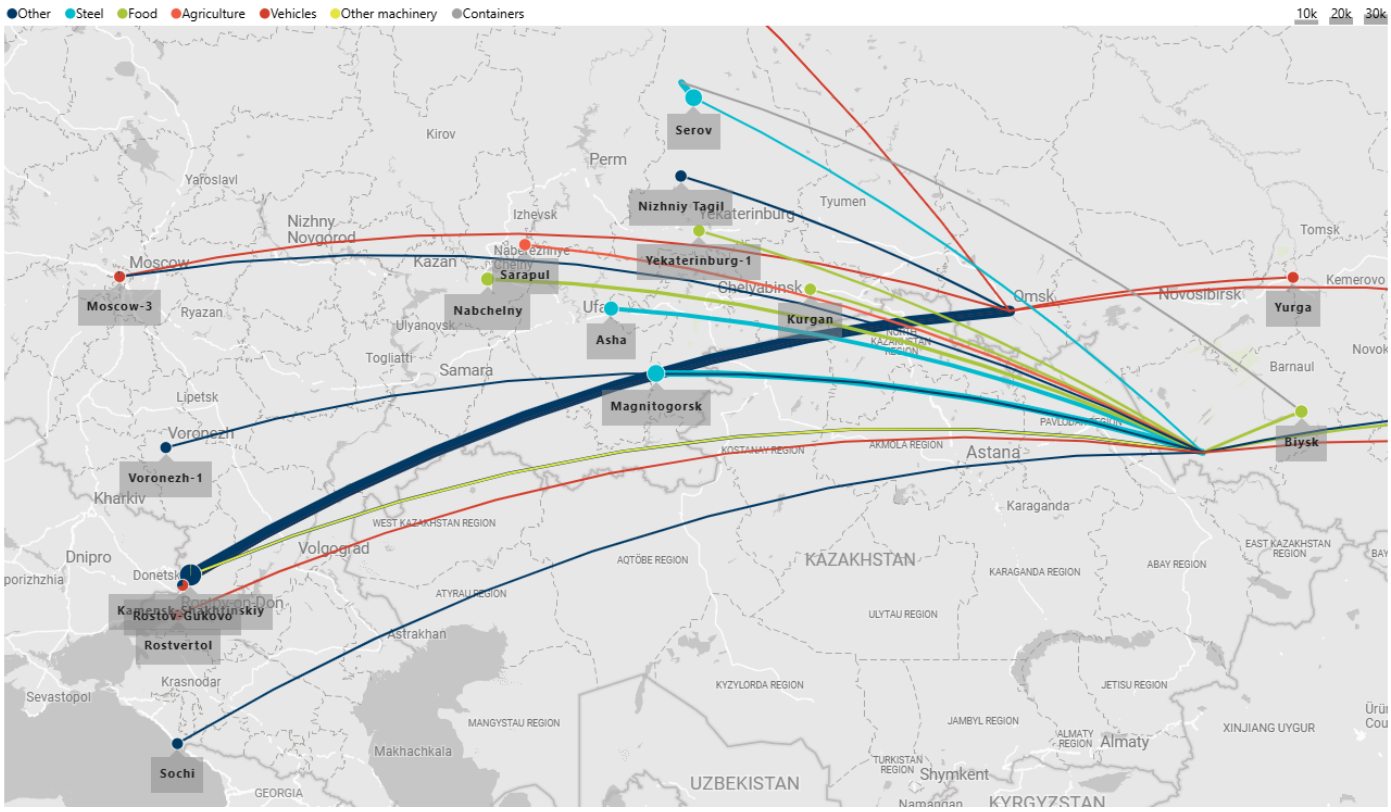


Figure 31: Main MIC cargo flows from Rubtsovsk, Volchansk, and Omsk Clusters, 2023



Source: KSE Institute

By mapping both inbound material flows and outbound product shipments, this analysis reconstructs the hidden supply chain of the military industry, shedding light on how critical resources are distributed and how final outputs are mobilized. This perspective enhances understanding of industrial logistics, providing a clearer picture of the connections between raw materials, production hubs, and deployment zones. We will further unpack these critical relationships in a future report of this series.

Figure 32: Shipments of explosive materials between key MIC clusters

Source: KSE Institute

Cargo flows can be analyzed not only by identifying origin and destination clusters but also by examining the movement of specific product types. A closer look at the shipments of explosive materials over 2021, 2022, and 2023 reveals key dependencies and emerging logistical patterns (see Figure 32) *In 2021*, the primary flows included shipments from Kemerovo to the Kiyzak cluster, reflecting the transportation of ammonium nitrate from NAK Azot to the explosives manufacturer PVV. Another significant route was from Angarsk to the Nakhodka cluster, indicating an established supply chain within the explosives sector. *By 2022*, two new destinations appeared: Gukovo and Taganrog. Their strategic proximity to the Ukrainian border strongly suggests that these new routes were established to support frontline military supplies. This shift indicates an increasing role of explosives logistics in direct combat support, with supply chains adapting to new operational demands. *In 2023*, another major new flow emerged, connecting Nakhodka to the Kirzhach cluster in the Moscow region. The Kirzhach cluster, known for its involvement in explosives logistics with undisclosed counterparties, highlights the military nature of these shipments. The origin of explosives in Nakhodka suggests an external supply chain, likely involving imports from North Korea or China, further underscoring the geopolitical dimensions of these material flows.

Tracking the evolution of material shipments of specific cargo types over time provides valuable insights into the restructuring of supply chains and their increasing alignment with military priorities. These shifting logistics routes reveal not only operational dependencies but also broader strategic trends and dependencies. We further explore this dimension of analysis in a future report of this series.

