Collaboration and Its Limits: Axis Partnerships in Emerging Technologies

Juljan Krause

jkrause@gatech.edu

Assistant Professor,

Digital Systems and International Affairs,

Sam Nunn School of International Affairs,

Georgia Institute of Technology

April 13th, 2026

1 Overview

- **Summary Statement:** While China, Russia, Iran, and North Korea, often referred to as the "Axis of Upheaval," have intensified defense collaborations, their partnerships in emerging technologies like quantum computing, artificial intelligence (AI), and robotics are marked by asymmetries, caution, and inherent limitations. Strategic mistrust, capability gaps, and sanctions severely limit the depth of cooperation in these technology domains. While the U.S. and its allies should take Axis efforts seriously, targeted monitoring and resilience are preferable to alarmism.
- **Contextual Background:** The post-2022 geopolitical landscape has encouraged deeper alignment among Axis actors in military and economic domains. However, translating this alignment into meaningful and sustained R&D cooperation in sensitive, high-stakes technologies remains difficult.
- **Objective of this Briefing Paper:** To provide a concise yet comprehensive, realist assessment of technological cooperation among Axis states in quantum, AI, and robotics, highlighting both areas of concern and structural limitations.

2 Strategic Motivations for Technological Collaboration

The technological partnerships emerging among China, Russia, Iran, and North Korea, what some analysts term the "Axis of Upheaval," represent more than single-shot opportunistic cooperation. These relationships reflect deliberate strategic calculations driven by shared opposition to the U.S.-led international order, growing mutual dependencies accelerated by sanctions regimes, and the recognition that technological superiority increasingly determines geopolitical power projection capabilities.

2.1 Shared Opposition to the West

The four states' opposition to perceived U.S. hegemony has evolved from rhetorical positioning to operational coordination in some domains. Following Russia's 2022 full-scale invasion of Ukraine, this alignment has crystallized around three technological imperatives: circumventing Western export controls, developing asymmetric military capabilities, and creating alternative technology ecosystems independent of Western specifications and standards.

China's "no limits" partnership with Russia, declared weeks before the invasion, and affirmed by China's President Xi Jinping in a phone call with Russian President Vladimir Putin on the day of the third anniversary of the attack on Ukraine [14], has translated into concrete technological support. Chinese exports to Russia increased by 46.9% between 2022-2023, and 64.2% from 2021-2023, making China Russia's largest trade partner. Significant elements of these exports, NATO notes, are items and technologies crucial to Russia's war effort in Ukraine, resulting in Russia "achieving the most significant military and defense industry expansion since the Soviet Union era." [**?**]

Iran's provision of Shahed-136/131 kamikaze drones to Russia—estimated at over 6,000 units as of August 2024—demonstrates technology transfer as a binding mechanism in anti-Western alignment [2]. The quid pro quo has been substantial: Russia has reportedly shared captured Western military technology with Iran, including components from HIMARS systems and Javelin missiles, potentially supporting reverse-engineering efforts that could accelerate Iran's indigenous defense programs [3].

North Korea's entry into this technology-sharing network, while more limited, has some strategic significance. Beyond the well-documented ammunition transfers and reports of captured North Korean soldiers in Ukraine, Russia in return is believed to have supplied advanced air defense equipment, anti-aircraft missiles and electronic warfare systems to North Korea [4].

2.2 Mutual Dependencies

The sanctions environment has created artificial scarcities and bottlenecks that incentivize technological cooperation. Russia's dependence on Iranian drone technology exemplifies this dynamic. The Shahed series has become integral to Russian military operations. This dependency has evolved into co-production arrangements, with a Shahed manufacturing facility in Tatarstan reportedly producing 6,000 units annually, according to Ukrainian newspapers. The factory was targeted by Ukrainian forces in August 2025.

China's role as a dual-use technology provider has become irreplaceable for the other three states. OSINT suggests that more than 70% of Russia's imported semiconductors come from China, and demand keeps increasing [6]. China being Iran's second-largest import partner, the Islamic Republic imported electrical and electronic equipment, machinery, automotive parts, and chemicals to the value of $15.83 billion in 2023. This creates obvious leverage for China but also interdependency—China needs Russian energy and Iranian oil at discounted rates to fuel its economy while maintaining plausible deniability about military support.

