ADVANCING QUANTUM COMPUTING TOWARD PRACTICAL APPLICATIONS THROUGH GOVERNMENT-INDUSTRY ENGAGEMENT

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About QED-C

The Quantum Economic Development Consortium (QED-C) is the world's premier association of pioneers in the quantum technology marketplace. Members of QED-C enable the real-world application of quantum technology, and, in turn, grow a robust commercial industry and supply chain.

Sitting at the intersection of tech, academia, business, entrepreneurship, and policymaking, QED-C is uniquely able to foster the collaborations the industry needs. *QED-C is where experts and organizations share knowledge and collectively shape how quantum technology will grow. QED-C is managed by SRI.*

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Executive Summary

To explore options for government-industry engagement, QED-C organized a workshop that convened experts in quantum computing, technology commercialization, regulatory navigation, and converging sectors like finance, healthcare, and defense to discuss bottlenecks to scaling quantum computing technologies and identify partnership approaches to overcome them. This report summarizes the workshop convened by the Quantum Economic Development Consortium (QED-C), managed by SRI International, on January 23, 2026, with the support of U.S. National Science Foundation (NSF) funding.

Participants from government, industry, and potential industrial end users gathered to discuss how government agencies that fund research can better engage with industry through direct partnership to transfer quantum computing research results to practical applications.

> *Throughout the workshop, participants described quantum computing as being at a critical inflection point: foundational research has advanced significantly, yet pathways for delivering tangible value remain unclear. Participants compared quantum computing to the development curve of artificial intelligence: promising, but not yet proven.*

Keynote remarks addressed government and private investment in quantum computing, as well as examples of partnership models that could inform future quantum collaborations. Industry stakeholders and prospective end users participated in panel discussions to outline how quantum computing might demonstrate measurable impact for major industries in the near term. The workshop also included small-group sessions that identified features of successful quantum partnerships and explored potential partnership models. These discussions inform the observations and recommendations summarized below.

Key insights include:

- Quantum computing is at an inflection point
- Partnerships are viewed as essential to bridging the translation gap
- End users require evidence of a quantum advantage
- The precompetitive space offers the highest near-term impact

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Introduction

Background

QIST is a critical and emerging technology area. The application of QIST for quantum computing (QC) has potential for large economic value and national security implications. But the US is not the only nation that recognizes the opportunities posed by quantum. In fact, the US is in a "QIST race" with allies and adversaries around the world.

Despite strong global competition, the US is a leader in QC from fundamental research to development for commercial applications.[1] Since 2019, as part of the National Quantum Initiative Act, the US Government has committed $7.6B toward QIST research.[2] According to the latest supplement to the President's Budget in FY2024, NSF has invested or plans to invest more than $1.5B in quantum-related research. Venture capital (VC) investment in 2025 approached $5B, more than half of which was US-based.[3]

Connecting federally funded stakeholders, e.g. at universities and national laboratories, and industry developers can greatly accelerate progress and ensure US leadership going forward. Engagement between government and industry can take many forms, including exchange of information, joint research, and technology transfer from research institutions to commercial entities. Given that the quantum ecosystem is still in early stages and many of the companies are small to mid-size enterprises, there are impediments at the company level to initiating collaborations. As a consortium that aims to help its members and the broader quantum community thrive, QED-C could help to facilitate various engagements and in the process strengthen the US quantum research enterprise, the talent pipeline, and the industrial base.

Role of Partnerships

Participants raised an early question that framed much of the discussion: *why partnerships***?** The U.S. government has provided substantial research funding for quantum computing and start-ups. This prompted a related question: What role, if any, should government play in advancing quantum computing? Partnerships between government and industry can:

- De-risk technology development
- Provide strategic focus
- Scale investments
- Leverage stakeholder convening power

There is a significant amount of work required to advance quantum computing, such as the discovery of improved algorithmic speedup mechanisms. This was one of several thoughtful