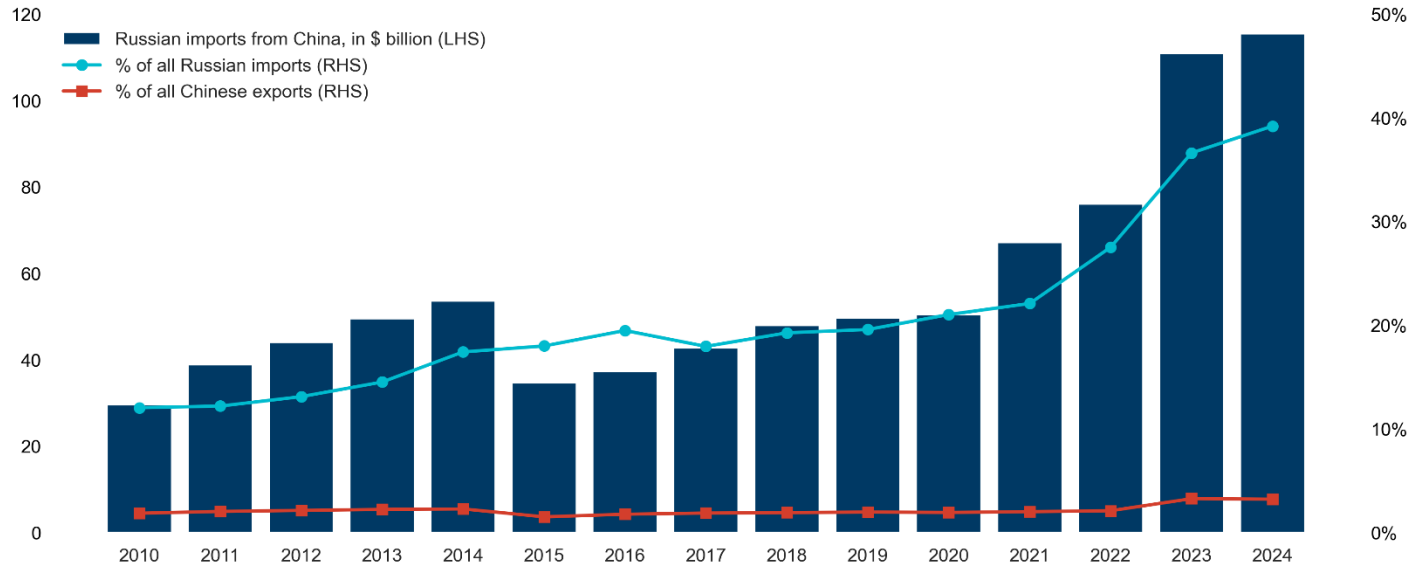
IV. The China Connection: Links and Dependencies

The Russian military industrial complex is highly dependent on imports of intermediate components, particularly high-tech electronics and industrial tools—many of which fall under export controls since 2022. With direct supplies from Western countries dropping to essentially zero within weeks of the imposition of sanctions, China has become Russia's lifeline. It facilitates the Russian MIC's access to critical inputs in three ways: Chinese producers provide it with substitutes for the Western goods that it previously relied upon; Chinese factories of Western companies produce goods that eventually reach Russia; and Chinese intermediaries facilitate the transshipment of goods manufactured in the West.

Russia-China Economic Links

While the Russian economy is relatively self-sufficient at two key phases of the military industrial complex's production cycle—raw materials and finished products—it is highly dependent on imports of intermediate components. Russian leadership recognized this vulnerability and made steps to onshore production, namely through import substitution programs. The programs failed to decouple the military industrial complex from either its European or Asian supply lines, however.

Figure 33: Trade between Russia and China



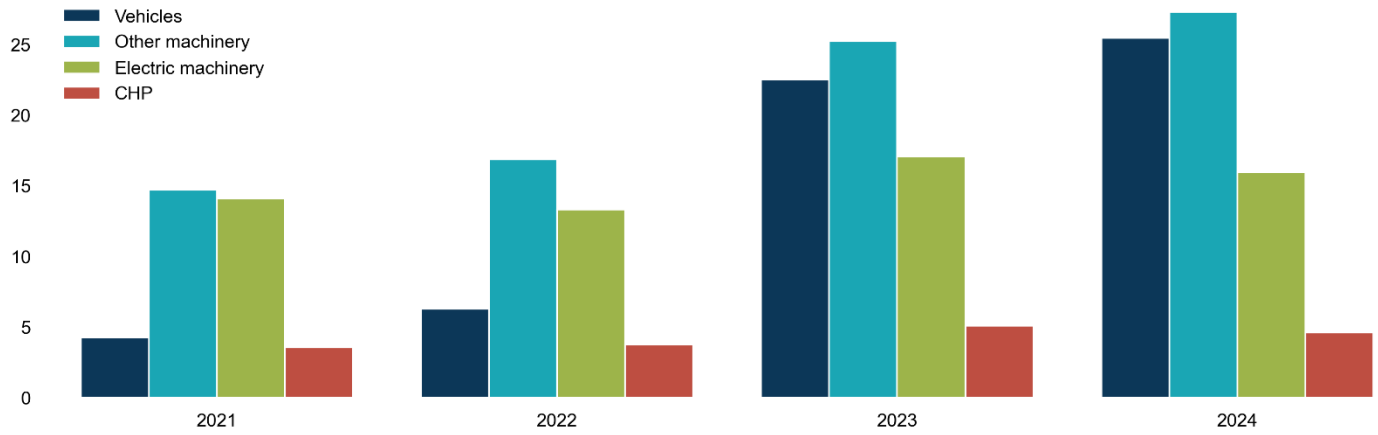
Source: UN Comtrade, Bank of Russia, General Customs Administration of China, KSE Institute

After sanctions severely limited Russian access to Western components, Russia was left with practically a single source for all its high-tech components: China.[78] Since 2022, bilateral trade between Russia and China has grown to a record high (see Figure 33).[79] Russia's imports from China reached $115 billion in 2024—a 4% increase vs. 2023 and 72% increase vs. the pre-war period (2021)—led by machinery, vehicles, and other manufactured goods (see Figure 34).[80] While these imports have served as a crucial lifeline for Moscow in the

[78] See "Export Controls and Technology Transfer: Lessons from Russia," testimony by Elina Ribakova in February 20, 2025 hearing before the US-China Economic and Security Review Commission
[79] See "China-Russia 2024 trade value hits record high—Chinese customs," Reuters
[80] Chinese customs data can be accessed here

face of its isolation from the West, the trade flows are far less meaningful for China. Russia's imports from China accounted for 39% of its total imports, but only about 3% of China's total exports in 2024.