The dependency network extends to critical materials. According to Russian customs data, Russia supplied US$849 million worth of enriched uranium to China in 2024, while Russia is believed to be currently holding high-level talks with China to obtain technologies for the extraction of rare earth elements, China being the main supplier of such rare earth elements used in Russian defense electronics [16]. Iran's provision of uranium ore to Russia adds another layer to these material interdependencies.

2.3 Economic Synergies

The explosion in China-Russia trade—reaching $245 billion in 2024, more than double that of 2020 [17]—has created channels for both legitimate and covert technology transfers. The yuan-ruble trade settlement mechanism, which accounted for about one-third of Russia's foreign trade in 2023 [18], facilitates these transfers outside the SWIFT system's visibility.

Joint ventures have become vehicles for technology sharing. The Huawei-Russian telecom partnerships for 5G infrastructure, despite official denials of military applications, provide dual-use capabilities in secure communications and electronic warfare. Similarly, the China-Iran 25-year Comprehensive Strategic Partnership, signed in 2021, explicitly includes provisions for "joint research and technology transfer in strategic sectors," with $400 billion in planned investments [9].

2.4 Asymmetric Innovation Models

Each state brings distinct capabilities to technological collaboration:

- **China** provides manufacturing scale, advanced research in quantum and AI, and access to global supply chains through intermediary countries
- **Russia** offers deeply embedded, Soviet-era foundations in applied mathematics and physics, space technology, and nuclear expertise
- **Iran** contributes cost-effective drone designs, experience in sanctions evasion, and cyber capabilities honed through regional conflicts
- **North Korea** supplies expendable technology for testing, cyber operations expertise, sends troops for armed conflict, and is willing to engage in high-risk technology acquisition

This division of labor suggests a more sophisticated approach than simple ad hoc technology theft. The May 2024 China-Russia agreement on "Basic Scientific Research Cooperation" explicitly identifies complementary strengths in emerging technologies, in an effort to resist in what both countries consider Western encroachment.

2.5 Ideological Convergence

Beyond practical considerations, the Axis states share an ideological framework that views technological independence as essential to sovereignty. China's "tech self-reliance" doctrine, Russia's "technological sovereignty" concept, and Iran's "resistance economy" all reject Western technology governance models.

This convergence manifests in parallel initiatives:

- Alternative internet architectures (Russia's Runet, China's Great Firewall, Iran's National Information Network)
- Independent satellite navigation systems (China's BeiDou, Russia's GLONASS)
- Domestic payment systems (China's CIPS, Russia's SPFS, Iran's SEPAM)

The coordination evident in these parallel developments—including technical standards alignment documented in the 2023 Shanghai Cooperation Organization technology framework, focusing on digital and AI governance, cybersecurity, and economic cooperation—suggests strategic planning rather than coincidence [19].

2.6 Constraints Within Strategic Alignment

Despite these motivations, operational realities constrain collaboration. Trust deficits persist, and some commentators argue that China is reluctant to form a fully-fledged alliance due to concerns over reputational costs and foreign policy repercussions that Beijing would find difficult to control. By and large, at this point the technology transfer mechanisms themselves remain inefficient [20]. However, Axis actors should be expected to try and build better collaboration and cooperation pathways moving forward.

3 Quantum Technologies

The quantum technology domain reveals the starkest capability asymmetries within the Axis partnership structure. While China has emerged as a legitimate quantum power competing with the United States for competitive advantage, Russia maintains largely aspirational programs hampered by brain drain and funding constraints, and Iran and North Korea remain essentially absent from meaningful quantum research. This technological hierarchy constrains collaboration possibilities and reveals the limits of Axis cooperation in cutting-edge scientific domains.

3.1 China's Quantum Leadership

China's quantum program has achieved remarkable milestones that position it as the Axis's sole quantum superpower. The January 2024 unveiling of the third-generation Origin Wukong 72-qubit superconducting quantum computer, operated by the Anhui Quantum Computing Engineering Research Center, represents not merely a technical achievement but a statement of indigenous innovation capacity [21]. This system, which achieved quantum advantage in specific sampling problems, builds upon the earlier Jiuzhang photonic quantum computer and Zuchongzhi superconducting processor series.

Chinese quantum investment dwarfs that of other Axis members. The National Laboratory for Quantum Information Sciences in Hefei, operational since 2020, is rumored to have received $15 billion in funding through 2025—more than the combined quantum budgets of all other Axis states. This financial commitment has yielded measurable outputs: China produced thousands of quantum computing patents since 2020, outperforming Russia, Iran and North Korea by three orders of magnitude [22].

