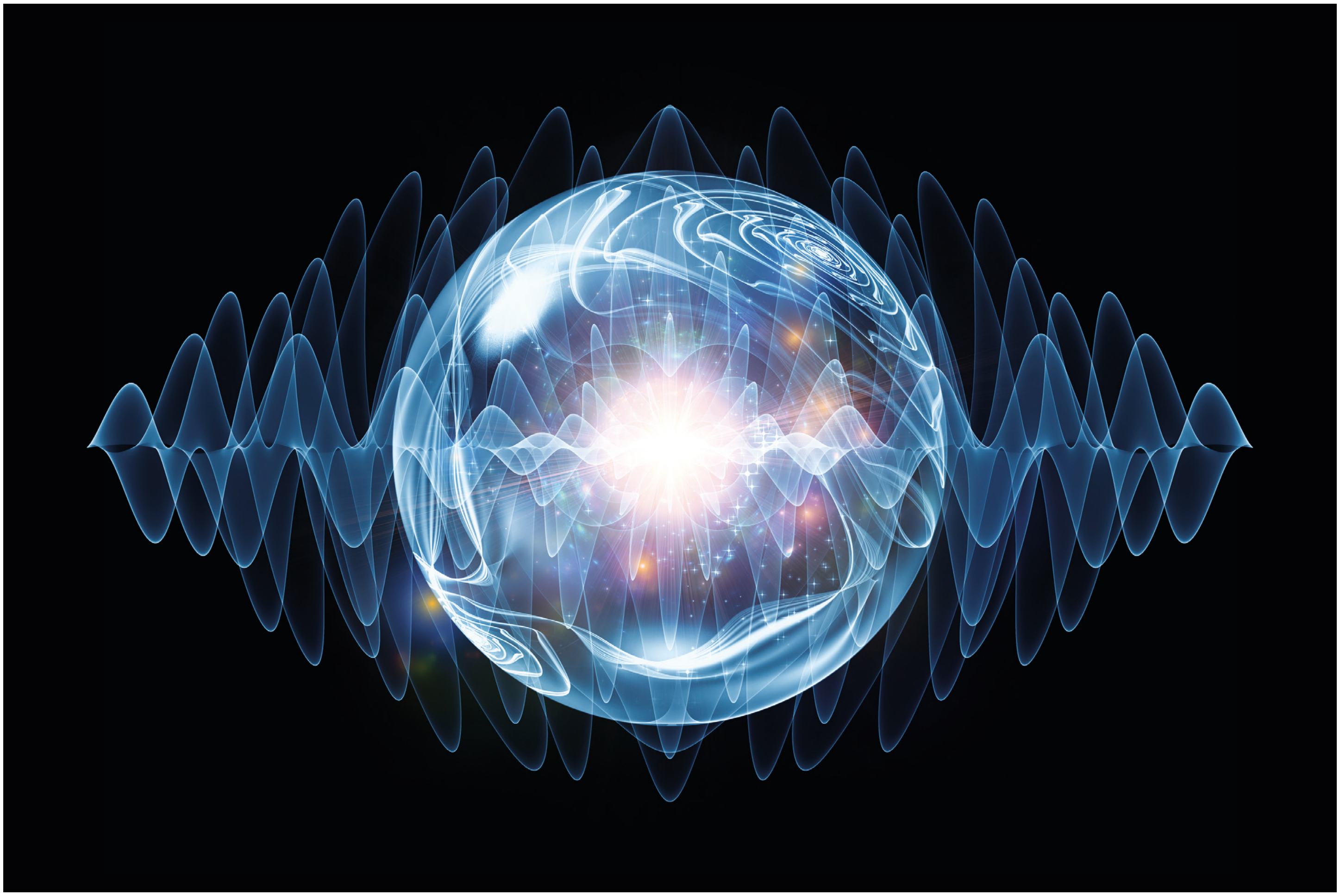
Policy Brief



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# Entangled Interests in Quantum Technology

## The United States, Japan, and Europe should align on innovation and economic security.

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The People's Republic of China's (PRC) China Standards 2035 strategy,[1] coupled with its growing leadership in 5G and influence in international standards bodies, served as a wake-up call[2] to the United States and its allies: Abstruse technical standards, often left to the private sector, are a geopolitical battleground. Today, this competition is unfolding across critical technologies from 6G and AI to quantum and biotechnology, with increased attention among the United States, Europe, and Japan to standard-setting as a driver of national technological power.

