



U.S. FEDERALLY FUNDED QUANTUM INFRASTRUCTURE

**STRONG, DISTRIBUTED CAPABILITIES AND
OPPORTUNITIES TO IMPROVE
COORDINATION AND ACCESS PATHWAYS**

OCTOBER 2026

About the Quantum Economic Development Consortium

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

Sitting at the intersection of technology, academia, business, entrepreneurship, and policymaking, QED-C fosters the collaboration the industry needs. Its experts and organizations share knowledge and collectively shape the growth of quantum technology. QED-C is managed by SRI.

Thank you to the QED-C Enabling Technologies Technical Advisory Committee (Sebastian Engelmann, Chair) for supporting this study. The following SRI staff contributed to this report:

- Jordan Bass, Nathan Harsono, Lucien Randazzese, and Dylan Solden, SRI Center for Innovation Strategy and Policy
- Marcus Bagnell and Joseph Christesen, SRI Advanced Technology and Systems Division
- Celia Merzbacher, QED-C Executive Director
- Jonathan Felbinger, QED-C Deputy Director
- Prachi Mishra, QED-C Policy Research Associate

Suggested Citation

Quantum Economic Development Consortium (QED-C). *U.S. Federally Funded Quantum Infrastructure: Strong, Distributed Capabilities and Opportunities to Improve Coordination and Access Pathways*. Arlington, VA: SRI International, October 2026.

<https://quantumconsortium.org/publication/federally-funded-infrustructure/>

Government Purpose Rights

Agreement No.: OTA-2019-0001

Contractor Name: SRI

Contractor Address: 333 Ravenswood Avenue, Menlo Park, CA 94025

Expiration Date: Perpetual

Use, duplication, or disclosure is subject to the restrictions as stated in the Agreement between the National Institute of Standards and Technology (NIST) and SRI.

Non-US Government Notice

Copyright © 2026 SRI International. All rights reserved.

Disclaimer

This QED-C publication does not necessarily represent the views of SRI, any individual member of QED-C, or any government agency.

Executive Summary

The United States has developed substantial infrastructure that is broadly aligned with the quantum industry's current level of maturity, but its usefulness is constrained by fragmented access and gaps in capabilities that support flexible process development and scale-up. As quantum technologies move from the lab toward commercial applications, access to fabrication, characterization, prototyping, packaging, testing, validation, and process-development capabilities becomes increasingly important.

This report assesses the extent to which United States (U.S.) infrastructure supports current and anticipated quantum-related technology development needs. It also identifies opportunities for federal investment and coordination to improve access and infrastructure capabilities and to address existing and anticipated capability gaps.

This assessment focuses on U.S. federally funded facilities and programs that provide or coordinate prototyping, testing, and evaluation capabilities for quantum technologies. These include federal laboratories, federally funded research and development centers (FFRDCs), mission-driven research centers, manufacturing institutes, and federally sponsored networks and hubs that connect capabilities across organizations.

A mixed-methods approach was adopted for this assessment, including a landscape review, creation of an infrastructure inventory, site visits, interviews, and a survey of over 300 experts. The following findings emerged from research, surveys, and interviews.

Key Findings

- **Substantial technical foundation:** The United States has substantial capabilities to support quantum technology research and development, from basic research collaboration to pilot-scale manufacturing. However, technical strengths are unevenly distributed across technologies and development stages, with the greatest concentration in specialized nanofabrication and materials processing, superconducting-device fabrication, cryogenic testing, and integrated photonics.
- **Uneven user awareness:** Providers were generally more willing and able to work with external users than prospective users assumed. Survey respondents who had engaged with facilities reported that, generally, their needs were partially to mostly met, suggesting that existing infrastructure can provide meaningful value when users are able to identify an appropriate provider and access pathway.
- **Fragmented infrastructure landscape:** Federally funded capabilities are distributed across facilities, programs, agencies, and regions. Often, providers operate independently, maintaining separate access policies and procedures, funding models, missions, and operating priorities. In the survey, 69% of all respondents recognized at least one listed facility or program, and nearly 55% of all respondents reported using at least one, indicating that awareness and discoverability shape utilization.
- **Dependency of capacity on more than equipment:** In interviews, providers did not indicate widespread capacity constraints. Instead, they indicated that practical capacity was often limited by availability to specific tools, process steps, or by staffing for technical support, maintenance, administration, and scheduling. And while not a capacity constraint,

providers also reported the need for work to align with their facility or program’s mission, further constraining a given provider’s practical accessibility.

- **Persistent gap between prototyping and production:** Existing infrastructure is strongest in research and prototyping but is less equipped for process development and scale-up. Survey responses indicated that process development and scale-up, as well as assembly and advanced packaging, were the most frequently reported unmet needs.
- **Continued demand for external capabilities:** Over the next three years, about 70% of respondents expected external facilities to be important to their development needs, and 60% anticipated three or more engagements if relevant prototyping, testing, or manufacturing services were accessible.

Recommendations

QED-C offers the following recommendations to strengthen the U.S. quantum infrastructure landscape.

1. **Develop and maintain a comprehensive quantum infrastructure directory to improve the discoverability of available capabilities:** Create and maintain a regularly updated national directory that allows prospective users to identify and compare relevant capabilities, services, costs, turnaround times, access requirements, and points of contact.
2. **Standardize facility-access agreements and streamline processes to remove accessibility barriers:** Develop common agreement provisions, clearer access pathways, and target timelines for project review, contracting, and onboarding to reduce the administrative burden of working with federally supported facilities.
3. **Expand flexible quantum fabrication and process-development capacity to address current and near-term industry needs:** Invest in facilities, staff, and operations that can support repeatable fabrication, small-batch production, process stabilization, yield improvement, packaging integration, and eventual transfer to high-volume commercial manufacturing.
4. **Expand access to and standardize test infrastructure and characterization methods and data to enhance performance confidence and meet testing needs:** Strengthen access to facilities that can test, characterize, and validate quantum components and systems under quantum-relevant conditions. Consistent measurement methods, test conditions, and reporting practices would improve confidence in performance data, facilitate comparisons, and reduce duplicative testing.
5. **Use government demand and investment to support early market formation, supply chain development, and quantum infrastructure:** Use prototype purchases, demonstrations, advance purchase commitments, and cost-shared investments to reduce demand uncertainty, accelerate technology maturation, and give quantum system and component developers greater confidence when making production and supply chain investments. Government procurement can also support demonstrations in real-world environments and generate demand for external fabrication, packaging, assembly, testing, and validation services, increasing utilization of existing infrastructure and strengthening the case for further capacity investment.

Together, these recommendations would build on existing U.S. quantum capabilities while making the infrastructure landscape more visible, accessible, coordinated, and responsive to the needs of quantum technology developers.

Table of Contents

Executive Summaryiii

Table of Contents v

Introduction..... 1

U.S. Federally Funded Quantum Infrastructure Landscape 2

QED-C Member Needs and Demand..... 15

International Infrastructure Models and Insights.....27

Cross-Cutting Takeaways and Gaps in the U.S. Quantum Infrastructure Landscape..... 29

Recommendations for Federal Investment and Coordination 32

Conclusion 36

Appendix A: Methodology37

Appendix B: Participating Organizations 38

Introduction

This Quantum Economic Development Consortium (QED-C) report assesses the United States (U.S.) federally funded infrastructure that supports quantum technology prototyping, testing, and evaluation. The report examines the technical capabilities available to quantum developers, how facilities and programs provide access to external users, and whether the current landscape can support technologies as they advance from research and early prototypes to process maturity and commercialization.

The first section offers a supply-side assessment of federally supported infrastructure, drawing on a landscape review and an infrastructure inventory, interviews with facility providers and program managers and site visits (see Appendix A for detailed methodology). The section describes the principal types of providers and programs, their access pathways, technical strengths, practical capacity, constraints, and efforts to connect capabilities across facilities and regions. It also discusses complementary federal programs that reach beyond physical infrastructure, supporting technology development through research funding, partnerships, demonstrations, and procurement.¹

The second section describes infrastructure needs and anticipated demand across QED-C members. This section draws on an updated QED-C member-needs survey with over 300 respondents and industry interviews to describe development needs, prior experiences with federally supported infrastructure, unmet technical needs, access barriers, industry-reported priorities, and signals of future demand for external services (see Appendix B for details on survey respondents and interview subjects). The section also examines selected international facilities and programs to identify alternative approaches and explore potential lessons for the United States.

The third section synthesizes findings on the strengths and gaps of the U.S. infrastructure landscape and offers recommendations for federal investment and coordination intended to make existing capabilities more visible and accessible, address priority technical gaps, and strengthen pathways from research and prototyping to commercial deployment. A directory separate from this report profiles domestic facilities and includes information on their capabilities, access mechanisms, points of contact, and, where available, pricing, schedules, capacity, and links to additional resources.

For purposes of this assessment, the report describes quantum technology development across five broad stages, typically defined as follows:

- **Design and evaluation:** Conceptual and engineering design, modeling, simulation, and assessment of technical feasibility.
- **Fabrication and prototyping:** Conversion of designs into physical devices, components, or early systems that can be tested and refined.
- **Assembly and advanced packaging:** Integration of fabricated devices with electrical, optical, mechanical, cryogenic, and other interfaces needed for functional components or systems.

¹ These complementary federal programs were developed based on several identified barriers that emerged from survey responses, interviews, and the broader landscape review.

- **Testing, validation, and characterization:** Measurement and evaluation of the properties, performance, and reliability of materials, components, subsystems, and integrated systems.
- **Process development and scale-up:** Translation of successful designs or prototypes into stable, repeatable processes through activities such as process refinement, yield improvement, quality control, supplier qualification, and increasing production volume.

These categories are intended as practical descriptions rather than rigid or universally defined stages. In real-world development, their boundaries vary by technology, manufacturing approach, organizational model, and level of maturity, and activities may overlap, occur in a different order, or recur as a technology develops.

U.S. Federally Funded Quantum Infrastructure Landscape

The current early stage of quantum information science (QIS) technology development and the rapid pace of commercialization mark a critical period for the United States to capture a position of global leadership in quantum technologies and their applications. If the United States is to achieve leadership at this early stage, it is critical to develop the necessary knowledge, infrastructure, and workforce. This report assesses federally supported infrastructure relevant to prototyping, fabrication, testing, and evaluation.

Since the enactment of the National Quantum Initiative in 2018, the federal government has sustained substantial investment into the quantum ecosystem, investing over \$4 billion in QIS research and development (R&D) alone between fiscal years 2019 and 2023, while also calling for coordination across the federal government.² This investment is overseen by the National Quantum Coordination Office (NQCO) within the White House Office of Science and Technology Policy. NQCO responsibilities include overseeing the interagency coordination of the National Quantum Initiative, serving as a central point of contact regarding Federal civilian activities, ensuring coordination among quantum centers, and conducting public outreach.

The United States has developed a substantial and diverse portfolio of quantum-relevant infrastructure capabilities distributed across national laboratories, federally funded research and development centers (FFRDCs), universities, federally sponsored research programs, regional networks and hubs, manufacturing institutes, and select commercial providers. Although many of these organizations receive support through common federal agencies or national initiatives, they generally do not act as coordinated components of a unified agency or initiative. Rather, the capabilities of a given facility and their relevance to quantum technology development are heavily influenced by institutional mission, technical competencies, technology focus, and user communities.

This section characterizes the supply-side landscape by examining the types of infrastructure providers, access pathways, technical capabilities, development stages supported, practical

² National Science & Technology Council Subcommittee on Quantum Information Science, *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>.

capacity, and efforts to connect distributed capabilities across the federally funded quantum infrastructure landscape.