Figure 34: Russian imports from China by type, in $ billion



Source: International Trade Centre (ITC) Trade Map (ITC calculations based on General Customs Administration of China statistics), KSE Institute

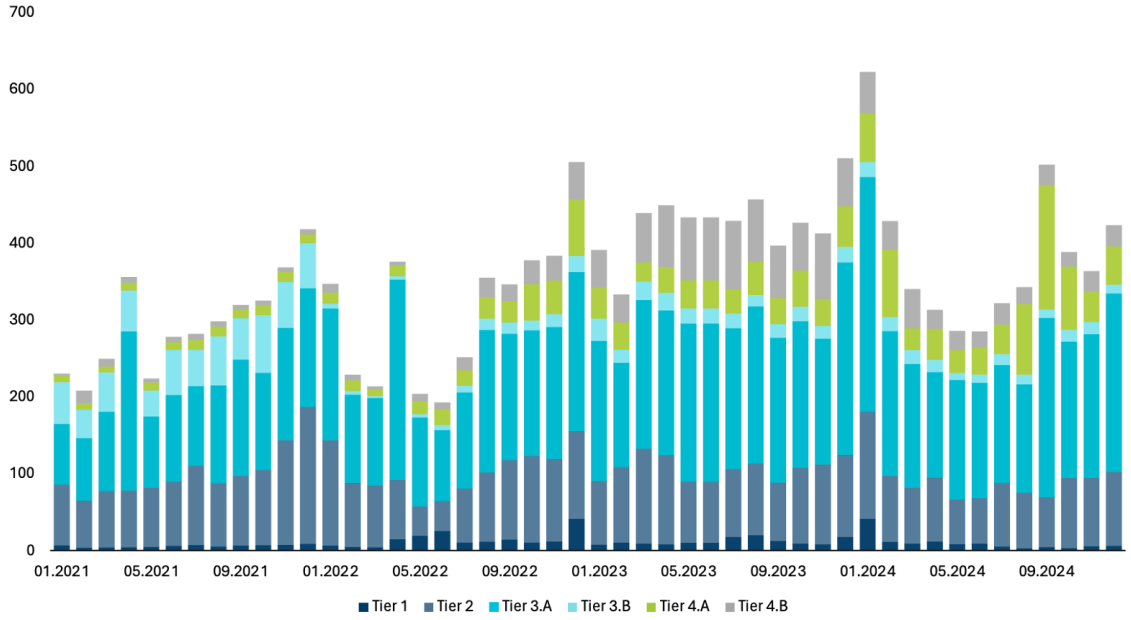
Note: CHP category calculated based on 8-digit HS codes; possible partial overlap with other categories.

Most importantly, from the perspective of the Russian MIC, the supply chains of Common High Priority (CHP) items—also called 'battlefield goods'—pivoted away from Europe and towards China.[81] In 2021, both the EU and China (incl. Hong Kong) accounted for 41% of deliveries of battlefield goods to Russia in terms of their monetary value.[82] Already in 2022, the EU's share fell to 13% while China and Hong Kong's share rose 68%. By 2023—the first full year of the new sanctions regime—the EU further fell to 2%, while China and Hong Kong reached 76%. Chinese exports of CHP items to Russia over time are shown in Figure 35. Even without providing lethal aid, China has served as the chief enabler of Russia's aggression. When we analyze all imports of CHP items that eventually made their way to Russia in 2023, 90% of them were in some way facilitated by China (see Figure 36).

China's facilitation of Russian export controls evasion occurs primarily in one of three ways. *First*, items can be made by Chinese companies in China–these deliveries are the least accessible for export control enforcement by the sanctions coalition. In 2023, this accounted for just under half (49%) of all Russian imports of CHPL item imports. *Second*, items can be delivered to Russia via transshipment—these are items manufactured outside of China by Western companies that are then shipped or sold from China. This category accounted for 18% of CHPL imports in 2023. *Third*, items can be manufactured by Western companies in Chinese factories. This offshore production accounted for 16% of CHPL imports in 2023. All three involve significant costs to the Russian economy. Chinese goods often come with a cost in quality, whereas Western goods come with added transaction costs to circumvent sanctions and export control regimes.

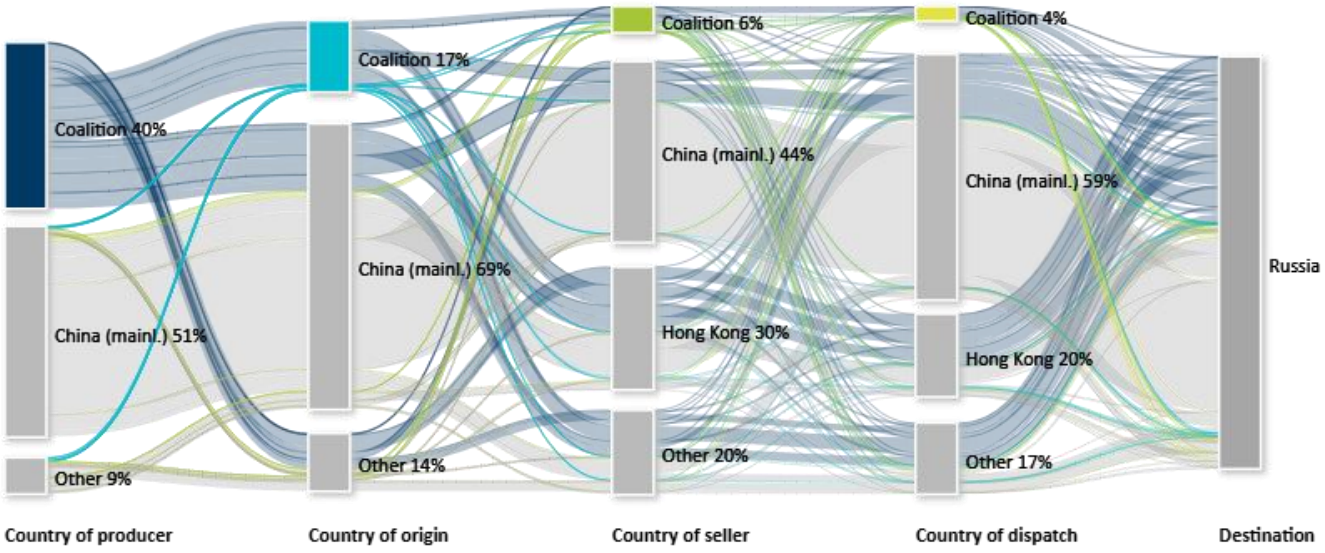
[81] The full Common High Priority list can be found at the US Bureau of Industry and Security site. The list is harmonized with the EU, Japan, and UK.
[82] These measures use the country of dispatch–from where goods are ultimately shipped to Russia–sourced from commercially available trade data. See Challenges of Export Controls Enforcement for more information.