Quantum technologies hold transformative potential across sectors and remain largely in a pre-competitive stage, making early alignment on standards a critical opportunity to shape global markets. As these technologies move from the lab to deployment, democratic allies should prioritize de facto standards alignment by increasing cooperation on innovation and economic security.

## Standard-Setting on Quantum Technologies

The year 2025 was the UN's "international year of quantum", but 2026 is operationalizing national commitments and thrusting quantum technologies firmly into the spotlight as a domain of active—and not just theoretical—great-power competition. In the face of intensifying technological rivalry with the PRC, the United States, Europe, and Japan each seek to expand their economies and international influence through global quantum leadership. International standard-setting is increasingly part of their strategies.

In the United States, the National Institute of Standards and Technology's (NIST) "Strategy for American Technology Leadership in the 21st Century" prioritizes[3] bolstering US leadership in standards and a scale-up of the US quantum industrial base. The EU's Quantum Strategy notes the importance of technical interoperability and promises[4] a European Quantum Standards Roadmap in 2026 to facilitate industrialization. Japan's 2025 New International Standards Strategy[5] includes a dedicated section on quantum, calling for public-private collaboration on technical standards to create markets, define norms, and solve societal challenges.

At the international level, the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) established[6] Joint Technical Committee (JTC) 3 in 2024 to standardize quantum technologies. Japan secured[7] a working group leadership role, the United Kingdom's British Standards Institution managed the group's inaugural secretariat, and NIST swiftly created a US Technical Advisory Group for the committee. In coordination with JTC 3, the EU's European Committee for Standardization (CEN) and European Committee for Electrotechnical Standardization (CENELEC) Joint Technical Committee on Quantum Technologies (CEN-CLC/JTC 22)[8] builds European standardization roadmaps. The committee works across quantum metrology, sensing, and enhanced imaging; enabling technologies; quantum computing and simulation; and quantum communications and cryptography.

While allied coordination on formal standard-setting can help blunt PRC influence, the United States, Japan, and Europe should also employ a de facto standardization strategy by aligning approaches to promoting and protecting quantum technologies. Coordinated innovation and economic security measures can nurture technical strengths and translate them into strategic advantage by bolstering innovation ecosystems, securing critical supply chains, and protecting technological advances. As quantum markets materialize, US, allied, and PRC innovation and economic security policy will shape which technologies are built, by whom, and on what scale. The countries that grow and protect their quantum industries today will see their technical approaches best positioned to become the international standard tomorrow. The US, Europe, and Japan can borrow and adapt successful strategies for technological competitiveness and economic security, and uncover cooperation opportunities—particularly in pre-competitive quantum technologies and in areas where critical supply chains are globally distributed. All three partners, however, must balance strong currents toward stated goals of technological self-reliance in quantum with the advantages they recognize of international partnership.

## Quantum Technologies and the Defense Innovation Nexus

The United States, Japan, and Europe are each pursuing leadership in quantum technologies. All three have made public funding commitments. The United States draws on a robust defense technology ecosystem to derisk technologies and advance its quantum industry, a nexus that Japan and Europe can leverage for their dual goals of translating research into commercial success while bolstering defense and security capabilities.

### The United States

The White House Office of Science and Technology Policy (OSTP) cites[9] quantum information science and technology (QIST) as a "key pillar of economic prosperity and national security" and has prioritized QIST in federal funding and whole-of-government initiatives. The Trump administration released a pair of executive orders in June 2026 that aim to bolster quantum innovation[10] and facilitate the federal government's transition to post-quantum cryptography,[11] including by developing a quantum computer, updating the National Quantum Strategy, and partnering with the private sector to develop quantum-enabling technologies. In 2025, the US Department of Energy pledged[12] $625 million to renew its five National Quantum Information Science Research Centers, issued[13] a call for proposals on quantum algorithms and error-correction protocols, and launched[14] a partnership with the Dutch firm Qblox to produce an open-source platform to coordinate control and readout for quantum devices. And in January 2026, a bipartisan group of senators introduced[15] the National Quantum Reauthorization Act. The act would extend the federally coordinated National Quantum Initiative to December 2034, launch new research centers and prize competitions, and require OSTP to develop an international quantum cooperation strategy to coordinate research and development with US allies.