[1] European Centre for International Political Economy, "Benchmarking Quantum Technology Performance: Governments, Industry, Academia and their Role in Shaping our Technological Future," March 2025, https://ecipe.org/publications/benchmarking-quantum-technology-performance/.
[2] U.S. Congress, House, *National Quantum Initiative Act*, H.R. 6227, 115th Cong. (2018), passed December, 2018, https://www.congress.gov/bill/115th-congress/house-bill/6227.
[3] National Science and Technology Council, "National Quantum Initiative Supplement to the President's FY 2025 Budget," December 2024, https://www.quantum.gov/wp-content/uploads/2024/12/NQI-Annual-Report-FY2025.pdf.

responses offered throughout the day. Government support is still needed to de-risk development and accelerate ecosystem maturation and translation to commercial technologies. Some participants from end-user industries noted that there is not yet sufficient evidence of advantage (increased speed, efficiency, and security) in key problem areas to justify adoption. Others observed that quantum solutions to industry problems are "physics-heavy": an industry team would require several physicists to solve a problem, a computer scientist to translate the problem, and an engineer to implement the solution. Bringing these key contributors to the quantum workforce together could chart a path for breakthrough advancements in quantum tech and associated applications. Fundamental scientific progress is also still required to bridge the gap to practical application.

One participant suggested that the field could benefit from greater engagement with mathematical physicists or mathematicians in adjacent areas (e.g., quantum algebras) whose work lies in distinct yet interconnected fields relevant to quantum computing. These researchers could offer novel approaches to quantum algorithm development and error correction. Partnerships could play a convening role by bringing together interdisciplinary groups, helping to break down traditional disciplinary silos and, incentivizing the development of algorithms that are useful across multiple use cases and sectors.

Overall, partnerships can serve as an effective vehicle to advance the government's goal of positioning the United States and its industry as a global leader in quantum computing for both national and economic security. There was broad agreement with this theme, and it served as a continued point of discussion. The sections that follow describe key considerations and partnership-ready problem spaces identified during the workshop.

Industry and Government Considerations

The trajectory of quantum computing is shaped not only by research progress, but also by the distinct incentives and priorities of industry, academia, and government. Quantum computing developers typically focus on demonstrating capabilities and value. This includes hardware improvements, early computational demonstrations, and exploration of narrowly defined problems that often do not directly translate to commercial applications. Academic researchers, by contrast, are driven by the pursuit of novel discoveries. End users are primarily concerned with performance gains, reduced costs, and integration with existing workflows. The federal government assesses quantum computing technologies through the lenses of national security, economic competitiveness, and long-term strategic advantage. In considering a partnership, it is critical to understand the differing perspectives of developers, researchers, end users, and the federal government.

Industry participants offered sector-specific insights into areas where quantum approaches could provide significant value.

- In finance, enhanced performance in constrained optimization, risk analysis, and portfolio optimization would be particularly valuable.
- In healthcare and the life sciences, quantum computing could accelerate molecular dynamics simulations, protein folding, and predictive analysis.
- In the energy sector, promising applications include multi-scale physics simulations,

materials discovery, partial differential equation-constrained optimization, and combinatorial decision-making.

- In the multi-scale physics domain, participants expressed a desire for modeling capabilities that could scale from the very small scale of the Schrödinger equation to larger scales governed by the Navier-Stokes equation.

Across industries, many high-impact challenges, including optimization, simulation, risk estimation, and scheduling, are resource-intensive or classically intractable. Addressing these with classical methods is often slow and costly. Improved modeling capabilities that reduce pilot requirements could deliver substantial value. However, without credible demonstrated advantages, companies are often hesitant to invest in emerging technologies. Although each of these application areas is the subject of active research, industry participants broadly agreed that additional work is needed to demonstrate a clear quantum advantage that would motivate industry adoption. In the interim, industry participants expressed interest in expanded access to high-performance computers for quantum simulation.

The U.S. government's interests in quantum technologies tend to prioritize opportunities that advance national security, public health, and economic competitiveness, prosperity and welfare. These are important for U.S. leadership, although they generally involve distinct business sectors and government agencies. As a result, investments in technologies with the potential to provide a clear military advantage are often made ahead of obvious technological feasibility, less defense-oriented commercial applications. Government and industry may have differing risk tolerances based on their specific aims, with the public sector often willing to invest heavily for a potential technological advantage in the space and defense domains.[4]

Taken together, these differing incentives and risk tolerances suggest that a successful partnership should define shared performance metrics and decision points that are meaningful to end users and aligned with government mission needs.