Figure 35: Russian imports of CHP items from China by type, in $ million[83]



Source: International Trade Centre (ITC) Trade Map (ITC calculations based on General Customs Administration of China statistics), KSE Institute

Figure 36: Flows of CHP items to Russia in 2023



Source: KSE Institute

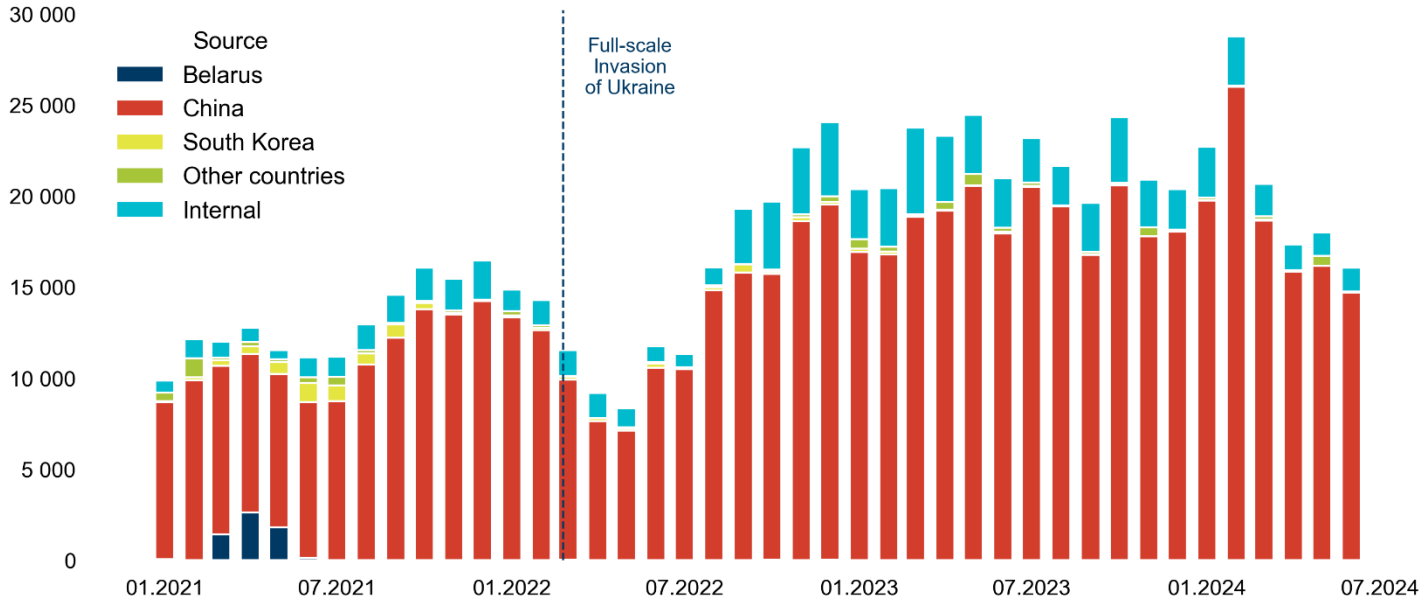
Country of producer = location of company ultimately responsible for the good; country of origin = location of manufacturing; country of seller = location of final seller to Russia; country of dispatch = location from which final shipment to Russia was made.

[83] Tier 1: Items of the highest concern due to their critical role in the production of advanced Russian precision-guided weapons systems, Russia's lack of domestic production, and limited global manufacturers. Tier 2: Additional electronics items for which Russia may have some domestic production capability but a preference to source from the United States and its partners and allies. Tier 3.A: Further electronic components used in Russian weapons systems, with a broader range of suppliers. Tier 3.B: Mechanical and other components utilized in Russian weapons systems. Tier 4.A: Manufacturing, production and quality testing equipment for electronic components, circuit boards and modules. Tier 4.B: Computer Numerically Controlled (CNC) machine tools and components.

Chinese Production and Substitution

While Russia is still purchasing re-exported Western goods from China and Hong Kong, trade relations between the Russian MIC and Chinese suppliers have also increased since Russia launched its full-scale invasion of Ukraine. This remains the case even when Chinese goods are less desirable than their Western analogues.[84] Examining supply chain logistics, we found several key components that Russia sources almost exclusively from China. This dynamic is made particularly clear by comparing shipments of goods to Russian destinations in terms of their origins—whether they are domestically sourced components, from China, or from any other country.[85] Electric devices—a broad category encompassing both high- and low-tech components with civilian and military uses—serves as a strong example (see Figure 37). Even before its full-scale invasion, Russia sourced the vast majority of its electric devices from China. Once the Russian economy was put on a war footing in Q3 2022, these imports increased by more than a third; what little volumes previously came from South Korea and other countries were supplanted by domestic production.

Figure 37: Shipments of electric devices, in metric tons



Source: KSE Institute

Metal cutting tools—including CNC machines—are even more stark (see Figure 38). Previous KSE Institute research has detailed Russia's reliance on EU-made, China-sourced CNC machines.[86] New analysis shows that this import reliance continued in 2024, particularly in the military industrial complex. Metal cutting tools are overwhelmingly imported from China, regardless of their intellectual property's origin.[87] MIC entities import metal cutting tools from China at an *even higher* rate than Russian firms as a whole. An important caveat to this

[84] See: "How Does Russia Make Missiles?" page 31, Rhodus Intelligence.
[85] This includes countries that are not connected by land to Russia; when a product is imported by air or sea and then shipped within Russia, the origin country is still retained in the data.
[86] See "The Challenges of Export Controls Enforcement" pages 21-24, KSE Institute
[87] Other researchers have found that Chinese CNC machines have become normalized in post-invasion years due to the scarcity of Western-made machines. See: "How Does Russia Make Missiles?" page 31, Rhodus Intelligence

observation is that Chinese-made CNC machines are not exclusively Chinese in nature. They themselves rely on Western components and technology, and are often produced by unsanctioned Chinese companies.[88]