US quantum leadership has also benefitted from its connection to the defense ecosystem in both foundational research funding and the promotion of commercialization. For example, the Defense Advanced Research Projects Agency's (DARPA) Quantum Benchmarking Initiative,[16] launched in 2024, evaluates approaches to constructing a utility-scale fault-tolerant quantum computer by 2033. It advanced[17] eleven companies—including London-based Quantum Motion—to the initiative's second stage in November 2025. DARPA's Microsystems Technology Office also launched[18] the Robust Quantum Sensors program in February 2025 to develop quantum sensors durable enough for real-world vibrational and electromagnetic environments, selecting[19] six companies[20] for phase one the following August. The latest National Security Strategy[21] names quantum computing as one of the technologies that "will decide the future of military power", and recent US defense threat assessments[22] on the PRC have warned of Beijing's push for military and dual-use quantum innovation. As such, the connection between quantum technologies and US defense-industrialization is only likely to deepen.

### Japan

Japan aims[23] to become a world leader in quantum technologies by 2030, targeting over 10 million domestic users, ¥50 trillion ($230 billion) in economic production, and the rise of its own unicorn quantum start-ups. The country's quantum ambitions draw on deep technical strength, including pioneering experiments in the engineering of superconducting qubits[24] and quantum annealing[25]—two key building blocks of modern quantum science and technology. Between 2000 and 2024, Japan produced the second-largest share (14%) of global quantum patents[26] (the United States produced 27%). In recent years, its leaders have accelerated investment toward these goals. Between January 2023 and April 2025, Japan alone accounted[27] for nearly 75% ($7.4 billion) of global public quantum funding, and a supplementary budget[28] passed late last year included[29] an additional

¥128.6 billion for quantum innovation. The year 2025—dubbed[30] the "first year of quantum industrialization" by former Prime Minister Shigeru Ishiba—saw an emphasis on commercialization with the announcement[31] of ¥50 billion (~$335 million) for domestic quantum companies in partnership with the Ministry of Economy, Trade, and Industry (METI), the development of a 256-qubit quantum computer[32] by RIKEN and Fujitsu, and a fully homegrown quantum computer at Osaka University relying on domestic hardware and a Japanese-built open-source software stack. With her pledge[33] to make Japan a "technology-driven nation", Prime Minister Sanae Takaichi is likely to intensify these efforts.

### Europe

Europe, too, seeks[34] to become a global leader in quantum technology by 2030. It holds the largest concentration of quantum talent worldwide and leads in scientific publications but has largely failed to translate these scientific advantages into commensurate commercial success. The EU's 2025 Quantum Europe Strategy[35] thus aims to bolster the continent's quantum competitiveness in the context of technological sovereignty, seeking to build and scale quantum computers sourcing from EU providers. Among other initiatives, it plans initial use cases and validation environments towards a European Quantum Internet, a research initiative for foundational and applied quantum science, and a quantum chip design facility connected with six €40-50 million quantum chip pilot lines. The EU will also establish a network of quantum testbeds, launch sector-specific challenges for large industrial firms to co-develop quantum technologies, and invest directly[36] in quantum through the Scaleup Europe Fund, a new multibillion-euro late-stage and growth fund for European deep tech. The bloc's forthcoming Quantum Act[37] is expected to build out[38] the strategy's funding mechanisms and governance. Despite its emphasis on European innovation, companies, and sovereignty, the EU also seeks to expand international cooperation with like-minded partners through joint research, coordinated calls, exchange of expertise, reciprocal access to infrastructures, aligned intellectual property frameworks, and preparation of global quantum standards.

The European Commission names quantum technologies as a priority defense capability domain in its March 2025 White Paper for European Defence-Readiness 2030,[39] which sets out a continent-wide plan to bolster European defense. Under this framework, the European Investment Bank will double its annual defense financing target to €2 billion to fund quantum and other defense technology projects. In 2026, the EU will also create a roadmap for defense and space applications of quantum sensing and launch[40] initiatives to bring together commercial quantum companies and academia to encourage innovation in dual-use technologies.

### NATO

NATO has also recognized the importance of quantum innovation leadership and may be a natural venue for allied quantum coordination and defense-relevant commercialization. Its first quantum strategy,[41] released in 2024, aims to innovate and integrate quantum technologies while defending against quantum-enabled attacks. The alliance's Science and Technology Organization (STO) conducts[42] research across defense applications of quantum computing, sensing, and communications. In November of 2025, it issued[43] a call for papers for NATO's second Research Symposium on Quantum Technology for Defence and Security, which Sweden will host in October 2026. Its voluntary Transatlantic Quantum Community[44] brings together stakeholders from government, industry, academia, and funding organizations across the alliance.