Provider Types

Federally funded infrastructure providers can be grouped into several operating models. These models are not mutually exclusive, as a single organization may operate a distinct facility or program in addition to participating in another initiative. The following types are intended to describe how the infrastructure landscape is organized.

Federal and federally sponsored mission laboratories and FFRDCs

This category includes agency-operated federal laboratories, national laboratories, and other FFRDCs operated on behalf of federal sponsors, as well as federally sponsored laboratories and specialized facilities hosted within these institutions. Their relevant capabilities and support for quantum technologies vary substantially according to institutional mission and technical competencies. Examples include Department of Energy (DOE) national laboratories such as Sandia National Laboratories, Lawrence Berkeley National Laboratory, Oak Ridge National Laboratory, and SLAC National Accelerator Laboratory; MIT Lincoln Laboratory, an FFRDC; and agency-operated facilities such as the National Institute of Standards and Technology (NIST) Center for Nanoscale Science and Technology (CNST).

Many federal and federally sponsored laboratories and FFRDCs receive support from additional federal agencies and initiatives to establish specialized centers, programs, or capabilities that build on existing institutional strengths. These efforts typically expand available capabilities while remaining aligned with the host institution's broader mission. One example is SLAC's Detector Microfabrication Facility, which builds on SLAC's broader microelectronics and characterization capabilities.

Federal research facilities outside the FFRDC system can play a similar mission-driven role. For example, CNST provides fabrication and characterization infrastructure and expertise in support of NIST's mission to stimulate innovation and U.S. industrial competitiveness through the advancement of science, standards, and technology.

There are many ways for industry to access these capabilities, but access usually depends on a proposed project's alignment with the facility's research mission. When alignment is strong, industry can gain access through user programs, collaborative R&D, or participation in national initiatives such as the Laboratory for Physical Sciences' Qubit Collaboratory (LQC) foundry program.

Other federally supported research organizations also provide access through centers and initiatives that focus and coordinate infrastructure around specific technical or strategic objectives. These initiatives may expand an existing capability or create a new one, and some extend into more applied or downstream stages of technology development, including prototyping, characterization, testing, fabrication, and limited-scale manufacturing. Their forms of support vary: some make capabilities available as a service or shared national resource, whereas others fund collaborative R&D, coordinate capabilities across institutions, or support workforce development. Examples include DOE's National Quantum Information Science Research Centers and the LQC, both of which seek to develop capabilities and

resources with benefits accruing beyond the institution to the broader national quantum ecosystem.

Infrastructure Networks and Innovation Hubs

Networked infrastructure and regional innovation hubs are federally sponsored initiatives that coordinate multiple organizations around a specific technical focus, national priority, or defined geographic region. Participating organizations retain local ownership and operation of their facilities while linking complementary capabilities, expertise, and services across the network. Depending on the program, these initiatives may provide coordinated or subsidized access to participating facilities, fund research and technology development projects, facilitate referrals among providers, or create other partnership opportunities.

These networks broadly reflect two models, which can overlap. The first model is focused on connecting and supporting access to distributed infrastructure. Examples include the National Science Foundation's (NSF's) National Quantum and Nanotechnology Infrastructure (NQNI) and the Department of War's (DOW's) Microelectronics Commons, which help connect users to specialized capabilities across the network and subsidize their operations.

The second model is focused on ecosystem and commercialization development. Examples include the Economic Development Administration's (EDA's) Regional Technology and Innovation Hubs (Tech Hubs), such as Elevate Quantum, which take a more active role in regional industry development and in developing commercialization pathways through workforce development, commercialization support, partnerships intended to help move technologies toward market entry, and other efforts.

Academic Facilities

Academic facilities and laboratories are typically university-led infrastructure that provides flexible environments for basic and applied research, technology development through proof of concept, and workforce training. Although these facilities were not a primary focus of this assessment, they are an important part of the broader infrastructure landscape and may complement federally operated facilities.

Academic fabrication facilities sometimes offer more transparent access arrangements than federal facilities and national laboratories, including publicly available pricing, defined service options, and clearer turnaround times. Like FFRDCs, they also support users through collaborative R&D and receive support from federal agencies and initiatives to establish centers, programs, or specialized capabilities that align with institutional strengths. Examples include the University of Colorado Boulder's NSF-funded National Quantum Nanofab and Colorado Shared Instrumentation in Nanofabrication and Characterization, Harvard University's Center for Nanoscale Systems, and the University of Colorado Boulder-NIST Boulder Cryogenic Quantum Testbed. Academic facilities also have a leading role in infrastructure network and hub programs and initiatives. University-led shared facilities form the core of NSF's NQNI network, and universities also participate in programs such as NSF's National Quantum Virtual Laboratory, DOW's Microelectronics Commons, and NSF's Quantum Leap Challenge Institutes.

Manufacturing Institutes

Manufacturing institutes, foundries, and commercial service providers include publicly supported manufacturing institutes and commercial entities that support the transition from R&D and prototyping to production, generally placing a stronger emphasis on process control, repeatability, yield, and production readiness. Some also receive support from broader federal manufacturing initiatives that can expand capabilities relevant to quantum technologies. Manufacturing USA institutes such as AIM Photonics provide an intermediate model between research-oriented infrastructure and full-scale commercial manufacturing, supporting prototyping, process development, packaging, testing, and low-volume production using production-relevant equipment and processes. AIM Photonics's focus on high-mix, low-volume manufacturing can limit throughput and scale of quantum projects.

Commercial foundries such as GlobalFoundries sit farther toward high-volume manufacturing. Some also support collaborative research, process development, and limited experimentation, providing important downstream support. Commercial foundries also receive federal support that can expand their quantum-relevant capabilities.

For example, recent CHIPS R&D awards have supported multiple efforts to strengthen domestic quantum semiconductor manufacturing, including an award of up to \$375 million for GlobalFoundries' development of a secure, domestic quantum foundry and an award of up to \$1 billion to Anderon, a newly formed IBM subsidiary, to establish a new quantum semiconductor foundry.³

Access Pathways and Barriers

Across interviews and site visits, infrastructure providers generally described themselves as willing to work with startups, established companies, government organizations, and researchers when the proposed work is technically feasible and aligned with the provider's mission and capacity is available. Although specific mechanisms vary by provider and may overlap, they can be broadly grouped into three pathways: collaborative research agreements, shared user programs, and programmatic or networked access.

Collaborative Research Agreements

Collaborative research agreements are a common pathway for industry engagement, particularly with national laboratories and FFRDCs. Common mechanisms include cooperative research and development agreements (CRADAs), under which a laboratory and external partner contribute resources toward collaborative R&D, and strategic partnership projects (SPPs), under which an external sponsor funds a laboratory to perform a defined body of work. Depending on the engagement, providers may also use technical service agreements, test agreements, licensing arrangements, or related mechanisms.

³ National Institute of Standards and Technology, "Department of Commerce Announces Finalization of CHIPS R&D Award with GlobalFoundries," press release, September 8, 2026, <https://www.nist.gov/news-events/news/2026/09/department-commerce-announces-finalization-chips-rd-award-globalfoundries>; National Institute of Standards and Technology, "Department of Commerce Announces Finalization of CHIPS R&D Award with Anderon," press release, September 16, 2026, <https://www.nist.gov/news-events/news/2026/09/department-commerce-announces-finalization-chips-rd-award-anderon>.

These agreements can provide industry with access to specialized equipment, staff expertise, process knowledge, and codevelopment capabilities. However, many are negotiated on a project-specific basis and require substantial engagement from technical, legal, and partnership staff. Interviewees identified friction around defining statements of work, intellectual property (IP) provisions, government-purpose rights, and unfamiliarity with federal contracting processes. While some interviewees reported substantial contracting timelines, the terms themselves were not generally viewed as insurmountable. Organizations with less experience working with national laboratories generally require additional time to understand and negotiate the applicable framework.

Providers also described IP protections as more flexible than some prospective users perceived them to be. Multiple providers indicated they could work under non-disclosure agreements and protect proprietary designs or information. Background IP typically remains with the originating party, while jointly generated IP and licensing rights are addressed through the relevant agreement. The recurring challenge was more often contracting complexity and unfamiliarity than an inability to protect proprietary work.

Costs vary substantially across access mechanisms. Some federally supported programs provide no-cost or subsidized access when work meets nonproprietary, public-benefit, or federal-sponsorship requirements, while proprietary or client-funded projects may require full-cost recovery.

For example, the NIST CNST offers reduced rates for qualifying nonproprietary work and full-cost-recovery rates for proprietary work, while MIT's Superconducting Qubits at Lincoln Laboratory (SQUILL) Foundry provides no-cost fabrication access to eligible U.S.-based users working under U.S. government grants.

Some providers have sought to reduce the burden of bespoke agreements by establishing lighter-weight or standardized mechanisms for recurring activities. These include technical-service or equipment-specific agreements, predetermined partnership terms, and program-specific user agreements. Such models can reduce onboarding complexity where the underlying technical capability and expected scope of work are sufficiently standardized.

Key Finding: Federal infrastructure is more open to industry than commonly assumed. Providers generally expressed willingness to support industry-led projects when the work aligned with their missions and capabilities. IP protections were usually negotiable; the greater challenges were identifying the appropriate mechanism and navigating project-specific contracting requirements.

Shared User Programs

Shared user programs are open-access pathways that grant individual researchers or groups access to shared tools and other facility capabilities, including cleanroom space. Examples include NSF, DOE, and university user facilities. Under these programs, external users are typically able to access equipment through proposal-based, hourly, user-fee, or other facility-specific processes. Depending on the facility, users may operate equipment directly after training or receive technical support or services from facility staff.

These programs can be valuable to companies seeking access to capital-intensive fabrication, characterization, testing, or cleanroom infrastructure that would be cost prohibitive to build in

house. However, the expertise and level of staff support available to users vary. Some facilities expect users to be experienced and operate tools independently, while others provide greater staff involvement or remote services. Tool availability can also vary within the same facility, with individual high-demand instruments creating bottlenecks even when overall facility utilization remains below capacity.

Shared research environments also vary in their suitability for later-stage technology development. Many academic and research-oriented user facilities prioritize process flexibility, which can be advantageous for discovery and prototyping but less suitable for work requiring standardized and repeatable processes. However, this limitation is not inherent to the shared user model. For example, the NIST CNST operates a comparatively standardized nanofabrication environment with contamination controls, qualified process recipes, preventive maintenance, and formal user onboarding that provide greater process stability and repeatability.

Programmatic or Networked Access

This pathway includes programs created specifically to broaden access to existing capabilities, connect users to distributed infrastructure, or subsidize strategically important technical services. Some programs provide streamlined access to a narrowly defined capability or modality, while others coordinate multiple facilities or organizations into a broader network. They often operate alongside, and complement rather than replace, the collaborative R&D or shared user mechanisms described above.

MIT Lincoln Laboratory’s SQUILL Foundry provides a targeted programmatic access model. The underlying superconducting fabrication capability can be accessed through conventional collaborative agreements, but the Laboratory for Physical Sciences-sponsored SQUILL Foundry provides a streamlined path for eligible U.S.-based users whose work is federally funded. Through a lightweight application and user agreement, participants can access scheduled fabrication runs, design guidance, packaging support, and characterization at no direct cost. The foundry’s principal contribution is therefore to simplify access to—and federal support for—an existing capability.