Figure 38: Shipments of metal cutting tools, in metric tons

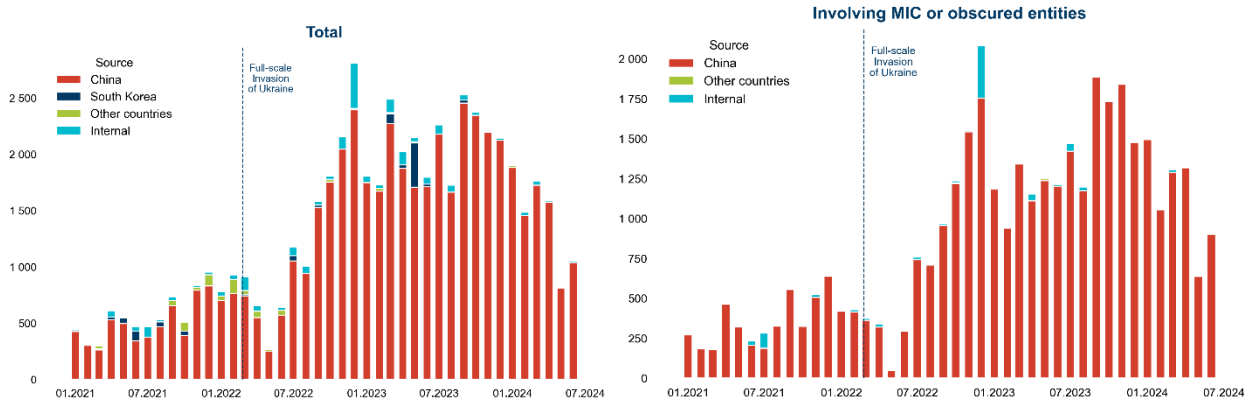


Figure 39: Shipments of optics, in metric tons

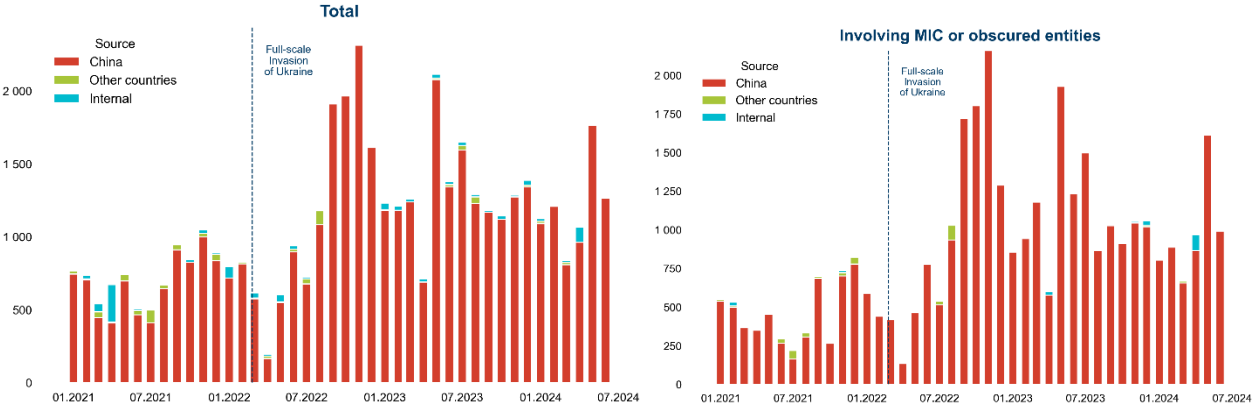
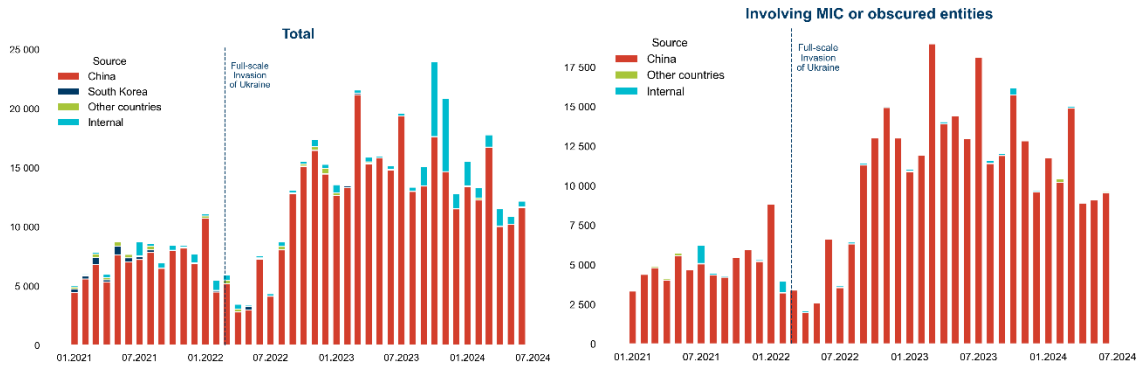


Figure 40: Shipments of radio & communication equipment, in metric tons



Source: KSE Institute

Two more types of components stand out in the China-Russia supply line. First are optics, which are imported primarily by military industrial complex entities (see Figure 39). Much like metal cutting tools, China serves as the sole origin of nearly all optics shipments completed in Russia. Radio and communication equipment, another

[88] See “Third-best option: ESCU’s new report on China’s role in Russian maintained access to critical industrial equipment” pages 23-28, Economic Security Council of Ukraine

key dual-use category, further illustrates Russia's dependence on China in importing both high- and low-tech components (see Figure 40). The category is unique in that it includes a surge in domestically sourced components in Q3 2023. Leveraging this report's network of military industrial complex entities, however, we see that this spike was entirely civilian in nature: the Russian MIC remains fully reliant on China for radio and communication equipment, even when there are domestic sources available.

Evidence for Chinese tools and components in the Russian military industrial complex goes beyond imports and shipments. Another key source of evidence is public procurement. In addition to a small but growing number of procurement contracts being denominated in yuan (the equivalent of $11 million in 2023), procurement contracts frequently detail the purchases of Chinese-made products.

War & Sanctions, a site maintained by the Ukrainian government, tracks foreign-made components recovered from Russian weapons and munitions used during the war.[89] It also tracks the usage of industrial machines and components in the Russian MIC by scouring public procurement records and using open source intelligence (OSINT) techniques. This includes 19 tools from 13 different Chinese manufacturers that are used in the production of Kinzhal missiles, ICBMs, and armored vehicles, among others.[90]