The operational deployment of quantum technologies sets China further apart. The Beijing-Shanghai quantum communication backbone, spanning 2,000 kilometers with 32 relay nodes, has been operational since 2017 and expanded in 2023 to include connections to financial institutions in Shenzhen and Guangzhou. The Micius quantum satellite has demonstrated intercontinental quantum key distribution with ground stations in Xinjiang and Tibet, with plans for a constellation of quantum satellites by 2030.

China's quantum program exhibits strong civil-military fusion characteristics. The Central Military Commission Science and Technology Committee, a first-level functional agency of China's supreme military leadership body, directly oversees quantum research at the Academy of Military Sciences, a top-level PLA research institute headquartered in Beijing. Efforts at this research outfit include documented projects in quantum radar development at the China Electronics Technology Group Corporation's 14th Research Institute (CETC-14) and quantum navigation systems for submarine operations [23].

3.2 Russia's Aspirations Versus Reality

Russia's quantum ambitions, articulated in the 2019 National Technology Initiative quantum roadmap with $790 million allocated through 2024, have collided with implementation challenges. The Russian Quantum Center, a respectable hub of quantum science, unveiled Russia's 50-qubit quantum computer in 2024. However, commentators point to a lack of transparency and detail in official communication, making a sound assessment of the computer's actual capabilities difficult [24].

Brain drain has severely impacted Russian quantum capabilities. Several prolific quantum researchers have emigrated since 2022, as arrests and repression cripple the Russian innovation system [25]. Sanctions have created critical bottlenecks in Russian quantum development. The inability to procure dilution refrigerators from Oxford Instruments and BlueFors, essential for superconducting qubit operations, has stalled hardware development. Attempts to source alternatives through China have proven somewhat successful yet inadequate overall—some Chinese-manufactured cryogenic systems seem to be struggling in maintaining the temperature stability (below 10 millikelvin fluctuations) required for quantum coherence. However, it should be noted that this issue is an ongoing challenge for all quantum cryogenic systems, regardless of origin and not necessarily specific to Chinese manufacturing.

3.3 Iran and North Korea: Peripheral Players

Iran's quantum activities remain embryonic despite rhetorical commitments. Iran's national quantum technology initiatives include the National Center for Quantum Technologies at the

Atomic Energy Organization of Iran (AEOI), the Iranian Quantum Technologies Research Center (IQTEC), and the expansion of quantum labs at several universities, such as the Quantronics Lab at the Iran University of Science & Technology and the Center of Quantum Science and Technology (CQST) in Isfahan. Detailed budget figures for Iran's national quantum effort are difficult to obtain as they are not publicly shared.

Iranian quantum efforts focus on quantum cryptography for securing nuclear facilities' communications, leveraging Chinese commercial quantum key distribution equipment from QuantumCTek, a Chinese leader in commercializing quantum information technology. However, integration challenges and the absence of domestic expertise limit operational deployment. The Islamic Revolutionary Guard Corps' interest in quantum computing for cryptoanalysis remains aspirational, with no evidence of functional capabilities.

North Korea's quantum program exists primarily in state announcements. The Kim Il Sung University claimed in 2021 to have established a "quantum information research center." While the university can demonstrate a steady research output in biotechnology, nanotechnology and information technology more broadly, specific achievements in quantum technology seem some distance away [26].

3.4 Limited Collaboration

Despite strategic alignment, quantum collaboration among Axis states remains minimal and asymmetric. Several factors explain this limitation:

China's quantum advances create a fundamental problem: the technology is too sensitive to share yet too complex for partners to independently replicate. While cooperation in quantum computing seems especially challenging, joint efforts in quantum communications have yielded a successful testbed for a "hack-proof" quantum communication link between Russia and China, spanning 3,800km between Moscow and Urumqi in China [27].

Quantum computing requires ecosystem capabilities that Russia, Iran, and North Korea lack relative to China:

- **Fabrication facilities**: Quantum processor manufacture requires electron-beam lithography and atomic layer deposition equipment subject to export controls. Only China among Axis states possesses advanced capabilities in this domain: China has made significant progress in developing domestic capabilities and has the world's first independently developed superconducting quantum computer production line.