NATO's newest innovation vehicles, the NATO Innovation Fund[45] (NIF) and the Defense Innovation Accelerator for the North Atlantic[46] (DIANA), count quantum technologies as a strategic priority area.[47] NIF, a €1 billion venture capital fund for deep tech, is currently invested[48] in UK-based quantum sensing start-up Aquark Technologies alongside venture capital funds for quantum and other emerging technologies, including Germany's Vsquared Ventures and Lithuania's BSV Ventures. For its part, DIANA provides dual-use start-ups with resources such as investor networks, mentorship from procurement experts and end users, and test-center access in an effort to accelerate innovation across the alliance. Its 2026 cohort[49] includes innovators in post-quantum cryptography, quantum-enabled AI, and quantum communications, all selected to address specific allied capability gaps. With Japan and NATO aiming to increase[50] security ties, NATO's defense technology initiatives are well-positioned to advance trilateral quantum cooperation.

## The Economic Security Toolkit for Quantum Technologies

Amid concerns over the security of advanced technology supply chains and competition from the PRC, the United States, Europe, and Japan are each expanding their techno-economic security toolkits, including on quantum technologies. Allies should coordinate on threat-intelligence sharing, shoring up supply-chain vulnerabilities, and blunting the economic impacts of restrictive measures such as export controls to any one country's industry.

### United States

In the United States, the Committee on Foreign Investment in the United States (CFIUS) can review[51] inbound investments in US business involving critical technologies including quantum if a foreign investor acquires rights such as board membership or access to non-public technical information. Executive Order 14083[52] requires CFIUS to consider in risk reviews whether covered transactions involve quantum computing and other technologies relevant to national security. The FY2026 National Defense Authorization Act[53] (NDAA) also expanded the outbound investment regime (or "reverse CFIUS") for critical technologies such as quantum, broadening the list of "countries of concern"—in which outbound quantum investment is restricted—to include the PRC, Russia, Iran, Cuba, North Korea, and Venezuela under the Maduro regime. Last year, Washington also added eight companies[54] connected to the PRC's quantum ecosystem to the Commerce Department's Entity List.

The United States may soon take additional steps at home and abroad to support quantum technologies' economic security. The US NQI Reauthorization Act[55] would require[56] the secretaries of commerce and energy to conduct a quantum supply chain study and would direct[57] the secretary of commerce to identify legislative or administrative measures to strengthen quantum supply chain resilience. In addition, Trump's June 2026 executive order on quantum innovation expresses the administration's interest in "harmonizing investment restrictions with international allies and partners"[58] to support its vision for an international quantum ecosystem.

### Japan

Japan has been an early mover[59] in economic security statecraft for quantum and other critical and emerging technologies. In 2022, its National Diet approved the Economic Security Promotion Act,[60] which directs ministers with jurisdiction over the production, import, or sale of designated critical products—including semiconductors and critical minerals found in quantum supply chains—to implement supply-chain security tools such as stockpiling, source diversification, and enhanced production methods. The Act also focuses on critical technologies whose development is essential for Japanese security, and government documents include[61] quantum among them.

Japan also restricts the export of some quantum technologies and related inputs under its Foreign Exchange and Foreign Trade Act,[62] which authorizes controls on goods exports and technology transfers for both security and economic reasons. In May 2023, Japan joined fellow G7 members and the EU[63] in imposing[64] export restrictions on "devices utilizing quantum properties" and related auxiliary devices and inputs in response to Russia's war in Ukraine. Japan's METI also requires[65] export licenses for quantum computers and quantum cryptography products irrespective of destination, with the latter subject to[66] controls under the Wassenaar Arrangement's[67] dual-use regime.

### Europe

The EU has also expanded its economic security toolkit for quantum and related inputs. The bloc provisionally agreed[68] in 2025 on a requirement for member states to establish foreign direct investment screening mechanisms for dual-use and military equipment, critical raw materials, and "hyper-critical technologies" such as quantum, AI, and semiconductors. In January, the European Commission called on[69] member states to review outbound investments in quantum, AI, and semiconductors with an aim to assess risks of the technologies and related technical know-how "falling into the wrong hands".