Partnership-Ready Quantum Computing Problem Spaces

While partnerships can add value across the quantum science and technology R&D ecosystem, certain characteristics make a problem especially well-suited to a high-impact partnership. Precompetitive challenges that represent industry-wide hurdles across, or within, qubit modalities are especially strong candidates.

> *Examples identified by participants include improving error correction, increasing qubit coherence times, supply chain resilience, and developing scalable infrastructure, including enabling technologies like cryogenic systems.*

Out of the problem spaces highlighted above, workshop participants identified algorithms and error correction as the two most promising focus areas that satisfy these criteria. A coordinated partnership dedicated to developing, identifying, and benchmarking algorithms

[4] For example, see: Anastasia Obis, "DoD plans to spend entire $152 billion from reconciliation bill in one year," *Federal News Network*, February 24, 2026, "Golden Dome" section, "Low-cost weapons" section, https://federalnewsnetwork.com/defense-news/2026/02/dod-plans-to-spend-entire-152-billion-from-reconciliation-bill-in-one-year/.

that demonstrate genuine quantum advantage for societally relevant problems could generate broad benefits for industry and government alike. Shared benchmarks and validation protocols could help build confidence in performance claims and accelerate adoption.

Limitations of Traditional Funding

Throughout the workshop, participants repeatedly returned to the challenge of translating foundational progress in quantum science into meaningful real-world applications. While university-led research has played a critical role in advancing quantum computing, participants emphasized that scientific progress does not automatically lead to deployment. Applied progress often depends on early engagement with end users, access to specialized infrastructure, iterative refinement of hardware, and validation against real-world constraints. These activities can be difficult to sustain under conventional funding mechanisms.

Participants also noted *that private investment alone is unlikely to close quantum computing's market translation gap.* Investors tend to prioritize scaling pathways that are more certain or defensible, while leaving high-risk, precompetitive technologies largely untested, even when their long-run potential is compelling.[5]

> *Quantum computing end users described in a workshop panel how adoption decisions hinge on clear, quantitative evidence of advantage over existing methods, typically expressed by performance metrics. In the absence of such evidence, technical advances in quantum computing may struggle to attract sustained engagement or investment.*

A related theme was the limitation of simply increasing funding for university-led research: university researchers, while often highly innovative, may have limited incentives and support for commercialization. Participants emphasized that many bottlenecks are not due to a lack of new ideas, but rather challenges related to integration, access, and validation. Discussions highlighted a growing imbalance between rapid advances in hardware capabilities and slower progress in demonstrating credible performance advantages. Over time, this imbalance risks eroding confidence among potential adopters and funders. Partnerships are one mechanism for sustaining progress and investment during periods of technical and market uncertainty.

Roles within Partnerships

Workshop participants noted that partnering with other quantum computing stakeholders is a significant challenge because of misaligned incentives. Partnerships support economic growth in technology-intensive and high-risk domains by aligning incentives across stakeholders, establishing governance structures that enable public investment to catalyze private activity, and distributing risk.[6] The roles outlined below focus on the practical contributions each actor brings to a partnership, rather than treating sectors as uniform entities:

- **Problem definers articulate the challenge**: End users, mission-driven government agencies, and other stakeholders. These actors serve as conveners, validators, and

[5] Lina Noureddin, "Building the future: What are PPPs and how do they help drive economic growth?," World Economic Forum, January 14, 2026, https://www.weforum.org/stories/2026/01/how-ppps-drive-economic-growth/

[6] Noureddin, "Building the future."

long-term stewards of the partnership, setting high-level strategic goals aligned with real-world priorities.

- **Innovation engines develop potential solutions**: Full-stack developers, laboratory-based researchers, and computational scientists. They provide the core source of ideas, talent, and independent technical scrutiny.
- **Performance enablers verify that those solutions deliver meaningful, validated results**: Algorithm designers, benchmarking teams, and validation experts. They contribute technical and business expertise, shared infrastructure and testbeds, and evaluation frameworks, helping ensure progress is measurable and relevant.