Export Controls Circumvention

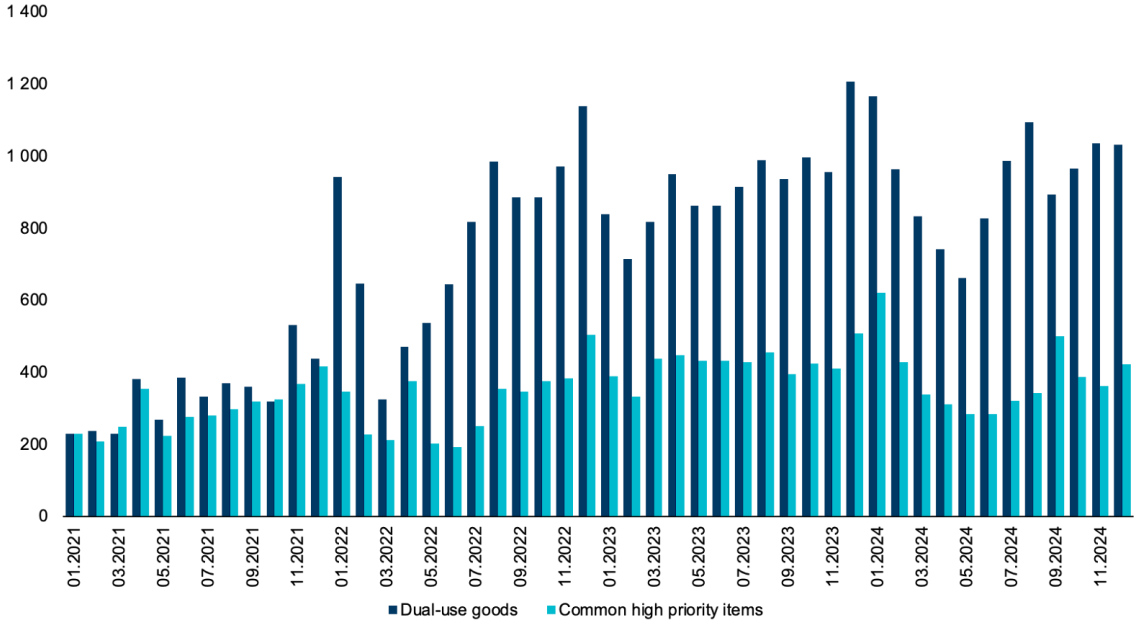
Russia depends to a large extent on networks of unscrupulous distributors and companies that pose as end-users in third countries and then redirect the flow of goods to Russia. The fact that Western companies have not been compelled to invest in thorough due diligence processes makes it easier for these diversions to go unnoticed and under-reported to authorities. Countries such as China, the UAE, Turkey, Kazakhstan and other former-Soviet countries have benefited greatly from this trade diversion. For example, in 2022-23, Turkey emerged as one of the key exporters of chips to Russia, after China, despite not being a producer itself.

Simply put, Russia's standard method of export control circumvention is predicated upon support–tacit or otherwise–from China. In most circumvention cases, a good is manufactured in China or the West, then sold and shipped by companies in China or Hong Kong (see Figure 37).[91]

A key impediment to curbing these China-centric routes is the manner in which Western corporations conduct—and are expected to conduct—export controls compliance. Based on several meetings with leading microelectronics and semiconductor manufacturers, the KSE team has found that there is little incentive for corporations to proactively avoid the aforementioned sales routes. As long as the first-level distributor is not on a sanctions 'black list'—even if there is suspicion that it is facilitating trade with sanctioned entities—the Western corporations will proceed with the sale of controlled goods. If, for example, a major distributor of high-tech microelectronics in the Middle East or Asia regularly sells export controlled goods to a second distributor, which then sells exclusively to sanctioned Russian companies, there is no incentive for the Western corporation to halt sales to the first distributor. The end result is Figure 41, where Russia imports hundreds of millions of dollars of battlefield goods–many of them ultimately Western in origin–from China each month.

[89] See War & Sanctions
[90] See the list of machines and tools here.
[91] This is a simplification of a complex supply chain network. See KSE Institute's Challenges of Export Controls Enforcement for a more in-depth analysis.

Figure 41: Chinese export of critical technology to Russia, in $ million



Source: International Trade Centre (ITC) Trade Map (ITC calculations based on General Customs Administration of China statistics), KSE Institute.

V. Conclusion

The Russian military-industrial complex has seen significant expansion in recent years, particularly following Russia's 2022 full-scale invasion of Ukraine, despite facing sanctions. However, few studies combine both micro and macro-level analyses of Russia's MIC, providing a comprehensive overview of its key players, capacities, and financial health. This report undertakes such an analysis and contribution to the literature.

We present a unique and comprehensive assessment of Russia's military-industrial complex, based on a new, innovative dataset. This is especially relevant at a time when Russia has restricted access to a significant portion of macroeconomic, regional development, and company statistics. Our approach is bottom-up, shedding light on the financial and legal ties within the MIC. By identifying specific entities involved in military production, we establish reference points to query available datasets, such as financial records, employment statistics, procurement contracts, and cargo flows. We then aggregate this entity-level data to build an extensive network of companies, which serves as the analytical foundation for this report.

We find that the Russian MIC is highly concentrated and struggling to modernize. Key players like Rostec are driving growth by leveraging state funding and off-budget sources, but significant challenges persist, including high funding costs, labor shortages, and collapsing arms exports. 52% of total assets are concentrated within the top ten groups, highlighting the oligopolistic nature of the industry; and 90% of all production used in the war effort allegedly comes from Rostec entities, with roughly half of the country's military procurement funneled through Rostec. Despite Russia's unprovoked invasion of Ukraine, many MIC entities remain unsanctioned by the US and EU, including key players like Roscosmos and Rosatom. At the same time, Russia has prioritized production for the front over modernization and innovation. In this context, China's support has been crucial, helping Russia bypass export controls and supplying vital components where domestic capabilities are lacking.

In this report, we provide evidence that lifting sanctions on Russia could offer a critical boost to the country's MIC, which is already struggling with inefficiency, corruption, and a lack of modernization. Over the years, MIC companies have repeatedly required bailouts due to excessive debt, and while the industry saw a temporary surge in funding following Russia's full-scale invasion of Ukraine, its core challenges remain unresolved. The war and resulting sanctions have only worsened these issues, leading to deteriorating macroeconomic conditions, labor shortages, and disruptions in supply chains. Additionally, the loss of export markets is further burdening MIC companies, which will continue to rely on extra funding to stay afloat. Given these circumstances, it is not surprising that Russia is seeking sanctions relief in its talks with the US, despite claiming the ineffectiveness of these measures. However, lifting restrictions at this point would be a strategic error, allowing the Russian MIC to overcome its limitations and bolster the military capabilities of a regime that poses a significant threat to peace and prosperity in Europe and the stability of the international order.