Securing quantum supply chains also factors into the EU's Quantum Europe Strategy[70] and forthcoming Quantum Act.[71] Under this framework, the Commission will conduct an EU-wide supply-chain mapping and risk assessment exercise as it seeks to mitigate dependencies on non-European sources. The NATO Transatlantic Quantum Community has also mapped the alliance's quantum computing[72] and sensing[73] supply chains. A pair of studies found moderate- or high-risk vulnerabilities across 28 of the 49 nodes of the two supply chains and proposed recommendations to mitigate allied vulnerabilities.

## The Path Ahead: Cooperation in an Era of Quantum Self-Reliance?

Trilateral cooperation on quantum technologies is both possible and necessary, but it faces headwinds from national and continent-wide efforts toward technological self-sufficiency. The United States, Europe, and Japan should seize existing interest in cooperation on economic security and defense technology to further alignment in these areas. They should:

- **Establish a trilateral technology security partnership.** Quantum technologies should be a key focus area of this partnership, alongside AI and 6G, given existing quantum node dependencies among the trilateral partners. This initiative could mirror the recent US-EU-Japan partnership[74] on critical minerals, which aims to diversify supply and coordinate trade policy. The foundation for such an initiative is already emerging in doctrine and practice. For its part, the EU recognizes that effective action on economic security "depends on cooperation and coordination with third countries" and aims to "engage with allies on the subject of outbound investment screening". In their 2025 trade framework agreement, the EU and the United States agreed "to strengthen economic security alignment to enhance supply chain resilience and innovation by … cooperating on inbound and outbound investment reviews and export controls". At the 2025 EU-Japan Summit,[75] the two partners committed to cooperation on economic security and the promotion and protection of critical and emerging technologies, as well as to advancing cooperation on sectoral standards for supply chain resilience through the G7. Japan and the EU are also signatories to the United States' Pax Silica initiative, and Japan is a partner in trilateral quantum cooperation[76] on industrial security with the United States and Korea.

- **Prioritize quantum technologies in national defense innovation initiatives and international defense-industrial partnerships.** Drawing on the example of the US defense technology ecosystem's success in driving both warfighter readiness and high-tech innovation, Europe and Japan should leverage increased focus on defense and security to advance civilian technology competitiveness in quantum innovation through investments, defense technology accelerators, and capability development in areas such as quantum sensing. This approach is consistent with US foreign policy goals for allies to step up on defense. Japan and the EU have committed to exploring further cooperation on security and defense and to strengthening defense capabilities, such as through the EU-Japan Security and Defense Partnership.[77] The Japan-EU Defense Industrial Dialogue also aims[78] to serve as a platform for industrial cooperation on dual-use technologies and should put concrete action on quantum atop its agenda. Similarly, the EU-Japan Digital Partnership includes cooperation on quantum among other technologies. Finally, quantum information science and technology feature prominently in the October 2025 Technology Prosperity Deal signed by the United States and Japan "as a means to strengthen stability in the region".

- **Build NATO-Japan quantum innovation and science collaboration.** Japan and NATO should deepen engagement on dual-use quantum technology research and innovation, capitalizing on their increased political dialogue[79] and emerging technology touchpoints[80] in 2025. Takaichi oversees a record defense budget[81] and has called for[82] her country to "proactively push for its fundamental buildup of its defense power", mirroring Europe's renewed defense focus. Japan and NATO are reportedly[83] already in talks to invite Japanese start-ups to enter DIANA challenges, through which selected companies receive specialized support from commercialization and investment experts and participate in lectures, workshops, and networking. Such access could help facilitate early alignment on standards and open avenues for Japanese dual-use firms to do business with NATO member states. In addition to including Japanese start-ups as participants, DIANA should prioritize quantum technologies as the first challenge area for Japanese inclusion and invite Japanese Ministry of Defense and METI officials to observe challenges. Japanese researchers, industry specialists, and military personnel with relevant quantum expertise should also join the NATO STO collaborative research network,[84] respond to calls for papers,[85] and participate in research symposia,[86] workshops, and other STO convenings—all of which already welcome Japanese and other Indo-Pacific Four participation.

Quantum technologies—particularly those in pre-competitive stages—provide concrete opportunities for alignment among the United States, Europe, and Japan. Focusing on defense innovation and economic security and selecting areas consistent with sovereignty and resilience goals can help leverage political and international momentum towards trilateral cooperation and quantum competitiveness. With cutting-edge innovation ecosystems and strong economic security postures today, the trilateral partners will also be well-positioned to shape the technical standards of tomorrow, cultivating holistic leadership as quantum technologies' transformative potential takes shape.

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*The views expressed herein are those solely of the author(s). GMF as an institution does not take positions.*

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