Other programs coordinate access across networks of independently operated facilities. NSF’s National Nanotechnology Coordinated Infrastructure (NNCI) and NQNI programs are part of NSF’s long-term investment in nanotechnology infrastructure and help connect users with specialized capabilities distributed across participating facilities.⁴ DOW’s Microelectronics Commons similarly uses regional hubs to connect infrastructure, technical partners, and funded development projects. These models can help users identify and access capabilities across multiple organizations, although participating facilities may retain their own operating rules, fees, and access requirements.

Programmatic pathways can reduce financial, administrative, and discoverability barriers to capabilities that would otherwise require a bespoke partnership. However, their continuity may also depend more on sponsor priorities and program funding than that of fee-based, standing

⁴ National Science Foundation, “NSF Launches \$100M National Quantum and Nanotechnology Research Infrastructure Program,” news release, February 13, 2026, <https://www.nsf.gov/news/nsf-launches-100m-national-quantum-nanotechnology-research>.

user facilities. The SQUILL Foundry, for example, indicated that its near-term fabrication-run capacity was influenced more by how many runs its sponsor would support than by physical fab capacity. Program transitions can create similar uncertainty, as illustrated by the end of NNCI, which ran from 2015 to 2025, and uncertainty surrounding the ongoing development of its NQNI successor.

Access Barriers

Although infrastructure providers demonstrated broad willingness to engage with external users, several recurring barriers emerged in the survey results and interviews. These barriers often related to reduced practical accessibility as well as to limited awareness and discoverability. Some companies were unaware that relevant capabilities existed, assumed they were ineligible to use federally supported resources, or did not know that providers could accommodate proprietary or industry-led projects. Infrastructure providers also noted that their available capabilities and engagement mechanisms were not always communicated clearly.

Industry interviews similarly indicated that awareness often developed through existing professional relationships, word-of-mouth, or active monitoring of federal programs. Even when a relevant facility was known, prospective users often needed direct discussion with facility staff to determine whether its exact capabilities could meet their needs and which partnership mechanism applied. For example, SLAC offers CRADAs, SPPs, technical service agreements, user agreements, and other mechanisms, but determining the appropriate route can itself require engagement with facility staff.

Administrative timelines represent a second barrier. Bespoke collaborative agreements can require substantial effort to define project scope and resolve legal and IP terms, particularly for organizations unfamiliar with federal partnership mechanisms. Providers that created lighter-weight programmatic agreements generally described them as more scalable.

MIT Lincoln Laboratory, for example, attributed part of the SQUILL Foundry's success to its substantially simpler user agreement compared with conventional CRADAs.

Together, the interviews suggest that the U.S. infrastructure landscape is more accessible in principle than it is legible and navigable in practice. A wide range of technical capabilities and partnership mechanisms are open to industry, but users must often identify the relevant provider, determine whether its capability fits their need, understand the applicable eligibility and IP framework, and navigate a locally defined access process. Streamlined programmatic pathways demonstrate that these barriers can be reduced without necessarily creating new physical infrastructure.

Key Finding: Access can be significantly improved by reducing friction for engagement with existing infrastructure. Standardized agreements, improved discoverability, improved technical guidance, and subsidized user programs can make existing capabilities substantially easier to use. Models such as the SQUILL Foundry demonstrate how program design can reduce barriers, increasing utilization.

Technical Strengths and Capabilities

Collectively, federally supported facilities offer capabilities across much of the quantum technology development cycle, including materials research, device design, fabrication, characterization, packaging, testing, and experimental validation. At these facilities, capabilities are strongest from research through proof-of-concept and low-volume prototyping, with a few facilities also supporting process development, pilot-scale fabrication, and other precompetitive activities. More extensive facility-level information is provided in the separate infrastructure directory. This section synthesizes the areas of technical strength across the landscape.

Much of this technical capacity comes from infrastructure established for adjacent fields rather than exclusively for quantum technologies. Semiconductor, nanotechnology, photonic, materials-science, high-performance-computing, and precision-measurement facilities provide tools and expertise that can be applied to quantum devices and systems. This cross-disciplinary foundation substantially expands the range of quantum-relevant capabilities available through federally supported infrastructure.

Technical capabilities are generally deepest for superconducting and photonic platforms, reflecting comparatively mature fabrication and experimental approaches and sustained federal investment. Relevant capabilities also support trapped-ion and neutral-atom systems, spin qubits, and enabling components. Across these modalities, the landscape's technical strengths cluster into several areas.

Nanofabrication and Materials

Specialized nanofabrication and materials processing are broad strengths of the federally supported landscape. The priority facilities collectively offer lithography, deposition, etching, annealing, materials growth and transfer, microscopy, and device-level characterization. Their capabilities extend across superconducting materials and devices, thin crystalline membranes, diamond and other quantum materials, III-nitride and wide-bandgap semiconductors, photonic devices, and quantum sensors. Facilities such as Sandia's Microsystems Engineering, Science and Applications (MESA) complex, the NIST CNST, and the Argonne Quantum Foundry provide specialized quantum-relevant processes and expertise. The Commercial Leap Ahead for Wide Bandgap Semiconductors (CLAWS) Research Foundry provides complementary capabilities spanning III-nitride epitaxy, process development, device fabrication, packaging, and testing for wide-bandgap electronic and photonic technologies.

Superconducting Fabrication

Superconducting-device fabrication represents one of the clearest concentrations of modality-specific capability. The reviewed infrastructure spans superconducting materials development, thin-film deposition, device and sensor fabrication, multi-project wafer (MPW) runs, packaging, and post-fabrication metrology. For example, the SQUILL Foundry and SLAC's Detector Microfabrication Facility provide relatively structured fabrication pathways. These resources support superconducting circuits, sensors, detectors, and radio-frequency and microwave quantum devices from research through prototyping and, in select cases, low-volume production.

Cryogenic Testing

Facilities provide dilution refrigeration, millikelvin measurement, spectroscopy, specialized magnetic-field environments, and device characterization. For example, Fermilab's Quantum Garage includes six extra-large dilution refrigerators capable of supporting millikelvin temperatures and high- and low-magnetic-field environments. Lawrence Berkeley National Laboratory's Advanced Quantum Testbed, the Argonne Quantum Foundry, the Boulder Cryogenic Quantum Testbed, and Elevate Quantum also provide complementary environments for testing quantum devices, materials, components, and integrated experiments.

Integrated Photonics

AIM Photonics combines 300-millimeter, complementary metal-oxide-semiconductor (CMOS)-compatible fabrication, process design kits (PDKs), MPW runs, and pilot-scale production with dedicated test, assembly, and packaging capabilities. Its Test, Assembly and Packaging (TAP) facility adds fiber attachment, heterogeneous integration, passive and active optical testing, radio frequency testing, and device metrology.

Translational Process Capabilities

A few facilities extend beyond flexible research infrastructure into more repeatable process development, packaging, and low-volume production. SLAC's Detector Microfabrication Facility reports capabilities for prototype scaling and low-volume production of superconducting sensors and detectors, with an emphasis on uniformity, yield, and reproducibility. AIM Photonics offers defined design processes, scheduled wafer runs, pilot-scale fabrication, and dedicated packaging and testing. Its TAP facility is particularly notable for connecting photonic-device fabrication with fiber attachment, heterogeneous integration, and post-fabrication testing. The CLAWS Research Foundry similarly links materials growth, device fabrication, packaging, and testing for III-nitride and wide-bandgap technologies relevant to quantum-enabling photonic and electronic components.

Quantum Networking

Specialized quantum networking and communications environments provide an additional area of technical strength. Air Force Research Laboratory's Extreme Computing Facility and Stockbridge Experimental Facility and the neighboring Innovare Advancement Center support research involving quantum networking, distributed information processing, quantum key distribution, and entanglement distribution. Q-NEXT facilities and partners similarly support the development of quantum repeaters, communications technologies, sensors, and related testbeds. These capabilities remain primarily oriented toward applied research and system development, but provide technical environments for integrating multiple quantum and classical components.

Multidisciplinary Expertise

Multidisciplinary scientific and engineering expertise amplifies the value of the physical infrastructure. Federally supported facilities bring together process engineers, materials scientists, device physicists, metrologists, packaging specialists, cryogenic engineers, and systems researchers. Interviews and site visits consistently indicated that this expertise—particularly assistance with process development, equipment operation, design adaptation, fabrication troubleshooting, and experimental setup—is itself a core technical capability rather

than merely an accessory to the equipment. This concentration of expertise enables facilities to address technically complex problems.

Key Finding: Federally supported infrastructure provides a substantial technical foundation for quantum technology development. Facility profiles, provider interviews, and site visits identified notable strengths in nanofabrication and materials processing, superconducting-device fabrication, cryogenic testing, integrated photonics, and characterization and metrology. These capabilities position the landscape particularly well to support development, design prototyping, and technical risk reduction.

Facility Utilization, Capacity, and Constraints on Expansion

Facility utilization and practical capacity vary by mission, technology modality, individual tools and process steps, and the degree of process control. A key distinction is that between physical capacity and effective capacity. For external users, effective capacity may represent only a portion of a facility's installed capacity because equipment and staff time are often allocated first to the programs, institutional missions, and research communications for which the infrastructure was funded. It also depends on staffing, operating support, access processes, project complexity, and suitability of available capabilities to a user's development needs, not simply on the physical availability of equipment or space.

Across the providers examined, there is no evidence of systemwide physical capacity saturation, although bottlenecks existed at specific tools and process steps. Several providers reported available or expandable capacity, while others were constrained at particular tools or capabilities. For example, NNCI facilities were generally not operating at full overall capacity, even though individual high-demand tools could be heavily utilized. Sandia reported capacity within MESA that could support additional work, while MIT Lincoln Laboratory indicated that the SQUILL Foundry's regularly scheduled MPW runs had generally been sufficient for current demand. By contrast, University of Colorado Boulder's National Quantum Nanofab and the NIST CNST described adding tool redundancy or using scheduling controls to address high demand for specific equipment and equipment downtime. These examples are illustrative rather than directly comparable because providers define and measure capacity differently.

When capacity constraints were reported, staffing and operational support emerged as the most common cross-cutting limitations. Many facilities require administrative and legal staff to establish partnerships, as well as technical staff to evaluate projects, develop processes, train users, operate and maintain specialized equipment, or collaborate directly with external teams. For example, Lawrence Berkeley National Laboratory's Advanced Quantum Testbed noted that a single technical staff member could typically support only two or three proposals at a time, significantly constraining the number of active collaborations the program could maintain. Similar staffing constraints affected training, user support, operating hours, and process-development assistance at several other facilities.

Although longer operating schedules or additional shifts could expand throughput at some facilities, doing so would require corresponding increases in technical staff and operating support.

Expanding capacity may therefore require more than purchasing equipment or constructing additional fabrication lines. Depending on the facility, expansion may also require additional cleanroom space, power, cooling, water, gases, maintenance resources, safety support, and sustained funding for staff and operations. These requirements can limit how quickly installed or underused physical capacity can be converted into capacity available to external users.

Equipment availability also does not necessarily translate into usable capacity for industry. Many shared user facilities are intentionally configured for flexible development rather than standardized, repeatable processing. This flexibility is valuable for research and early prototyping but may be less well suited to projects that require tighter process control, repeatability, and sustained process engineering. More translationally oriented facilities—including the NIST CNST, AIM Photonics, Sandia’s MESA/Quantum Foundry Facility (Q2F), and SLAC’s Detector Microfabrication Facility—place greater emphasis on process stability and repeatability, although their operating models and capacity for external users still vary.