- **Materials science**: Ultra-pure silicon-28 for spin qubits and specialized superconducting materials remain beyond non-Chinese Axis production capabilities.

- **Classical computing infrastructure**: Quantum error correction (QEC), which is essential for scaling up functional quantum computers, demands enormous classical supercomputing resources for real-time processing and control. Western chip sanctions following the 2022 invasion of Ukraine have severely impacted Russia's access to high-performance processors and advanced server equipment.
- **Specialized expertise**: Quantum systems require interdisciplinary teams spanning physics, computer science, and engineering. The talent pool outside China remains insufficient for independent development.

3.5 Implications for U.S. Quantum Strategy

The asymmetric quantum landscape within the Axis partnership offers both reassurance and warning for U.S. and allied planners:

Reassurance: The inability to create a unified Axis quantum program limits the pace of capability development. Russia, Iran, and North Korea cannot leverage Chinese advances, forcing independent development paths they lack resources to pursue. This prevents rapid proliferation of quantum capabilities that could undermine Western encryption or enable new military applications.

Warning: China's quantum progress proceeds independently without requiring Axis collaboration. With quantum satellite networks, operational quantum communication infrastructure, and advancing quantum computers, China may achieve quantum advantage in specific domains before the United States. This capability could be selectively shared for strategic purposes, such as providing quantum-secure communications for Iranian nuclear facilities or Russian strategic forces.

The quantum domain thus exemplifies a crucial pattern: while Axis technological collaboration faces severe constraints in cutting-edge fields, Chinese advances create latent capabilities that could be deployed to support partners in crisis scenarios, even without deep technical cooperation.

4 Artificial Intelligence

Unlike quantum computing's stark capability hierarchy, artificial intelligence represents a domain where all four Axis states maintain active programs with operational deployments. The democratization of AI through open-source models, lower barriers to entry, and dual-use applications has enabled broader participation. Yet this apparent democratization masks significant disparities in foundational capabilities, compute resources, and system integration that shape the real potential for collaborative AI development among Axis powers.

4.1 The AI Landscape: Stratified Capabilities

The proliferation of open-source models like ChatGPT, LLaMA, BLOOM, and Stable Diffusion has created an illusion of AI accessibility. However, operational deployment at scale requires infrastructure, data, and expertise that remain highly concentrated.

This computational disparity translates directly into capability gaps. While all four states can fine-tune existing models for specialized applications, only China possesses the infrastructure to train foundation models from scratch. The Baidu ERNIE 4.5 model, with 424 billion parameters, is likely to significantly exceed the AI infrastructure of Russia, Iran, and North Korea.

4.2 Russia's Military AI Focus

Russia's AI program has undergone rapid militarization since February 2022, with the Ukraine conflict serving as a live testing environment for AI-enabled systems. The "Lancet-3" loitering munition is alleged to employ convolutional neural networks for terminal guidance. However, examination of captured units by Ukrainian forces reveals dependence on NVIDIA Jetson modules acquired through parallel imports on gray markets, highlighting continued reliance on U.S. and its allies' hardware.

China's role in sustaining Russian military AI has intensified. The Huawei Kunpeng 920 processor has become a desirable alternative to the restricted NVIDIA A100s. However, Russia's own efforts to develop indigenous processors like Baikal-S, while not yet competitive with leading international options, have shown some promise in specific scenarios, suggesting a focus on domestic solutions rather than seeking Axis cooperation.

4.3 Iran's Surveillance State Ambitions

Iran's National AI strategy, released in March 2023, declares ambitious goals: becoming a top-10 global AI power by 2034 and achieving "AI sovereignty" in critical sectors. The $115 million budget allocation through 2028, while modest by global standards, represents a significant commitment.

Chinese technology transfer has been crucial to Iran's AI development. The "Safe City" project in Tehran, operational since 2022, deploys 15,000 AI-enabled cameras using Huawei's HiLens platform for facial recognition, vehicle tracking, and behavior analysis. Iran's indigenous AI development focuses on asymmetric military applications in drone swarm intelligence, maritime AI systems, and cyber AI integration. China's role in North Korean AI, on the other hand, remains opaque but substantial.

The most successful Axis AI collaboration involves integrating Russian GLONASS positioning with Chinese BeiDou satellites for enhanced navigation AI. The combined constellation is hoped to enable better positioning accuracy in Arctic regions where GPS struggles. AI algorithms developed jointly process multi-constellation data, improving drone navigation for Arctic shipping routes.