Each role complements the others. Together, these roles allow partnerships to amplify the expertise and capabilities of participants across industry, government, and academia. Making these roles explicit early can clarify governance, accountability, and decision responsibilities. Additionally, clearly defined roles in partnerships ensure alignment on priorities and interests, reducing incentive misalignment across stakeholders.

Models Discussed for Potential Partnerships

Several models for partnerships were discussed during the workshop, including challenge- and prize-based competitions, as well as center-scale and consortium-based approaches. Partnership options also drew on the 2022 QED-C report, *Public-private partnerships in quantum computing*.[7] This report suggested that the most effective way to identify near-term, government-aligned quantum use cases is through a collaborative discovery process involving a diverse set of stakeholders, including quantum researchers, developers, government agencies, end users, and regulators. Workshop participants also considered opportunities for interagency coordination in the design and structure of quantum computing partnerships. These models are not mutually exclusive; a future program could combine elements or sequence them over time, such as pairing a prize competition with access to shared testbeds.

Challenge and Prize-based Models

Challenge and prize-based funding mechanisms typically offer a cash award to incentivize progress toward a defined goal. These competitions can be administered by individuals, private companies, philanthropic organizations, or through partnerships.

- One example is the Google XPRIZE open competition for quantum algorithms, a three-year, $5 million competition run in partnership with XPRIZE and the Geneva Science and Diplomacy Accelerator (GESDA).[8] In December 2025, the competition's independent selection panel named seven finalists with proposed applications spanning

[7] Quantum Economic Development Consortium (QED-C). *Public-private partnerships in quantum computing*. Arlington, VA: SRI International, September 2022. https://quantumconsortium.org/publication/public-private-partnerships-2022/.

[8] Brigitte Hoyer Gosselink and Ryan Babbush, "Google, GESDA and XPRIZE Launch New Competition in Quantum Applications," *Google Blog,* March 4, 2024, https://blog.google/innovation-and-ai/technology/research/google-gesda-and-xprize-launch-new-competition-in-quantum-applications/.

computer science-relevant algorithms, chemistry, and materials science.[9]

- Another example is the Wellcome Leap Quantum for Bio prize competition.[10] The program offers a $40 million + $10 million prize focused on advancing quantum algorithms for health and biology applications.
- An example of a government-sponsored prize competition is the National Institutes of Health (NIH) prize competitions, administered through the National Center for Advancing Translational Sciences.[11] Stage 1 winners have included projects applying quantum-enhanced algorithms for microbial design and cancer treatment planning.[12]
- The Defense Advanced Research Projects Agency (DARPA) is also well known for its challenge competitions.

A distinguishing feature of challenge and prize competitions is their ability to narrowly focus participant efforts. By narrowly defining the goal, scope, and selection criteria, sponsoring organizations can shape the direction of research. Participants noted that this ability to guide efforts is a unique strength of challenge models, making them well suited for use-inspired research. The framing of the problem statement can significantly influence outcomes. Effective problem statements are typically simple, clear, attainable, and measurable.

> *Workshop participants emphasized cash prizes as a strategic complement to or replacement for traditional university-led research grants. These "fewer strings attached" awards differ from university-led research grants, as winners generally have flexibility in how they use the funds. Participants noted that this flexibility, combined with clearly scoped problem statements, can accelerate progress toward applied outcomes. Additionally, prize competitions can broaden participation beyond traditional academic researchers, attracting nontraditional teams and new entrants.*

Challenge competitions can help surface new or previously theorized quantum use cases while focusing researchers on real-world impact. Government-industry collaboration in designing and administering such competitions could further expand available expertise and resources.

Center-scale and Consortium Models

A partnership focused on quantum computing could draw on existing efforts within the field, as well as models from more mature industries such as semiconductors, for program design and governance structures.

Programs such as NSF's Industry-University Cooperative Research Centers (IUCRC) support sustained collaboration between industry and academia to accelerate the translation of

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[9] Ryan Babbush, "The 7 Finalists in the XPRIZE Quantum Applications Competition," *Google Blog*, December 10, 2025, https://blog.google/innovation-and-ai/technology/research/google-gesda-xprize-quantum-applications-finalists/.