The suitability of available equipment can also differentiate available capacity from usable capacity. Nominally similar fabrication capabilities can differ substantially in wafer format, process integration, equipment generation, and the degree of process control available to external users. This issue can be particularly important for quantum technologies designed to leverage conventional semiconductor manufacturing infrastructure, for which access to advanced CMOS-compatible process environments may itself enable development and scale-up. One industry interviewee highlighted limited domestic access to modern 300-millimeter processing as a particular concern. More advanced infrastructure, however, also introduces trade-offs between technical capability and affordability. The substantial cost of acquiring, maintaining, and using leading-edge fabrication tools may not be justified for the quantum industry, where demand remains relatively low.

For collaborative R&D and other partnership-based models, effective access to capacity also depends on alignment with the provider’s mission and technical scope. Providers generally expressed willingness to support external projects when the projects were technically feasible, were aligned with institutional objectives, and could be accommodated with available resources. In practice, mission alignment appeared to be interpreted relatively broadly across many providers rather than as a narrow exclusion criterion.

Key Finding: Physical capacity does not necessarily translate into usable capacity. Capacity is often limited by bottlenecks at specific tools or process steps, staffing and operating support, mission priorities, and access processes. Expanding industry access may therefore require sustained investment in personnel and operations—not necessarily additional equipment or facilities.

Connecting Distributed Capabilities

Federal programs have increasingly sought to connect existing facilities and capabilities across institutions and regions. These efforts range from national referral networks to regional prototyping hubs that coordinate facilities, fund infrastructure upgrades, and support projects across multiple stages of development.

Depending on their design, these programs may improve visibility, refer users to specialized facilities, coordinate cross-facility projects, or subsidize access and infrastructure improvements.

Although not exclusively quantum-focused, DOW's \$1.8 billion Microelectronics Commons is one of the most prominent examples of this shift. The program was explicitly designed to accelerate the "lab-to-fab" pipeline by organizing regional hubs that connect industry, universities, national laboratories, and fabrication infrastructure. This model combines technical capabilities with funded prototype projects, infrastructure upgrades, and organizational mechanisms intended to help technologies progress across multiple development stages. The QED-C survey identified 128 reported engagements with the Microelectronics Commons, including uses related to fabrication, packaging, and process development. Fewer than half of these engagements were reported as mostly or fully meeting the identified need. Given the program's relative novelty, these results are better viewed as early evidence of use and implementation than as a definitive assessment of the model.

Other programs perform different coordinating functions. NSF's former NNCI and its planned successor NQNI primarily operate as distributed infrastructure networks in which participating facilities remain locally managed while the coordinating network increases visibility and refers users to relevant capabilities. NQNI is intended to broaden this approach through a "network of networks." By contrast, EDA's Tech Hubs place greater emphasis on commercialization and regional ecosystem development. Elevate Quantum is using this model to connect regional quantum and photonics strengths, including shared laboratories, photonic integrated circuits (PICs) fabrication, advanced packaging, workforce development, and partner capabilities.

Alongside formal network programs, facility- and regional-level initiatives have also worked to connect complementary capabilities across development stages and, where needed, through external partnerships. At Sandia, users can move between the Center for Integrated Nanotechnologies' flexible research environment and MESA/Q2F's more process-controlled, pilot-scale fabrication capabilities, with external partnerships supporting selected downstream needs. Similarly, SLAC's Detector Microfabrication Facility has intentionally developed a tight, vertically integrated environment that links fabrication with metrology, packaging, room-temperature and cryogenic characterization, and millikelvin testing, while complementary SLAC and Stanford University capabilities provide additional nanofabrication and materials characterization. Interviewees described a development pathway in which exploratory prototypes can originate at Stanford, move to the Detector Microfabrication Facility for scaling and process stabilization, and ultimately transition to a commercial foundry for higher-volume production.

These initiatives provide meaningful foundations for a more connected U.S. infrastructure landscape, but most coordination remains concentrated within individual programs and regions. Participating facilities commonly retain their own access requirements, fees, operating priorities, and capacity constraints. As a result, users may still need to independently identify and navigate multiple providers as they move between development stages. These models provide useful foundations for addressing this fragmentation, but the broader ecosystem does not yet provide a consistent national pathway from design through fabrication, packaging, testing, scale-up, and commercial production.

Complementary Federal Programs Supporting Quantum Technology Development

These programs address barriers to quantum technology development that extend beyond physical infrastructure, such as connecting researchers and companies with technical resources, funding applied research and demonstrations, supporting technology maturation, and creating demand through government missions and procurement. These complementary federal programs do not replace physical infrastructure. Rather, they emerged from survey responses, interviews, and the broader landscape review as complementary mechanisms that provide the funding, coordination, partnerships, and market demand needed to use physical infrastructure effectively and move technologies toward deployment.

Networked Research, Demonstration, and Translation Programs

These programs can connect researchers, facilities, and expertise around shared technical objectives without creating a centralized physical facility. For example, NSF's National Quantum Virtual Laboratory is envisioned as a national framework for making distributed quantum research resources more broadly available, facilitating partnerships between academia and industry, and translating scientific advances into applications.

Public-Private Translational and Manufacturing Partnerships

These partnerships provide another mechanism for addressing development challenges that existing facilities may not be equipped to solve alone. An example is NIST's recently established Quantum Manufacturing Engineering Center (QMEC), operated through a partnership with SRI. With a planned initial investment of \$20 million, the center is intended to accelerate the manufacture of scalable, high-performance quantum components and systems through close industry collaboration. It provides a flexible mechanism for developing, piloting, and implementing manufacturing-engineering advances intended to address critical gaps and strengthen the U.S. quantum industrial base.⁵

Other Federal Funding and Partnership Mechanisms

Mechanisms such as Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) awards, Broad Agency Announcements, cost-shared R&D programs, and agency-specific partnerships can complement larger initiatives by financing technology development and access to expertise at universities, national laboratories, and other technical resources.⁶ These mechanisms can be particularly useful when a company requires specialized infrastructure or expertise but cannot justify building a new capability. Where award and agency rules allow, funded projects may also be paired with CRADAs, SPPs, or other laboratory partnership mechanisms.

Mission-Driven Programs and Government Procurement

These can support downstream technology development by creating credible demand. Federal agencies can define mission-relevant requirements, fund development and demonstrations, and create pathways to procurement and operational use. This support can be particularly

⁵ National Institute of Standards and Technology, "NIST Launches Center to Drive the Manufacture of Quantum Technologies," news release, June 29, 2026, <https://www.nist.gov/news-events/news/2026/06/nist-launches-center-drive-manufacture-quantum-technologies>.

⁶ SBIR and STTR programs provide competitively awarded federal R&D funding to small businesses. SBIR awards support small-business-led R&D, whereas STTR awards require collaboration with a research institution.

important for strategically significant emerging technologies whose commercial markets are too small or uncertain to justify private investment. For quantum technologies, the challenge may be compounded when low-volume or unconventional projects compete for shared fabrication capacity with larger, more predictable markets. Government can reduce this uncertainty through early procurement, advanced market commitments, guaranteed minimum volumes, and other demand signals that give suppliers confidence to invest in capabilities and move toward repeatable production. One example is DARPA's It's About Time program,⁷ which supports accelerated production and delivery of up to 125 IonQ Evergreen-05 optical atomic clocks for U.S. government customers.

QED-C Member Needs and Demand

This section examines QED-C members' experiences with federally supported infrastructure and their current and anticipated needs for external capabilities and services. The analysis draws on a survey of QED-C members and follow-up interviews with selected industry respondents. These sources provide insight into the types of organizations that use quantum-relevant infrastructure, their prior experiences, the challenges they encounter, and how demand may evolve as technologies mature.

There is minimal substantive difference in responses between the general population of QED-C members and from the subset of industry members. Accordingly, survey results are generally presented for the full QED-C membership to maximize the available sample and provide a broader view of infrastructure needs across the ecosystem. Any notable industry-specific differences are identified where they emerged.

User Types

The QED-C survey received responses from 307 individuals representing 137 unique organizations. Respondents represented multiple roles across the quantum technology supply chain. The user types below provide a useful framework for interpreting infrastructure needs. However, the types are not mutually exclusive; many organizations develop components, systems, software, and applications simultaneously.

Component Developers and Suppliers

Component developers and suppliers build enabling hardware, materials, and subsystems used within larger quantum systems, including lasers, cryogenic equipment, photonic and electronic devices, control systems, and fabricated components. This group includes quantum-focused startups, suppliers, and diversified manufacturers for which quantum represents one of several markets. Their infrastructure needs may include specialized fabrication, process development, packaging, characterization, and production capacity that can serve multiple system platforms.

Quantum System Developers

Quantum system developers integrate components, controls, software, and specialized technical expertise into quantum computers, sensors, networking systems, and related products. This group includes pure-play quantum companies, established technology

⁷ "It's About Time," DARPA, accessed September 10, 2026, <https://www.darpa.mil/research/programs/its-about-time>.

companies with quantum programs, and developers of specialized quantum systems. Depending on their scale and level of vertical integration, these companies may either maintain substantial internal infrastructure or rely on external facilities for selected fabrication, testing, packaging, and process-development activities.

Quantum Software Developers

Quantum software developers develop algorithms, middleware, controls, development tools, and applications that connect quantum hardware with classical systems and end-user needs. Their direct need for physical fabrication infrastructure may be more limited, but they may require access to quantum systems, testbeds, high-performance computing, representative hardware environments, and technical collaborators for development and validation. System developers and large technology companies may also develop software capabilities internally.

End Users

End users evaluate, adapt, or deploy quantum technologies for specific commercial, scientific, or government applications. These organizations may need access to demonstration environments, testbeds, validation services, and systems integration support to assess whether quantum technologies can meet operational requirements or outperform existing approaches.

Other User Types

Other user types include organizations categorized as academic institutions, nonprofit research organizations, and government research laboratories. These organizations may conduct basic and applied research; develop components, systems, or applications; operate specialized infrastructure; and support technology commercialization and scale-up. They are also represented within QED-C's membership, and they were included in the member-needs survey to capture their input on infrastructure needs across the broader ecosystem. Although their missions, funding structures, and demand for external services may differ from those of commercial firms, their activities both contribute to and shape demand for quantum-relevant infrastructure.

Factors Shaping Infrastructure Needs

Infrastructure needs vary across organizations and are not always shaped by their choice of quantum technology or their core competencies. Large or vertically integrated system developers may possess substantial internal capabilities and prefer to retain strategically differentiating activities in house. Smaller companies and specialized suppliers may depend more heavily on external infrastructure because they cannot independently maintain every fabrication, packaging, or testing capability they require. Company maturity, available capital, production volume, and prior experience with federal facilities also shape whether and how an organization seeks external support.

Superconducting, trapped-ion, neutral-atom, photonic, spin-based, sensing, and networking technologies require different combinations of materials, fabrication processes, cryogenic or vacuum environments, optical systems, packaging, controls, and testing capabilities. Organizations working within the same functional user type may therefore have substantially different infrastructure needs.

Despite this diversity, industry interviews identified areas in which infrastructure needs overlap. Shared facilities were viewed as particularly valuable for capabilities that are capital intensive, used intermittently, precompetitive, or insufficiently differentiating to justify duplicative internal investment. Examples included fabrication equipment, cryogenic testing, packaging, characterization, and other repetitive technical processes. Access to these capabilities can be especially consequential for smaller companies while allowing firms of different sizes to concentrate internal resources on their most differentiating technologies.

A separate QED-C assessment examines shared infrastructure and industry needs related to PICs in greater detail.⁸

Development Needs

To understand how external infrastructure supports QED-C members, the survey grouped technology development needs into five broad categories. These activities overlap and do not necessarily occur in a fixed sequence; organizations may move repeatedly among design, fabrication, testing, and process development as technologies mature.