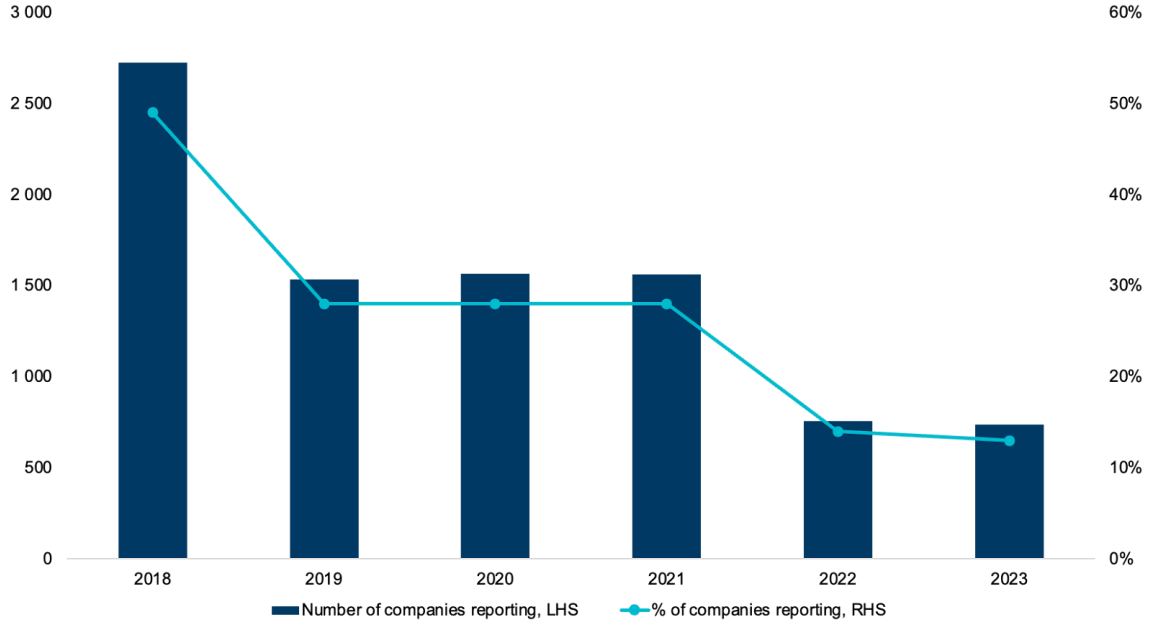
This report is part of a series examining Russia's military-industrial complex. In the first report, we introduced Russian military production capabilities, provided an overview of the key players, critical clusters, and the role of China. Subsequent reports will offer in-depth analyses of Russia's various production clusters, including those dedicated to weapons and aviation manufacturing, as well as missile, artillery, and engine production. We will also assess the key logistical hubs and their critical connections to China, North Korea, and Iran. Lastly, this series will explore the essential materials required for Russia's weapons manufacturing and the degree of civilian-military fusion, which plays a pivotal role in bolstering the country's military capabilities.

Appendix

Financial Analysis

The number of companies in our database, which reported financial information dropped from over 2,000 in 2018 to less than 600 in 2023 (see Appendix Figure 1), indicating attempts to conceal details about the Russian military-industrial complex from the public. This lack of transparency is particularly acute in aviation and research, where companies have stopped reporting on almost their entire asset base since 2019. Machinery and weapons manufacturing sectors followed suit in 2022.

Appendix Figure 1: Number of companies reporting and % of companies reporting by year



Source: KSE Institute

However, even as total sector assets have decreased due to these reporting exemptions, certain segments have demonstrated steady increases in average company assets (see Appendix Figure 2). Logistics, construction, parts and components, IT, electronics, repairs, military, and explosives companies have all seen their asset bases grow. Notably, logistics firms have tripled their asset sizes over the past five years, driven by high profitability during the war years, albeit with slowing asset turnover.

The holding company sector has also seen significant changes, with around 50% of entities ceasing their public financial disclosures in 2022. The remaining holding companies exhibited peak profitability in 2023, but with slowing activity as measured by asset turnover. In contrast, the raw materials sector showed a decline in asset bases, but a different pattern of profitability and asset turnover - peaking in 2020.

The biggest war profiteers appear to be construction, naval, and army entities who enjoyed record-high asset turnover and profits in 2023. Other sectors like logistics, holdings, parts and components, and explosives display peak profitability but slowing asset turnover. The reverse is true for trading, IT, and repairs - improving asset turnover but flagging profitability.

Despite the reporting limitations, the data do reveal significant shifts in the asset profiles, profitability, and operational efficiency of various military industry segments. The full-scale invasion has given the MIC an infusion of cash, but it has by no means been a silver bullet for its financial struggles.

Appendix Figure 2: MIC financial statements trends by sector, 2018-23

Source: KSE Institute

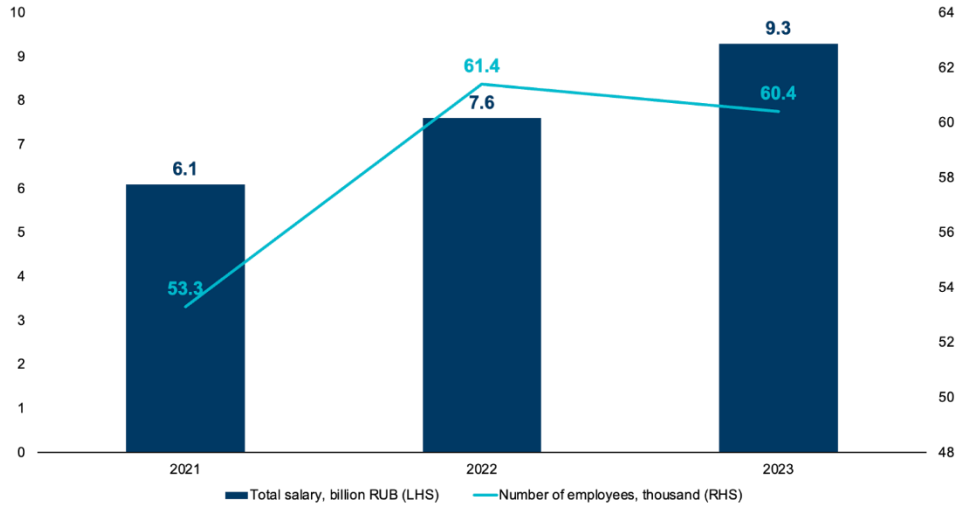
Note: Dots is assets turnover and profit margin panels represent maximums.

Workforce Analysis

Our analysis of employee and salary dynamics is based on data from 1,002 MIC companies, 511 of which have consistent data for 2021-2023. This dataset, primarily representing trading, IT, and holding companies, offers a window into broader trends in the sector. Army entities, repair and maintenance enterprises, and weapons manufacturers are underrepresented in this subset, however. In addition, the employment and salary statistics that companies report to the Federal Tax Service depend on the aggressiveness of tax optimization schemes they use. The number of employees in the sample increased by 7% from 2021 to 2022, then remained relatively

stable through 2023 with only a slight 1.6% decrease (see Appendix Figures 3 & 4). The IT sector saw the most significant growth, adding 1,100 new employees (+11%). Administrative services and food providers experienced the largest cuts, letting go of 1,400 people (-19%). The companies that gained the most personnel include Rostec's digitalization services provider Bars Group, the Shahed drone maker proxy Alabuga Development, the metals supplier Permmetall, and the IT firm Sitronics from the Sistema group.