[10] Wellcome Leap, "Q4Bio," accessed February 13, 2026, https://wellcomeleap.org/q4bio/.

[11] National Center for Advancing Translational Sciences (NCATS), "Challenges and Prize Competitions," *National Institutes of Health*, n.d., https://ncats.nih.gov/funding/challenges.

[12] National Center for Advancing Translational Sciences (NCATS), "NIH Quantum Computing Challenge Stage 1 Challenge Winners," *National Institutes of Health*, n.d., https://ncats.nih.gov/funding/challenges/winners/nih-quantum-computing-challenge-stage-1-winners.

university-led research.[13] These centers also contribute to workforce development by equipping students with skills aligned with industry needs.[14]

Quantum Leap Challenge Institutes (QLCI) use a model that bridges traditional challenge awards and the larger consortium or hub structure exemplified by IUCRC. While not explicitly a public-private partnership, QLCIs are interdisciplinary research initiatives that bring together academic and industry partners around focused, high-priority challenges. Similarly, the Joint University Microelectronics Program 2.0 (JUMP 2.0) is a large-scale, multi-institutional research consortium in the semiconductor sector. JUMP 2.0 is led by the Semiconductor Research Corporation (SRC) in collaboration with DARPA.

Center-scale and consortium models typically represent long-term, large-scale commitments. They facilitate sustained relationship building, coordination across institutions, and the transfer of knowledge and skills among academia, industry, and government. These models are well suited for multi-year roadmaps and sustained workforce development.

Infrastructure and Resource Sharing Models

An infrastructure and resource-sharing model represents a distinct form of public-private partnership centered on coordinated access to critical hardware, facilities, and computational resources. This model uses shared physical and digital infrastructure as the primary mechanism for collaboration. Because quantum computing R&D often depends on specialized, costly hardware, competitors may be hesitant to collaborate if doing so could compromise their competitive advantage and raise intellectual property (IP) concerns. A resource-sharing model helps balance these pressures by enabling partners to contribute to, or gain access to, shared infrastructure for experimentation and validation while maintaining clear boundaries around proprietary technologies.

NSF, the Department of Energy, and other federal agencies have supported the development of quantum testbeds. Ensuring researchers and industry participants can access to hardware and compute resources is essential for quantum partnerships. One participant proposed that industry partners could contribute in-kind access to cloud-based computing resources, enabling experimentation and validation without requiring a quantum computer on-premises.

Interagency Coordination

Interagency coordination was identified as another key feature of potential public-private partnerships. Collaboration across government agencies on requests for information, funding opportunities, and governance could strengthen program implementation.

Interagency collaboration may also help prevent a partnership from over-focusing on a single application area or approach, encouraging a more balanced and strategic portfolio. The National Nanotechnology Initiative is a potential model, given its broad participation across

[13] National Science Foundation, "About the IUCRC Program," *Industry–University Cooperative Research Centers (IUCRC)*, n.d., https://iucrc.nsf.gov/about/.
[14] National Science Foundation, "About the IUCRC Program," https://iucrc.nsf.gov/about/.

federal agencies and coordinated approach to advancing nanoscale research.[15]

For industry participants, a coordinated interagency approach can also reduce transaction costs by providing more consistent points of contact and program requirements.

Design Considerations

While many partnership models exist, participants emphasized that effectiveness depends less on the model chosen and more on the design decisions that shape how partners work together. The considerations below were raised repeatedly in the workshop's small- and large-group discussions.

Defining the Partnership (Purpose and Value)

- **Clear definition of expectations**: Effective quantum public private partnerships begin with a shared understanding of the problems being addressed, why they matter, and what participation requires. For example, quantum public-private partnerships may require industry partners to provide technology expertise and product performance data, while government partners are required to define potential use-cases and problem spaces. Clearly communicating expectations across these dimensions at the outset of the program is essential to enable informed decision-making about participation and commitment.
- **Clear value proposition**: Participants emphasized that successful partnerships must offer a clear value proposition for participating sectors. For industry, value comes from de-risking the exploration and development of quantum approaches. For academic partners, value centers on access to real-world problem contexts and specialized infrastructure. For government, partnerships enable higher return on taxpayer dollars, scale investments in fundamental and translational R&D, and expand U.S. innovation capacity. Partnerships also provide mechanisms for governments to test approaches and technologies with greater agility while distributing risk across partners.