Design and Evaluation

Design and evaluation include conceptual and engineering design, modeling, simulation, and assessment of whether a proposed device or system is technically feasible. For PICs, PDKs or research development kits (RDKs) allow developers to design and simulate devices using the materials, processes, and design rules available through a specific fabrication platform.

Fabrication and Prototyping

Fabrication and prototyping convert designs into physical devices, components, or early systems that can be evaluated and refined. Depending on the technology, these activities may involve nanofabrication, materials processing, machining, device assembly, or other specialized processes. For PICs and some other semiconductor-based devices, MPW runs allow multiple designs to share a wafer and provide a comparatively economical pathway to initial prototypes.

Assembly and Advanced Packaging

Assembly and advanced packaging include integrating fabricated devices with electrical, optical, mechanical, or cryogenic interfaces and protecting them from environmental conditions. Relevant activities may include die bonding, fiber attachment, wire bonding, heterogeneous integration, interposers, thermal management, and specialized enclosures. For quantum technologies, packaging must often preserve highly sensitive optical, electrical, thermal, or coherence properties.

Testing, Validation, and Characterization

Testing, validation, and characterization measure the properties and performance of materials, components, subsystems, and integrated systems. These activities occur throughout development rather than only after assembly and may require cryogenic, vacuum, optical, magnetic-field, or other quantum-relevant environments. For PICs, testing may assess signal

⁸ Quantum Economic Development Consortium (QED-C), *Commercial Fabrication of Photonic Integrated Circuits: Challenges and Opportunities for Enabling Quantum Technologies* (SRI, September 2026), <https://quantumconsortium.org/publication/commercial-fabrication-of-photonic-integrated-circuits/>.

transmission, optical loss, coupling efficiency, and whether the fabricated device performs as designed.

Process Development and Scale-Up

Process development and scale-up translate a successful design or prototype into a stable and repeatable production process. This work may involve refining process recipes, reducing variability, improving yield, qualifying materials and suppliers, establishing quality controls, and increasing production volume. For PICs, it can include transitioning from exploratory or MPW fabrication to dedicated wafer runs and more consistent production processes.

Current Sources of Support and Unmet Needs

Table 1 shows the primary source QED-C respondents used to address each category of development needs. Even though respondents spanned multiple organizational roles, technology modalities, and organization sizes, the results should not be interpreted as statistically representative of the entire quantum industry.

Table 1: Development Needs and Primary Sources of Support

Development Need Category	Internal Resources	Primarily Academic or Nonprofit Providers	Primarily Private or Commercial Providers	Primarily Federally Funded Facilities	Primarily Non-U.S. Facilities	Combination of Sources	Not Currently Met
Design & Evaluation	56.6%	7.6%	3.3%	12.3%	1.9%	13.2%	5.2%
Fabrication & Prototyping	34.0%	5.3%	15.3%	13.4%	4.3%	19.1%	8.6%
Assembly & Advanced Packaging	35.1%	4.9%	16.6%	10.7%	3.9%	14.6%	14.2%
Testing, Validation & Characterization	56.6%	4.7%	4.7%	14.6%	1.9%	11.8%	5.7%
Process Development & Scale-Up	39.9%	3.4%	7.7%	8.7%	3.4%	13.0%	24.0%

For some development need categories, respondents reported greater reliance on commercial providers, federally funded facilities, or a combination of sources. Reliance on internal resources does not necessarily indicate that organizations considered those resources sufficient or preferred; in some cases, it may reflect limited awareness or availability of suitable external options. Internal resources were also more substantially utilized by industry members for every development need. On average, industry members used internal resources 58% of the time, compared with all QED-C members using them only 44% of the time.

Respondents identified federally funded facilities as the primary source of support about 12% of the time across the five categories, ranging from 8.7% for process development and scale-up to 15% for testing, validation, and characterization. Commercial providers were the most prominent source of support for fabrication and prototyping (15%) and assembly and advanced packaging (17%), while respondents reported using a combination of sources most often for fabrication and prototyping (19%). These findings indicate that development activities frequently draw on a mix of internal and external capabilities rather than a single infrastructure provider.

The share of respondents reporting that their needs were not currently being met increased for activities closer to production. Unmet need was highest for process development and scale-up (24%), followed by assembly and advanced packaging (14%). By comparison, only 5.2% of respondents reported unmet design and evaluation needs, and 5.7% reported unmet testing, validation, and characterization needs. This pattern provides an early indication that infrastructure gaps become more pronounced as organizations seek to move from prototypes toward repeatable processes, integrated products, and greater production volumes.

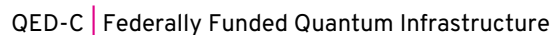
Key Finding: Internal resources are a dominant source of need fulfillment across industry and all QED-C members. Private sector capabilities are generally able to meet the development needs of members. While federal facilities do capably support some member needs, they only fulfill about 12% of needs across development. Meanwhile, needs are usually met. On average, only 12% of needs are unmet, but this number is dominated by two outliers: 24% for process development and scale-up, and 14% for assembly and advanced packaging. Without these two needs considered, only 6.5% of needs are unmet.

QED-C Member Experiences with Federally Funded Infrastructure

Perceptions and Awareness

Open-ended survey responses conveyed mixed but often critical perceptions of U.S. federally funded quantum infrastructure. The most common terms included “underfunded,” “inadequate,” “insufficient,” “lacking,” “limited,” and “fragmented.” At the same time, terms such as “accessible,” “developing,” “promising,” and “competitive” indicated that some respondents recognized existing strengths and the potential for continued growth. [Figure 1](#) summarizes the relative frequency of terms used in the open-ended responses; it should be interpreted as a depiction of recurring perceptions rather than a quantitative measure of satisfaction.

Figure 2: Selected Facility Recognition vs. Engagement



Reasons for Engagement

The four most commonly reported purposes for engaging with existing infrastructure were collaboration with facility staff or researchers, fabrication or prototyping of quantum components, exploration or evaluation of future capabilities, and design support or codevelopment of quantum components or systems. These activities align with the broader development needs reported by QED-C members, particularly access to specialized technical expertise, fabrication, prototyping, design, and testing capabilities. Current engagement appears concentrated primarily around research, design, and prototyping. This pattern suggests that existing infrastructure is used more frequently for earlier-stage activities than for the downstream capabilities that respondents identified as most difficult to obtain.

Provider Selection

Industry interviews indicated that technical fit was the first consideration when selecting a facility: companies sought providers with the required equipment, processes, operating environments, and technology-specific expertise at the appropriate stage of development. Among technically suitable options, decisions were also shaped by turnaround time, cost, available staff support, process maturity, IP and security requirements, provider neutrality, and the complexity of establishing an agreement. Companies therefore did not necessarily select the facility with the most advanced equipment, but selected the provider offering the most usable combination of capability, support, speed, cost, and acceptable partnership terms.

Outcomes of Prior Engagements

As shown in table 2, respondents generally reported that facilities “partially” to “mostly” met their needs. Among the named need categories, average ratings ranged from 2.51 to 2.99 on the four-point scale. Design support or codevelopment received the highest rating (2.99), followed by workforce training and skills development (2.91), access to specialized equipment (2.86), and fabrication or prototyping (2.84).

The results also indicate opportunities for improvement. Collaboration with facility staff or researchers was the most frequently reported type of engagement, with 137 responses, but received an average rating of 2.57. Testing, validation, or characterization received a similar rating of 2.56, while exploration or evaluation of future capabilities received the lowest average rating at 2.51. Overall, prior engagements generally provided value, but none of the named categories averaged above “mostly met.”

Table 2: Extent to Which Facilities Met Reported Needs

Answer Choice	Responses	Weighted Average Rating
Design support or codevelopment of quantum components or systems	76	2.99
Workforce training or skills development	51	2.91
Access to specialized equipment or tools not available in house	55	2.86

Answer Choice	Responses	Weighted Average Rating
Fabrication or prototyping of quantum components	100	2.84
Process development, reliability, or scale-up support	43	2.79
Materials development, characterization, or metrology	67	2.71
Assembly, integration, or advanced packaging	47	2.69
Collaboration with facility staff or researchers	137	2.57
Testing, validation, or characterization (device, system)	74	2.56
Exploration or evaluation of future capabilities	82	2.51

Note: Ratings used a four-point scale: 1 = Did not meet needs, 2 = Partially met needs, 3 = Mostly met needs, and 4 = Fully met needs.

Key Finding: Although 69% of respondents recognized at least one facility or program, 55% had used one, and recognition and engagement were concentrated among a relatively small number of prominent programs. Where engagements occurred, respondents generally reported that the facilities “partially” to “mostly” met their needs.

Unmet Needs and Barriers to Infrastructure Access

Unmet Technical and Development Needs

When asked which needs were not adequately met by U.S. infrastructure, respondents most frequently identified process development, reliability, and scale-up support; workforce training or skills development; fabrication and prototyping; assembly, integration, and advanced packaging; and testing, validation, and characterization. These responses span both physical capabilities and the technical expertise and operating support needed to use them effectively.

Comparing unmet needs with the reasons for prior engagement reveals a potential mismatch between available pathways and downstream development needs. Process development, reliability, and scale-up, and assembly and advanced packaging, were among the less frequently reported reasons for facility engagement, yet they were the two development need categories with the highest percentages of respondents reporting unmet needs. This pattern suggests that organizations may have fewer opportunities to engage external infrastructure for these later-stage activities.

Fabrication and prototyping present a different pattern. They were a common reason for using existing infrastructure but also remained a notable unmet need. This suggests that access to fabrication does not always provide the specific processes, production scale, turnaround time, or level of technical support required by a particular project.

Key Finding: U.S. quantum infrastructure gaps are most pronounced in the transition from initial prototypes toward production. Respondents identified process development, reliability, and scale-up support, and assembly, integration, and advanced packaging, as the least adequately supported needs.

Barriers to Access

As shown in [table 3](#), survey results indicate that no single barrier prevents access across the quantum ecosystem, although several barriers emerged more frequently than others. Administrative burden, contracting, or access requirements was the largest individual category, followed by lack of knowledge; unclear access policies or limited awareness; and IP, data-protection, or confidentiality concerns.

These results suggest that respondents more frequently encountered barriers related to discoverability, access, and administration than barriers related to technical capability or capacity constraints, although the latter remained meaningful for some respondents. Industry interviews reflected this pattern. Interviewees described long contracting timelines and substantial legal and administrative effort associated with partnership agreements, while awareness of available infrastructure often came through existing relationships, word-of-mouth, or active tracking of federal investment. Several interviewees also reported that the practical relevance or full scope of a facility’s capabilities was not always clear before engagement, with users sometimes learning what was technically or administratively possible only after discussions or partnerships had begun.

Table 3: Top Identified Barriers

Answer Choice	Responses	
Administrative burden, contracting, or access requirements	12%	55
Lack of knowledge that such shared infrastructure exists and is available for use	11%	51
Unclear access policies or lack of awareness of available facilities	11%	49
IP, data-protection, or confidentiality concerns	10%	47
Facilities not configured for our specific use case or development stage	8.6%	40
Long lead times, limited availability, or scheduling constraints	8.2%	38
Cost or fee structure	7.6%	35
Internal constraints (e.g., staffing, readiness, or competing priorities)	7.3%	34
Limited technical support, staffing, or facility expertise	6.3%	29
Required capabilities or equipment not available at existing facilities	4.8%	22

Answer Choice	Responses	
Geographic distance or travel burden	4.1%	19

Note: Respondents could identify multiple barriers, generating 463 total responses to the question. Percentages represent each category’s share of those responses.