Appendix Figure 3: Total salaries and number of employees



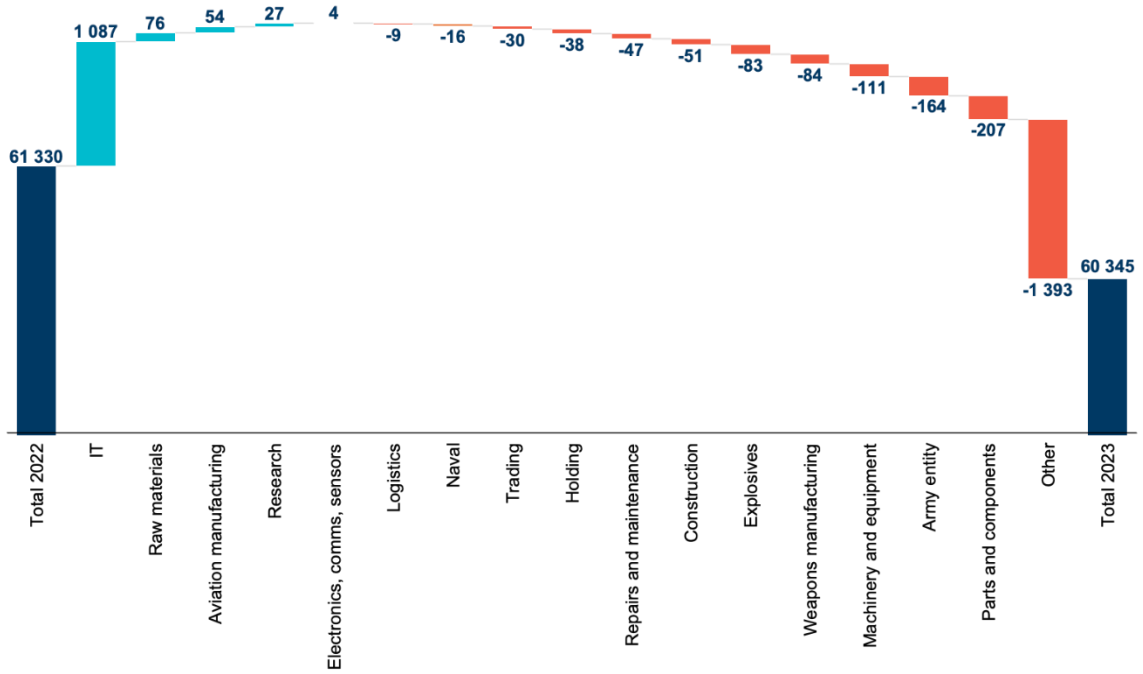
Source: KSE Institute

Interestingly, even as employee numbers fluctuated, total salaries paid continued to rise, increasing by 24% in 2022 and 22% in 2023. This suggests that the military industry was not immune to broader labor market shortages, with average MIC salaries reaching 2.25 times higher than 2019 levels, far outpacing the 1.5-fold increase in the broader Russian economy (see Appendix Figure 5). As of 2023, the MIC sample's salaries were almost two times higher than the national average. Public announcements also support this trend: according to Rostec head Sergey Chemezov, Rostec enterprises fulfilling military procurement contracts have a labor shortage of 30 thousand personnel,[92] while the premier tank manufacturer Uralvagonzavod raised its employees' wages twice in 2024, including by 28% in August.[93]The sectors with the highest salary growth rates between 2021 and 2023 were IT, holdings, logistics, and research, with increases in average pay ranging from 11% to 20%. In contrast, weapons manufacturing and repair/maintenance were the only segments to see decreases, potentially due to data limitations, as the sample for weapons producers was particularly small.

These insights into the MIC's evolving workforce and compensation trends provide important context for understanding the industry's adaptability, priorities, and competitiveness in attracting and retaining talent, even as broader economic conditions have deteriorated. The MIC has remained competitive by offering twice the average market salary, particularly in IT, logistics, and research sectors.

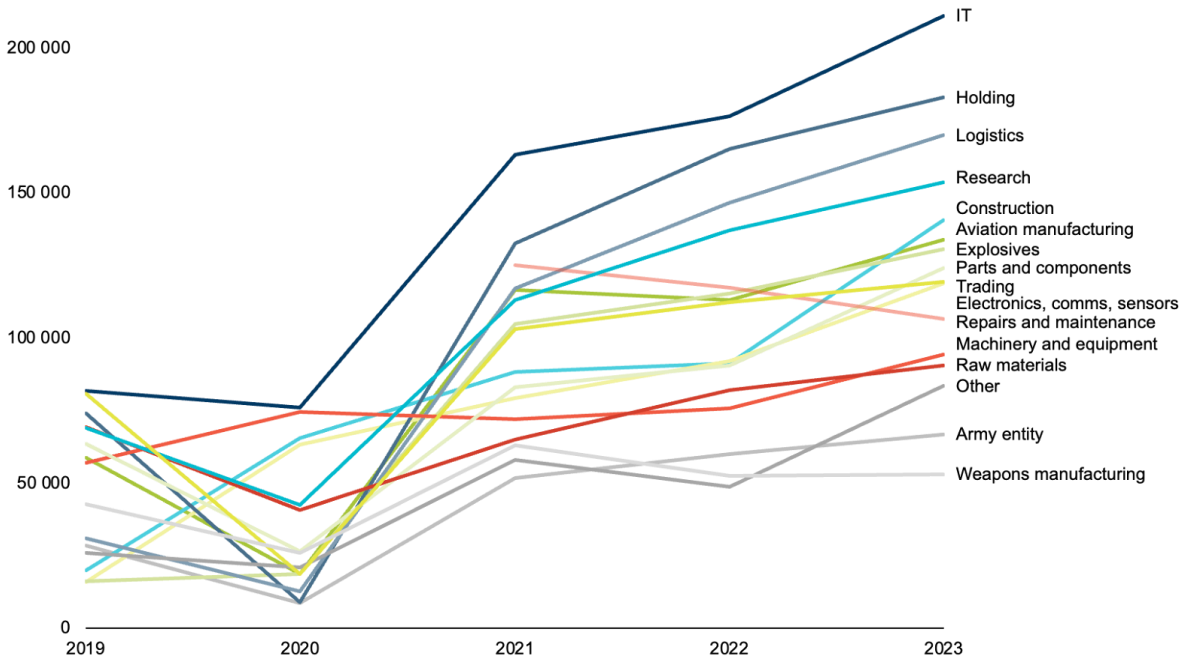
[92] See here [ru]
[93] See TASS [ru]; "The Russian Economy at a Turning Point" page 3, SWP

Appendix Figure 4: MIC Workforce 2022 vs. 2023



Source: KSE Institute

Appendix Figure 5: Change in average salary by sector, in rubles



Source: Federal Tax Service, KSE Institute