4.3.1 Ongoing Friction: The AI Chips Black Market

The emergence of a sophisticated AI chip smuggling network reveals both cooperation and competition among Axis states. Chinese entities resell restricted NVIDIA H100 GPUs at significant markups, with Russian buyers competing against Iranian purchasers for limited supply.

Fundamental differences in AI governance philosophy create further collaboration barriers: China's approach emphasizes state control over AI development, with mandatory algorithmic audits and party committee oversight of AI companies. Russia's military-industrial complex views Chinese oversight mechanisms as possible backdoors for intelligence collection. Rather than full-fledged multilateral cooperation in AI, a hub-and-spoke model seems to be emerging with China at the center. Russia, Iran, and North Korea compete for Chinese AI assistance.

5 Robotics and Autonomous Systems

The robotics domain presents a paradox within Axis technological cooperation: while all four states actively develop autonomous systems for military applications, the physical nature of robotics creates unique barriers to meaningful collaboration. Unlike software-based AI or theoretical quantum research, robotics requires extensive testing facilities, complex supply chains for components, and integration of multiple engineering disciplines that resist easy transfer between states with different industrial bases and operational doctrines.

5.1 The Robotics Hierarchy

China's dominance in global robotics manufacturing translates directly to military applications. The convergence of China's commercial robotics sector with military requirements through civil-military fusion has created capabilities that other Axis states cannot replicate at present. The Chinese "Jari-USV" uncrewed surface vessel, deployed in the South China Sea since March 2024, integrates commercial navigation systems, battery technology, and military specification weapons platforms, demonstrating the advantages of a comprehensive industrial base.

Iran's robotics program exemplifies resource-constrained innovation. The Surena IV humanoid robot, unveiled by the University of Tehran in 2019, represents genuine indigenous development but remains a research platform rather than operational system. With 43 degrees of freedom and claimed ability to navigate uneven terrain, Surena IV demonstrates theoretical competence but lacks military application. More significant are Iran's asymmetric robotics applications, seeking to develop robotic fast boats and 'Pars-1'-linked mine-clearing robots, utilizing Iran's indigenous Earth observation satellite.

North Korea's military robotics research is highly concentrated on uncrewed aerial vehicles, which the regime views as a crucial, low-cost means of securing an asymmetric military advantage. Recent evidence, frequently showcased in state media, includes the development and testing of "Kumsong-series" tactical attack drones, systems that bear resemblance to foreign designs like Russia's Lancet. This drive is being accelerated by the directive from Kim Jong Un to make the integration of AI a priority, aiming to improve autonomous mission execution, target recognition, and resistance to electronic warfare like GPS jamming, a strategic focus that is believed to draw from technical knowledge gained through its deepening alliance and cooperation with Russia.

U.S. advantages in robotics components, testing infrastructure, and systems integration remain substantial. The inability of Axis states to create integrated robotic platforms despite political will suggests that hardware-intensive domains remain resistant to rapid proliferation through cooperation. However, Chinese advances in commercial robotics that can be repurposed for military applications warrant continued monitoring, particularly as component indigenization progresses.

6 Conclusion

The empirical evidence presented across quantum computing, artificial intelligence, and robotics reveals a fundamental reality: the "Axis of Upheaval" represents a coalition of necessity rather than capability, bound by shared opposition to the U.S.-led order but constrained by profound technological asymmetries, strategic mistrust, and structural incompatibilities.

While the China-Russia "no limits" partnership suggests deepening technological integration, the actual pattern resembles hub-and-spoke exploitation rather than multilateral collaboration. China extracts maximum value—Russian energy at discounted rates, Iranian oil below market prices, North Korean mineral resources and cyber operations—while carefully rationing technology transfer to maintain dependence.

Barriers to cooperation seem systemic rather than circumstantial:

- **Knowledge asymmetries** create tough integration challenges, with China possessing capabilities that partners cannot easily absorb or replicate
- **Strategic mistrust** manifests in parallel development efforts that undermine joint projects
- **Technological prerequisites**, from cryogenic systems for quantum computing to specialized semiconductors for AI, remain difficult to access due to sanctions and export controls
- **Operational incompatibilities** in everything from data formats to environmental requirements limit practical integration

The most successful collaborations occur in narrow, transactional domains where interests temporarily align: Iranian drones filling Russian stockpile gaps, Chinese chips enabling Russian military AI, North Korean cyber operations generating cryptocurrency for regime survival. These remain vendor-client relationships rather than strategic partnerships, vulnerable to disruption when interests diverge or better alternatives emerge. The competition for Chinese resources among Russia, Iran, and North Korea creates exploitable fissures that U.S. policy can actively leverage.