Survey results also indicate that the most frequently identified barrier varied by user type. System developers and end users ranked IP and confidentiality concerns the highest; component suppliers were split between administrative burden, unclear access, and IP concerns; component developers considered lead times their biggest barrier; and software developers identified a limited knowledge of available facilities. Results also varied by modality. For example, respondents focused on trapped ions and quantum dots reported long lead times more than other modalities. The subgroup results discussed here should be interpreted with the number of respondents for each category in mind.

Key Finding: Federally funded infrastructure access is constrained by cumulative friction. No single barrier explains limited infrastructure access. Instead, users reported different combinations of administrative requirements, limited awareness, IP concerns, technical misalignment, lead times, cost, and internal constraints.

QED-C Member Priorities to Strengthen Quantum Infrastructure

When asked what the United States should prioritize to strengthen domestic quantum infrastructure, QED-C members provided 387 responses informed by their experiences across the ecosystem. These responses fall within five recurring themes. These themes represent member-reported priorities rather than the report’s final recommendations, although they informed the assessment findings and recommendations.

Fabrication, Prototyping, and Manufacturing

Fabrication, prototyping, and manufacturing formed the most prominent theme. Respondents emphasized the need for domestically accessible foundries, cleanrooms, specialized equipment, and process expertise that can support rapid iteration and progression from laboratory-scale concepts toward manufacturable products. They reported that existing facilities were not always configured for quantum devices and enabling components or lacked sufficient capacity at particular tools and process steps. QED-C members therefore identified fabrication and process-development capacity as an important bridge between research prototypes and repeatable production.

Funding, Cost, and Access

Funding, cost, and access captured concerns about the expense of quantum technology development and the affordability of specialized facilities and equipment. Respondents reported that high capital and user costs can discourage exploratory work, slow iteration, and place infrastructure-intensive development beyond the reach of some smaller companies. Suggested priorities included support for capital investment, subsidized access to existing facilities, and government-as-a-customer procurement pathways that can help create demand for emerging technologies.

Testing, Validation, and Benchmarking

Testing, validation, and benchmarking responses emphasized the need for consistent methods to characterize quantum technologies and compare performance. QED-C members identified priorities including accessible calibration and metrology capabilities, and independent testbeds, reliable operating availability, and common measurement and reporting approaches. Such infrastructure could help evaluate components and systems under quantum-relevant conditions and produce more comparable performance data.

Strategy, Coordination, and Policy

Strategy, coordination, and policy formed the final recurring theme. Respondents called for clearer national objectives, stronger interagency coordination, and more consistent policy frameworks across federal infrastructure and technology development programs. Other priorities included public-private partnerships, predictable and workable IP provisions, coordination across facilities and development stages, and stronger government demand signals. Some respondents perceived the current landscape as fragmented across programs and institutions and called for a more coordinated national approach.

Materials, Components, and Supply Chain

Materials, components, and supply chain responses focused on the reliable availability of specialized inputs and enabling technologies. Examples included wafer materials with limited sources, lasers, dilution refrigerators, PICs, and other components used across multiple quantum modalities. Respondents viewed reliable sourcing, domestic availability, and supply chain resilience as important to sustaining development and increasing production of quantum hardware.

Demand Signals for External Services and Additional Capacity

The survey results provide several indicators of potential demand for external services over the next three years, including the reported importance of external facilities and respondents' anticipated frequency of use. These measures demonstrate interest and expected reliance but do not constitute a quantitative forecast of required facility capacity, equipment time, or production volume. Actual demand will also depend on whether appropriate services are available at an acceptable cost, timeframe, and level of technical support. Accordingly, the discussion below considers both survey-based demand signals and broader factors that may affect the availability and accessibility of external capabilities, including the role of commercial and academic providers and potential supply constraints.

Anticipated Importance and Use

More than two thirds (70%) of respondents indicated that external facilities would be important, critical, or essential to their developmental needs over the next three years, and 60% anticipated engaging with external facilities three or more times over the same period. These findings reveal that expected use is not limited to isolated or one-time engagements; a substantial share of respondents anticipate recurring use.

When analyzed by user type and modality, the results point to interesting takeaways. All responding component developers indicated that external facilities would be important, critical, or essential, and 82% of end users concurred. Component developers also reported particularly strong expectations of recurring use, with 81% anticipating three or more

engagements compared with an average of 59% across other survey response groups. These results suggest that demand may be especially strong among organizations developing physical components and those seeking to integrate quantum technologies into end-use applications.

Regarding the importance of external facility access to modalities, vapor-phase or ensemble systems was an outlier: 86% of respondents viewed such access as important to this modality, compared with an average of 77% across all modalities. Meanwhile, engagement expectations tended to drift toward opposite ends among the modalities. Across all modalities, the average of recurring-use expectations was 62% of respondents. On the high end were photonics, quantum dots, and spin qubits, with an average of 71%. On the low end were Rydberg atoms, single trapped atoms, superconducting qubits, and trapped ions at 55%. Only vapor-phase or ensemble systems were near the average at 66%. These results suggest that while external facilities are recognized as important to the future development of all modalities, their developments will require varying amounts of assistance.

Role of Commercial and Academic Providers

Potential demand may be met through a combination of federal, academic, nonprofit, and commercial providers. Commercial foundries and service providers already supply fabrication, prototyping, packaging, assembly, testing, and characterization services. However, commercial capacity is not necessarily interchangeable with publicly supported infrastructure. Its practical suitability depends on cost, minimum production volume, process flexibility, turnaround time, IP protections, and whether prospective users view the provider as sufficiently neutral. Industry interviews indicated that affiliation with a competitor can discourage use even when the underlying technical capability remains available.

One example is through acquisitions that can potentially reduce market availability and competition. Recently, the SkyWater Technology foundry was acquired by the quantum system developer IonQ. While IonQ plans to maintain SkyWater as a pure-play foundry, concerns have been raised about the kind of impact this acquisition will have on the larger quantum industry.⁹

Universities and federal laboratories may also provide complementary demand for many of the same facilities, although their patterns of use differ from those of industry. Industry demand is often tied to product development milestones, commercialization timelines, anticipated production volumes, and the economics of external versus internal capabilities. Academic and laboratory demand is more commonly shaped by research awards, programmatic missions, experimental requirements, and fixed project budgets. It may therefore provide a comparatively persistent baseline of low-volume and technically diverse activity while remaining constrained by the availability and timing of grant or program funding.

⁹ IonQ, “IonQ to Acquire SkyWater Technology, Creating the Only Vertically Integrated Full-Stack Quantum Platform Company,” news release, January 26, 2026, <https://www.ionq.com/news/ionq-to-acquire-skywater-technology-creating-the-only-vertically-integrated-full-stack-quantum-platform-company>; Constanza M. Vidal Bustamante and John Burke, *Quantum’s Industrial Moment: Strengthening U.S. Quantum Supply Chains for Scalable Advantage* (Center for a New American Security, March 2026), https://s3.us-east-1.amazonaws.com/files.cnas.org/documents/Quantum_TECH_260311_Final-D.pdf

Anticipated Supply Constraints

While it is difficult to predict where specific shortages will emerge, supply constraints are most likely to arise in specialized components, materials, and manufacturing inputs that are produced by a limited number of suppliers. Disruptions at these points can propagate through the broader quantum supply chain because many systems depend on highly specialized components with few readily substitutable alternatives.

Potential vulnerabilities include specialty semiconductor and photonic materials, high-purity or isotopically controlled materials, rare-earth elements, gallium-based compounds, cryogenic components, vacuum equipment, and precision electronics. In some cases, key inputs or processing capacity are concentrated in China and a small number of other countries.¹⁰ Even where relevant manufacturing facilities could be established domestically, they may lack access to an economical domestic supply chain, sufficient production scale, or competitively priced upstream inputs. As a result, these supply chain vulnerabilities can affect multiple layers of the quantum technology stack, from materials and components through device fabrication, system integration, testing, and deployment.

International Infrastructure Models and Insights

International facilities provide useful points of comparison for the U.S. landscape and, in some cases, alternative sources of capabilities and services. QED-C examined selected international models with demonstrated quantum relevance, pathways for external access, and capabilities related to prototyping, testing, process development, or manufacturing. This review relied primarily on publicly available information and QED-C member perspectives and is not intended as a comprehensive evaluation of international infrastructure.

Distributed Access Networks

European photonics network JePPIX and the Australian National Fabrication Facility (ANFF) illustrate two approaches to connecting distributed capabilities. JePPIX serves as Europe's photonics networking platform linking users to commercial foundries, design houses, and packaging and testing providers. Its network supports design access, MPW runs, custom fabrication, pilot production, testing, assembly, packaging, and transfer toward larger production volumes.¹¹ ANFF connects micro and nanofabrication facilities across Australian universities and research institutions through a national user network. Its capabilities include lithography, deposition, etching, microfluidics, photonic and quantum-device fabrication,

¹⁰ Quantum Computing Inc., "Thin Film Lithium Niobate (TFLN)," policy paper, May 15, 2026, <https://quantumcomputinginc.com/learn/research-and-publications/thin-film-lithium-niobate-tfln>; Mika Takahashi, "Shifting Supply Chains in the Era of Photonics," *Photonic Integrated Circuits* 2026, no. 2 (2026): 26–30, https://picmagazine.net/article/124176/Shifting_supply_chains_in_the_era_of_photonics; Matthew P. Funaiole et al., *De-Risking Gallium Supply Chains: The National Security Case for Eroding China's Critical Mineral Dominance* (Center for Strategic & International Studies, August 2023), <https://www.csis.org/analysis/de-risking-gallium-supply-chains-national-security-case-eroding-chinas-critical-mineral>; Laurie Chen and Liam Mo, "China's Control over Indium Phosphide Exports Threatens AI Data Centre Rollout," *Reuters*, June 10, 2026, <https://www.reuters.com/world/china/chinas-control-over-indium-phosphide-exports-threatens-ai-data-centre-rollout-2026-06-11/>.

¹¹ "About: Partners," JePPIX, accessed September 10, 2026, <https://www.jeppix.eu/about-us/partners/>.

microscopy and metrology, packaging, and prototype development.¹² The network is supported through public investment, host institutions, industry partners, and user fees.

Multidisciplinary Research Institutes

Ireland's Tyndall National Institute and Quantum and Canada's Nanotechnologies Research Centre represent multidisciplinary research institutes that combine public investment, advanced technical infrastructure, and collaborative work with universities and industry. Their capabilities span photonics, advanced materials, cleanroom fabrication, characterization, prototyping, packaging, testing, and system integration.¹³ These models concentrate complementary equipment and technical expertise within research organizations that can support both scientific objectives and applied technology development.

Coordinated Pilot and Testing Programs

The European Union's Qu-Pilot and Qu-Test programs demonstrate a coordinated approach to cross-border quantum infrastructure. Qu-Pilot connects developers with pilot fabrication, prototyping, process-development, and scale-up capabilities, while Qu-Test focuses on characterization, metrology, benchmarking, validation, and independent testing.¹⁴ Their complementary roles are intended to connect component development with the testing and qualification needed to move technologies beyond laboratory demonstrations.

The imec Integrated Model

Interuniversity Microelectronics Centre (stylized as imec) provides a particularly prominent reference model because it combines advanced semiconductor cleanrooms and pilot lines with process-development expertise, technical staff, and long-term industry partnerships. Its capabilities include advanced CMOS and lithography, silicon photonics, heterogeneous integration, packaging, sensor development, design enablement, prototyping, and quantum-device process development. Public investment is combined with contract research, licensing, and industrial partnerships, allowing imec to support projects across multiple stages of development.