Structuring for Execution (Design & Operations)

- **Selective by design**: Programs that rely on extended proposal processes, protracted contract negotiations, and lengthy kickoff timelines risk losing momentum before technical work begins. A quantum public private partnership should instead be structured to enable streamlined agreements and rapid program launch. Limited participation resulting from clearly defined or restrictive terms is not necessarily a drawback if those terms allow partners to move efficiently through the agreement process and begin substantive work sooner.
- **Flexible structures**: Rigid program structures were viewed as particularly risky in quantum contexts, where early assumptions about hardware capabilities, algorithmic performance, or timelines may not hold. Flexibility can be built into program design through shorter funding cycles, staged commitments, and clearly defined on-ramps and off-ramps for participants. Clearly defined rules governing changes to participation, scope, and program objectives should be established at the outset.
- **Intellectual property considerations**: IP was repeatedly cited as a practical constraint

[15] National Nanotechnology Initiative, "Federal Departments and Agencies Participating in the National Nanotechnology Initiative," n.d., https://www.nano.gov/agencies/.

on collaboration. Participants emphasized the importance of addressing IP concerns early in a public private partnership's design. Well-defined IP frameworks were seen as essential to supporting participation and trust among partners.

Sustaining Impact (Growth & Longevity)

- **Workforce development**: Workforce development emerged as an important secondary benefit of effective partnerships. Industry engagement and mentorship were viewed as especially valuable for providing students and early-career researchers with practical experience in applied quantum work and exposure to real-world challenges. Additionally, workshop participants suggested that industry and government can partner to co-sponsor research sabbaticals for university faculty.
- **Built to evolve**: Successful public private partnerships should be understood as ongoing, adaptive systems rather than one-time collaborations. Incorporating regular check-ins, assessments, and opportunities to revisit goals and responsibilities can help maintain alignment among partners and sustain a shared understanding of success.

These design choices determine whether a partnership can move quickly, keep stakeholders actively engaged, and produce credible, decision-relevant evidence of quantum advantage.

Conclusion

Quantum computing is approaching an inflection point between early experimental demonstrations and deployable applications with proven commercial and practical value. Coordinated action, including partnerships, can accelerate progress, reduce risk, maximize national security and competitiveness, and provide societal and economic benefits. The workshop described in this report provides a foundation for deliberate coordination among government, industry, and academia to strengthen U.S. leadership in quantum computing.

By targeting precompetitive problem spaces, partnerships can bridge the gap between advancing quantum computing hardware capabilities and less mature algorithmic applications. Partnerships can also accelerate the translation of foundational research into practical use cases, enabling stakeholders to proactively identify and capture quantum advantage in domains such as finance, energy, and pharmaceuticals. In addition to accelerating innovation, such partnerships can support workforce development and strengthen relationships across traditional sector boundaries. Well-designed partnerships can build credible evidence of advantage and de-risk adoption of quantum technologies.

Looking ahead, the workshop highlights NSF's potential to catalyze these partnerships by convening cross-sector stakeholders, supporting translational research, and seeding collaborative pilot efforts. Through this role, NSF can help align emerging quantum capabilities with real-world needs and accelerate the path to practical impact.

The workshop surfaced key insights that translate into clear next steps:

- Initiate targeted efforts between NSF, other federal agencies, and industry participants for near-term funding opportunities for partnerships and coordinated action.
- Supports access to testbeds and shared infrastructure
- Consider pilot efforts focused on the two identified partnership-ready research areas:

algorithms and error correction

- Clearly define future partnership components, including flexible mechanisms for onboarding and offboarding partners, and clear aims, roles, and a compelling value proposition for near- and long-term outcomes.

A participatory process that brings together end users, government, quantum developers, and researchers will position a future public-private partnership for success. The stakes for U.S. leadership in quantum computing are high, and an effective public-private partnership can help ensure that quantum technologies strengthen U.S. economic competitiveness, health, and national security for decades to come.