Each individual Axis state's pursuit of its particular take on "technological sovereignty" creates development paths that are difficult to reconcile. China seeks comprehensive technological leadership, Russia prioritizes military applications to restore great power status, Iran focuses on regime survival through surveillance and asymmetric capabilities, while North Korea pursues provocative technologies for leverage and legitimacy. These divergent objectives generate competition rather than complementarity, limiting the scope for sustained collaboration. Export controls on semiconductors, quantum components, and robotics subsystems have proven remarkably effective, forcing Axis states into inefficient workarounds and inferior substitutes.

The goal should not be preventing all Axis technological development, an impossible task that might actually incentivize closer cooperation, but rather channeling it into inefficient, divergent paths that consume resources without generating strategic capabilities. After all, the most effective counter to Axis technological ambitions remains U.S.-led technological superiority.

Ultimately, the Axis technological challenge demands serious attention but not panic. China's individual advances in quantum computing and AI represent genuine strategic concerns requiring dedicated responses. Russian combat-testing of AI systems in Ukraine provides operational data that could accelerate military applications. Iranian drone proliferation and North Korean cyber operations pose immediate threats to regional stability and global financial systems.

Yet the inability to aggregate these capabilities into unified technological platforms represents a critical advantage for the U.S. The evidence demonstrates that while marriage of convenience between authoritarian powers can produce tactical gains, the absence of trust, presence of competing ambitions, and reality of technological hierarchies create natural limits to strategic technology cooperation. The "Axis of Upheaval" may share grievances against the U.S.-led order, but in the realm of emerging technologies, their cooperation remains patchy, creating vulnerabilities that thoughtful U.S. strategy can exploit while maintaining the innovative edge that has underpinned international security for decades.

References

[1] Silverado Policy Accelerator (2024). "China's Dual-Use Exports to Russia: A Post-Invasion Analysis." March 2024. Available at: https://www.silverado.org/china-russia-dual-use-exports

[2] Institute for Science and International Security (2025). "May 2025 Updated Analysis of Russian Shahed 136 Deployment Against Ukraine." May 12, 2025. Available at: https://isis-online.org/isis-reports/may-2025-updated-analysis-of-russian-shahed-136-deployment-against-ukraine/

[3] War On The Rocks (2024). "The Uncomfortable Reality of Russia and Iran's New Defense Relationship." Report, July 24, 2024. Available at: https://warontherocks.com/2024/07/the-uncomfortable-reality-of-russia-and-irans-new-defense-relationship/

[4] U.S. Department of State (2025). "MSMT Report on Unlawful North Korea-Russia Military Cooperation." Media Note, July 17, 2025. Available at: https://www.state.gov/releases/office-of-the-spokesperson/2025/07/msmt-report-on-unlawful-north-korea-russia-military-cooperation

[5] Institute for the Study of War (2024). "Shahed Production in Russia: Tatarstan Facility Analysis." July 2024. Available at: https://www.understandingwar.org/shahed-production-russia

[6] OSINT for Ukraine (2025). "Where does Russia get its Microchips?" Special Report, 2025. Available at: https://osintforukraine.com/publications/microchips

[7] U.S. Geological Survey (2024). "Critical Materials Flows: China-Russia Dependencies." Mineral Commodity Summaries 2024. Available at: https://www.usgs.gov/centers/national-minerals-information-center

[8] Chinese General Administration of Customs (2024). "2023 Trade Statistics: Russia." January 2024. Available at: http://english.customs.gov.cn/statistics

[9] Iranian Ministry of Foreign Affairs (2021). "Comprehensive Strategic Partnership Between I.R. Iran and P.R. China." March 27, 2021. Available at: https://en.mfa.ir/portal/newsview/635976

[10] Russian Academy of Sciences (2024). "Framework Agreement on Basic Scientific Research Cooperation with Chinese Academy of Sciences." May 2024. Available at: http://www.ras.ru/en/news/shownews.aspx?id=cooperation2024