Industry interviewees particularly valued imec's ability to connect process development with manufacturing-oriented equipment and experienced technical staff. IC-Link extends this model by helping users access design, prototyping, manufacturing, packaging, and supply-chain partners when capabilities are not provided directly by imec.¹⁵ Interviewees also identified imec as a source of routinely accessible 300-millimeter CMOS process-development and optimization capabilities relevant to some quantum devices, which is an offering they viewed as less readily available through U.S. infrastructure. A potentially transferable feature of this model is the early coordination of research and pilot facilities with commercial manufacturers, enabling process qualification and production transfer to begin before larger volumes are required.

¹² "Equipment," ANFF, accessed September 10, 2026, <https://anff.org.au/equipment/>.

¹³ "Infrastructure," Tyndall, accessed September 10, 2026, <https://www.tyndall.ie/about-us/infrastructure/>; "NRC Facilities," National Research Council Canada, accessed September 10, 2026, https://nrc.canada.ca/en/research-development/nrc-facilities?f%5B0%5D=division_nrc_facilities%3A10242.

¹⁴ "Qu-Test & Qu-Pilot," Horizon Europe, accessed September 10, 2026, <https://qu-test.eu/>.

¹⁵ "IC-Link by imec," imec, accessed September 2, 2026, <https://www.imeciclink.com/en>.

QED-C Member Perspectives on International Infrastructure

QED-C respondents had limited direct knowledge with which to compare U.S. and international infrastructure. Only 36% indicated they had sufficient experience or familiarity to make such a comparison. Among that group, 75% rated international infrastructure as comparable to or stronger than U.S. offerings, with responses leaning modestly toward international facilities. Frequently cited examples included imec and the United Kingdom's National Quantum Computing Centre. Respondents who viewed international offerings more favorably most often emphasized industry orientation, pricing, speed and ease of access, and the breadth of available tools and capabilities.

Industry interviews provided additional context for these comparisons. Some companies used international providers because required capabilities were not available domestically, while others cited faster turnaround, lower cost, or more established production processes. Several interviewees expressed a preference for domestic production when feasible, particularly because of security and supply chain considerations, but indicated that domestic alternatives must also be competitive in technical capability, reliability, speed, and price.

Cross-Cutting Takeaways and Gaps in the U.S. Quantum Infrastructure Landscape

The ecosystem of U.S. federally funded quantum infrastructure does not fully support companies across the technology development pathway. Capabilities are uneven, access models vary, user knowledge is inconsistent, and important gaps remain between research-oriented prototyping and production-ready development.

Capabilities are Substantial but Fragmented

Across the facilities reviewed, the strongest technical capabilities cluster around specialized nanofabrication and materials processing, superconducting-device fabrication, cryogenic testing, and integrated photonics. Select facilities extend into process development, packaging, and low-volume production, but these more translational capabilities are not broadly available across technologies or regions.

The QED-C member survey found that better-known facilities generally reported greater use. Facilities that respondents had used often met or partially met their needs, suggesting that existing infrastructure can provide meaningful value when users identify an appropriate capability and access pathway.

Companies often struggle to determine what capabilities exist, whether they are eligible to use them, and whom to contact. Public descriptions may list equipment without explaining available services, staffed capacity, costs, turnaround times, IP terms, or access requirements. Providers also use a range of access mechanisms, including proposals, user agreements, sponsored research, CRADAs, hourly access, and fee-for-service arrangements, with terms and processes that can vary even when facilities use the same general model.

Federal facilities are often more accessible than prospective users assume. Providers generally expressed willingness to work with companies when projects fit their missions and capabilities, and some offer subsidized, at-cost, or no-cost access. Provider interviews similarly suggested

that IP protections were often more flexible than prospective users assumed; contracting complexity was a more common obstacle than an inability to protect proprietary work. Models such as the SQUILL Foundry demonstrate how standardized agreements can simplify engagement. Other useful practices include published rates and schedules, clearly defined onboarding, dedicated technical points of contact, and concierge services. However, these advantages are not consistent or sufficiently visible across the landscape. Industry interviews also identified cases in which lengthy negotiations, unfavorable terms, or unclear service offerings prevented engagement.

Networked access models are beginning to improve visibility and coordination across facilities. However, most coordination remains concentrated within individual programs or regions, and participating facilities generally retain their own access requirements and operating priorities, making access challenging.

Flexible Support is Needed to Bridge Prototyping and Production

Providers are usually well positioned to help users explore material and device designs, fabricate early prototypes, evaluate feasibility, and conduct low-volume development. However, the landscape is less equipped to support process refinement and scale-up.

Companies need environments where they can repeat fabrication processes, increase batch sizes, improve yield and consistency, integrate packaging and interconnects, and prepare processes for commercial transfer. The clearest survey evidence of unmet need occurred in process development and scale-up, reported as unmet by 24% of respondents, and assembly and advanced packaging, reported as unmet by 14%. Academic facilities often lack the capacity and repeatability necessary for moving prototypes to production. On the other hand, commercial foundries generally require that processes already be mature, with larger minimum volume requirements and tighter design rules.

This difference leaves a gap in scale-up support and demand for a dependable intermediate capacity that helps companies move toward repeatable, transferable processes. This includes small-batch fabrication, rapid iteration, customized materials and process steps, production-oriented documentation, and coordinated packaging and testing. Companies may also need to work directly with facility staff and adjust processes between runs.

Testing and validation are essential parts of this pathway. Survey comments and industry interviews emphasized the need for accessible testbeds, benchmarking and calibrated metrology, component- and system-level validation, and reliability characterization. Industry interviews indicated that companies often repeat testing internally because supplier specifications do not cover quantum-relevant conditions, independent capabilities are unavailable, or results cannot be compared reliably. Shared metrics and documented test conditions are needed to qualify suppliers, support procurement, and demonstrate that laboratory performance can translate into deployable systems.

Demand for External Capabilities is Established and Expected to Grow

Survey results provide signals of future demand for external capabilities. Seventy percent of respondents expected external facilities to be important, critical, or essential to their development needs over the next three years, and 60% anticipated three or more

engagements if prototyping, testing, or manufacturing services become available and accessible. Companies generally retain rapidly evolving processes, strategically important IP, and activities central to internal learning. They are more likely to outsource capital-intensive, mature, repetitive, or non-differentiating functions when dependable providers are available. As a result, infrastructure needs vary: companies with extensive internal resources may require targeted services, while fabless developers, component suppliers, and smaller firms may depend heavily on external facilities.

Value Depends on the Operating Model

Equipment and technical capabilities do not necessarily translate as useful or usable to industry, as other factors can determine the practical usability of a given capability. These factors include cost, turnaround time, contracting, IP treatment, capacity, staff expertise, and reliability. Even if a facility possesses relevant capabilities, long lead times can deter companies. High costs can render available capabilities inaccessible.

Neutrality and security can also shape practical usability. Companies may hesitate to use facilities associated with competitors because of disclosure risks. Government, university, and nonprofit facilities are generally viewed as neutral providers. Some companies expressed concern that government use rights may force IP disclosure. Companies pursuing applications with stringent national security requirements may lack access to secure external facilities that meet their technical needs.

Even when capacity is available, facility priorities that do not align with proposed work can constrain capabilities. For example, AIM Photonics may be capable of supporting larger-scale work, but dedicating capacity to one user could displace many high-mix projects and conflict with its operating model. Provider interviews also emphasized that funding must match the scale and type of assistance a program promises. The federal role therefore extends to making federally funded capabilities practically accessible.

The United States needs to build on existing investments through a coordinated portfolio of research, prototyping, process development, testing, and production-transition capabilities. The following recommendations outline actions to address these takeaways.

Recommendations for Federal Investment and Coordination

Develop and Maintain a Comprehensive Quantum Infrastructure Directory

The NQCO should support development and promotion of a comprehensive directory of quantum-relevant fabrication, prototyping, packaging, assembly, testing, and evaluation capabilities. The directory should extend beyond federally funded facilities to include relevant university, nonprofit, state-supported, and commercial providers in the United States. This effort should build on initial QED-C efforts to inventory federally funded quantum infrastructure and map commercial PIC providers, expanding and integrating this work into a broader, regularly maintained resource.

Directory entries should identify the technologies and users supported, available services and capacity, technical assistance, typical cost and turnaround time, eligibility requirements, general IP terms, security restrictions, access mechanisms, and points of contact. The entries should also explain whether providers offer standardized services, collaborative R&D, or pathways for technically feasible projects outside their established offerings. Furthermore, federal agencies could designate technical contacts to help prospective users identify suitable providers and assemble pathways involving multiple facilities within the agency's portfolio.

Facility providers should be able to submit new directory entries and propose updates to existing information. Submissions should be reviewed before publication, and entries should display their most recent verification date. This process would help the directory evolve alongside a rapidly changing infrastructure landscape without relying solely on periodic federal reviews.

Providers are often more open to external users than prospective users assume, but capabilities and access pathways remain fragmented and difficult to interpret. A comprehensive directory would reduce these information barriers while generating data on searches and recurring capability needs. Such search data could inform future infrastructure investments, facility mission expansions, and federal coordination priorities.

Standardize Facility Access Agreements and Streamline Processes

The National Quantum Coordination Office should convene relevant federal agencies, laboratories, and user facilities to develop standardized and faster pathways for accessing federally supported quantum infrastructure. Common provisions could address IP, data rights, cost recovery, publications, customer confidentiality, export controls, secure work, and related requirements. Facilities should retain flexibility for mission-specific or technically unusual projects, but users should not have to renegotiate substantially similar baseline terms at every facility.

The SQUILL Foundry provides a useful model. It offers a standing pathway through which federally funded researchers can access MIT Lincoln Laboratory's superconducting-qubit fabrication capabilities without establishing a new collaboration, funding arrangement, and laboratory role for each project. Expanding this type of standardized mechanism could reduce transaction costs while preserving appropriate federal protections (e.g., around research security).

Facilities should establish and publish their target timelines for responding to inquiries, determining project fit, completing standard agreements, and initiating work. Administrative and project timelines should reflect the development cycles of intended users.

Industry interviews indicated that slow contracting, onboarding, and facility turnaround can make otherwise relevant capabilities commercially unusable. Speed should therefore be treated and tracked by the cognizant federal agency as part of a facility's effective capability.

Administrative burden and IP or data concerns were among the most common barriers identified in the QED-C member survey. Provider interviews indicated a belief that federal IP arrangements are often more workable than industry assumes, but industry interviews also identified cases in which unfavorable terms or lengthy negotiations prevented engagement. NIST, DOE, and other agencies should pilot common agreements and administrative timelines across a small number of facilities and assess their effects on time to agreement, project initiation, participation, and repeat use.

Expand Flexible Quantum Fabrication and Process-Development Capacity

Federal agencies should invest in fabrication and prototyping capacity that supports repeatable processes that can transfer into commercial production. This capability should fill the gap between high-mix, low-volume fabrication and commercial foundries that generally require more mature processes, larger volumes, and greater standardization.

The QED-C member survey identified fabrication, prototyping, process development, and scale-up support as being among the most significant unmet infrastructure needs. Provider interviews suggest that existing facilities are strongest in research, development, and low-volume prototyping, with fewer capabilities designed to help companies improve repeatability, increase batch sizes, develop production-oriented process controls, and prepare processes for transfer. Industry interviews similarly identified a need for dependable access to specialized fabrication that can accommodate quantum devices, integrated photonics, trapped-ion systems, superconducting circuits, and other enabling components.