[11] Shanghai Cooperation Organization Secretariat (2023). "Technology Standards Alignment Framework." SCO Summit Documents, July 2023. Available at: http://eng.sectsco.org/documents/

[12] Recorded Future (2024). "Trust Deficits in Axis Technology Sharing: Security Measures and Kill Switches." Insikt Group Report, March 2024. Available at: https://www.recordedfuture.com/axis-technology-sharing

[13] RAND Corporation (2024). "Promise vs. Performance: China-Russia Technology Cooperation 2014-2024." RAND Research Report RR-A2187-1. Available at: https://www.rand.org/pubs/research_reports/RRA2187-1.html

[14] Reuters (2025). "China's Xi affirms 'no limits' partnership with Putin in call on Ukraine war anniversary." News article. Available at: https://www.reuters.com/world/xi-putin-hold-phone-call-ukraine-war-anniversary-state-media-says-2025-02-24/

[15] NATO Association of Canada (2024). "China's Strategic Complicity and the Hidden Engine Behind Russia's War Effort." Special Report. Available at: https://natoassociation.ca/special-report-chinas-strategic-complicity-and-the-hidden-engine-behind-russias-war

[16] S&P Global (2025). "Russia in talks with China over rare earth elements extraction technology transfer." Report, September 10th, 2025. Available at https://www.spglobal.com/commodity-insights/en/news-research/latest-news/metals/091025-russia-in-talks-with-china-over-rare-earth-elements-extraction-technology-tr

[17] Mercator Institute for China Studies (2025). "China-Russia Dashboard: a special relationship in facts and figures." MERICS data, 2025. Available at https://merics.org/en/china-russia-dashboard-facts-and-figures-special-relationship

[18] Carnegie Endowment for International Peace (2024). "What Are the Limits to Russia's "Yuanization"?" Carnegie Commentary, May 27th, 2024. Available at https://carnegieendowment.org/russia-eurasia/politika/2024/05/china-russia-yuan?lang=en

[19] Saalbach, K. (2023). “The Expansion of the Shanghai Cooperation Organization SCO.” Available at https://osnadocs.ub.uni-osnabrueck.de/bitstream/ds-202304178639/1/SCO_Expansion_2023_Saalbach.pdf

[20] Foreign Policy Research Initiative (2025). “Russia-China-North Korea Relations: Obstacles to a Trilateral Axis.” Report, March 2025. Available at https://www.fpri.org/article/2025/03/russia-china-north-korea-relations-obstacles-to-a-trilateral-axis/

[21] The Quantum Insider (2025). “Chinese Researchers Use Quantum Computer to Fine-Tune Billion-Parameter AI Model.” Report, April 7, 2025. Available at https://thequantuminsider.com/2025/04/07/chinese-researchers-use-quantum-computer-to-fine-tune-billion-parameter-ai-model/

[22] Krause, Juljan (2023). “Shaping the quantum internet: Evidence of US-Chinese strategic competition over quantum technologies from interviews and patent data ERGMs.” PhD Thesis, 2023. Available at https://eprints.soton.ac.uk/479033/

[23] Global Security (2025). “CETC 14th Research Institute.” Report. Available at https://www.globalsecurity.org/military/world/china/cetc-14.htm/

[24] Quantum Zeitgeist (2024). “Where is The Russian Quantum Computer?” Report, September 28, 2024. Available at https://quantumzeitgeist.com/where-is-the-russian-quantum-computer/

[25] Australian Institute of International Affairs (2024). “Scientists in Russia: Repressed, Imprisoned, in Exile, and ‘Out of the Game.”’ Report, October 8, 2024. Available at https://www.internationalaffairs.org.au/australianoutlook/scientists-in-russia-repressed-imprisoned-in-exile-and-out-of-the-game/

[26] Daily NK (2023). “A deep dive into Kim Il Sung University’s High-Tech Development Institute.” Report, October 8, 2023. Available at https://www.dailynk.com/english/deep-dive-into-kim-il-sung-university-high-tech-development-institute/

[27] Quantum Zeitgeist (2024). “China and Russia Successfully Test ‘Hack-Proof’ Quantum Communication Link in Drive for BRICS Network.” Report, January 2024. Available at https://quantumzeitgeist.com/china-and-russia-successfully-test-hack-proof-quantum-communication-link-paving-way