Quantum system developers and component suppliers generally do not yet need immediate high-volume manufacturing or full commercial production. Rather, quantum companies need an intermediate environment in which they can:

- Iterate on custom device designs and process recipes
- Produce larger or repeated batches of devices
- Improve process stability, repeatability, and yield
- Introduce specialized materials or nonstandard process steps
- Integrate fabrication with packaging, interconnects, and intermediate testing
- Document and qualify processes for eventual transfer to a commercial manufacturer

These capabilities must remain flexible enough to support tailored company needs. Quantum technologies use diverse materials, device architectures, wavelengths, operating conditions, and process flows, many of which are not yet sufficiently mature for standardized commercial foundry services. Companies may also need their engineers to work directly with facility

process staff, make modifications between runs, and protect proprietary design and process information.

Focused federal investment could expand quantum-relevant capacity at existing facilities. Potential investments include additional fabrication lines, specialized tools, process-development staff, operating hours, materials, and packaging or testing capabilities. AIM Photonics provides one example: it possesses substantial equipment and expertise, but its high-mix operating model limits the capacity that can be dedicated to larger-scale projects.

New infrastructure may be appropriate where existing facilities cannot meet validated needs, but expansion of existing facilities should be considered first. Any expansion of fabrication and process-development capacity should align the facility's mission, funding purpose, and operating model around a clear commitment to serving external users. Investments should support not only equipment, but also the technical staff, maintenance, user support, materials, utilities, and operating time needed to deliver those services.

Expand Access to and Standardize Test Infrastructure and Characterization Methods and Data

The NQCO should strengthen coordination among and access to facilities that can test, characterize, and validate quantum components, subsystems, and enabling technologies. This assessment found a recurring need for reliable testing and validation beyond fabrication. Respondents emphasized that testing capabilities must be accessible, dependable, and able to produce comparable performance data. Industry interviews also indicated that companies often conduct duplicative internal testing because supplier specifications do not cover quantum-relevant conditions, results produced under different conditions cannot be compared reliably, or independent testing is unavailable.

Access pathways should clearly identify available testing services, operating conditions, technical support, costs, timelines, and safeguards for proprietary information. The NQCO, in coordination with NIST, should encourage greater consistency in measurement methods, calibration practices, test conditions, and reporting formats. More accessible testing services and comparable characterization data would improve confidence in device performance, reduce duplicative testing, and make it easier for suppliers, system developers, and customers to evaluate technologies.

Initial efforts could focus on:

- Cryogenic characterization of electronic, photonic, and radio-frequency components
- Testing the performance and reliability of quantum packaging, interconnects, and integrated components
- Establishing shared measurement methods, calibration practices, test conditions, and reporting formats
- Allowing component suppliers to evaluate products within quantum systems and testbeds, including evaluating quantum sensing components and systems under documented and reproducible conditions or characterizing qubits and quantum processing units

Federal agencies should begin by identifying existing testing capabilities and a limited number of high-priority gaps that could be addressed through additional equipment, staffing, operating support, or coordination. The objective should be to make reliable testing more available and results more comparable, helping to move quantum technologies from laboratory demonstrations toward supplier qualification, procurement, system integration, and deployment.

Use Government Demand and Investment to Support Early Market Formation, Supply Chain Development, and Quantum Infrastructure

The federal government should use its role as an early customer and investor to accelerate the development, validation, and production of strategically important quantum technologies. Federal mission agencies should identify opportunities for field demonstrations, advance purchase commitments, and cost-shared investments in quantum companies and their suppliers. These mechanisms can provide early revenue and demand signals while helping companies improve production processes, develop suppliers, and demonstrate technologies in realistic settings.

Government purchases need not be limited to fully mature products. Staged acquisitions could begin with prototypes or small production runs and progress toward larger orders as companies meet technical, reliability, cost, and manufacturing milestones. Complementary grants or cost-shared awards could support production engineering, tooling, packaging, supplier qualification, workforce development, and other investments needed to fulfill anticipated government demand.

DARPA's It's About Time program provides a model in which federal acquisition of multiple atomic-clock systems can support technology maturation, production learning, and validation for government use. Similar approaches could support quantum sensors, timing systems, communications technologies, cryogenic systems, photonic devices, and other enabling technologies.

This approach can also strengthen the broader infrastructure ecosystem. Early orders may generate demand for external fabrication, packaging, assembly, testing, and validation services, increasing utilization of existing infrastructure.

Federal initiatives often stop at research or proof of concept rather than advancing technologies through customer validation, production, and deployment. Industry interviews emphasized that credible government demand, recurring production commitments, and guaranteed minimum volumes can reduce uncertainty and encourage investment in specialized suppliers and manufacturing capabilities.

Conclusion

The United States has developed a substantial infrastructure base for quantum technology across national laboratories, FFRDCs, universities, manufacturing institutes, regional hubs, and commercial providers. Under the National Quantum Initiative, federal agencies have funded new centers, initiatives, and capabilities. This landscape provides technical capabilities and expertise that support technology development and commercialization, and its strengths broadly reflect the current maturity of quantum technologies. However, the suitability and practical accessibility of these capabilities vary by modality, technical approach, use case, and development stage.

Existing infrastructure is strongest in research, development, prototyping, and technical risk reduction, with more limited support as technologies move toward repeatable processes, packaging, validation, scale-up, and production-ready development. Facilities that appear technically relevant may also lack the process control, flexibility, security, operating model, or technical configuration required by particular users.

Discoverability and access create additional barriers. Capabilities and access pathways remain fragmented across providers, and companies may need to navigate different agreements, eligibility requirements, costs, and operating processes as they move through development. At the same time, successful models—including streamlined agreements, shared-user facilities, and programmatic access mechanisms—demonstrate that these barriers can be mitigated without building new physical infrastructure.

Federal investment and coordination should remain responsive to demonstrated industry needs as quantum technologies and markets continue to develop. While new or expanded capabilities may be warranted where validated gaps exist, the current landscape would benefit substantially from better visibility, simpler access, stronger coordination, and sustained support for existing facilities, staff, and operations. New investment is particularly justified where shared infrastructure can effectively pool non-recurring engineering investment to provide capabilities that would be too expensive or duplicative for individual organizations to build and can bridge the gap between early prototypes and commercial production.

The recommendations provide a basis for a staged approach for stakeholders including the National Quantum Coordination Office. Near-term actions could emphasize improving discoverability; convening agencies and providers to promote or incentivize more consistent access mechanisms; and monitoring priority testing, validation, and process-development gaps. Federal agencies could then use data from facility use, industry demand, and pilot programs to help determine where additional capacity or new infrastructure is justified. Implementation would necessarily involve coordination with the Department of Commerce, other federal agencies, laboratories, industry, and infrastructure providers rather than a single centralized federal model. This approach is consistent with the report's emphasis on making existing capabilities more visible and accessible while directing new investment toward demonstrated gaps as the industry scales up production of quantum components and systems.

Appendix A: Methodology

Infrastructure Inventory

An initial inventory of U.S. federally funded infrastructure helped map and characterize the variety of capabilities and operating models. The information compiled during this research included the relevant quantum specialization areas, the maturity of the facilities, their business models and funding sources, access mechanisms, and geographic information. Information gathered provided the framework for an infrastructure directory, available to QED-C members, that profiles domestic facilities and includes information on their capabilities, access mechanisms, points of contact, and, where available, pricing, schedules, capacity, and links to additional resources.

QED-C Member Survey

A survey of QED-C members collected perspectives on the quantum federal infrastructure landscape, current and anticipated development needs, future demand for external services, barriers to access, and prior users' experiences with federally supported facilities and programs.¹⁶ Respondents answered a variety of questions that provided demographics, engagement satisfaction, and freeform responses that yielded a mix of quantitative and qualitative data. Follow-up industry discussions with highly engaged respondents from industry provided deeper insights into the key problems and needs.

Interviews and Site Visits with Infrastructure Providers

Interviews and site visits with infrastructure providers allowed for proximal insight into the business operations and technical capabilities of facilities identified during the initial infrastructure inventory. These visits were concurrent with the QED-C member survey and helped analyze what services were available and supportive to quantum technology development.

¹⁶ The QED-C member survey on quantum infrastructure needs was submitted under NIST's OMB-approved clearance process pursuant to the Paperwork Reduction Act (OMB Control No. 0693-0043). SRI was notified on March 16, 2026, that the survey had been approved for administration.

Appendix B: Participating Organizations

This appendix catalogs the organizations that participated in various stages of this report's investigative process, including site visits, survey, and interviews.

Responding Organizations: Site Visits and Provider Interviews

Air Force Research Laboratory & Griffiss Institute*	AIM Photonics*	AIM Photonics Test, Assembly and Packaging Services Facility*
Argonne Quantum Foundry*	Boulder Cryogenic Quantum Testbed*	CU Boulder National Quantum Nanofab*
EDA Regional Technology and Innovation Hubs	Elevate Quantum	Illinois Quantum Microelectronics Park*
Lawrence Berkeley National Laboratory (LBNL) Advanced Quantum Testbed	LBNL Quantum Systems Accelerator	MIT Lincoln Laboratory SQUILL Foundry*
NIST Center for Nanoscale Science and Technology	NSF National Nanotechnology Coordinated Infrastructure	NY Creates*
Oak Ridge National Laboratory Quantum Science Center	Sandia Quantum Foundry Facility & Quantum Demonstration Facility	SLAC*
Superconducting Quantum Materials & Systems Center*		

* Participation included an in-person site visit by SRI staff.

Responding Organizations: Survey

Accenture Federal Services	ALEKSCO	Alice & Bob
Alphaket Capital	Amera IoT	Amphenol Corporation
Anametric	AOSense	Aperio Global
Atom Computing	BCC UNITED	Beacon Photonics
Bluefors, Inc.	Boeing	Boston Cryogenics
Boston Quantum Photonics	Brookhaven National Laboratory	Chattanooga Quantum Collaborative
CJW Quantum	Colorado School of Mines	Covesion
CryoCooler	D-Wave Quantum	Deloitte Consulting, LLP
DHS Science and Technology Directorate	Diraq	DOE National Energy Technology Laboratory
DOE Office of Science	Element Six	Elevate Quantum
enQase	Enzi-Edge	EPB Quantum

Responding Organizations: Survey

Ernst & Young	ExxonMobil	Fermi National Accelerator Laboratory
FieldLine Industries	Florida State University	Frequency Electronics, Inc.
Fujitsu	George Mason University	Georgia Institute of Technology
Google Quantum AI	HEQA Security	High Precision Devices
HKA Marketing Communications	IBM Research	Icarus Quantum
Inflection	In-Q-Tel	IonQ
IQM Quantum Computers	Korea-US Quantum Technology Cooperation Center	Kyocera Corporation
L3Harris	Laboratory for Physical Sciences	Lake Shore Cryotronics
LaPine Development, LLC	Lawrence Berkeley National Laboratory	Lawrence Livermore National Laboratory
Leidos	Lockheed Martin Corporation	Logiqal
Los Alamos National Laboratory	Luminar Semiconductors	Maybell Quantum Industries, Inc.
Menlo Systems	Mesa Quantum Systems	Microsoft
MITRE Corporation	MolKet	Monarch Quantum
Montana State University	Nanofiber Quantum Technologies	NASA
New York University	NIH	NIST
Nord Quantique	Northrop Grumman	Northwestern University
NowQuantum	NuCrypt	Oak Ridge National Laboratory
Opulentia	Orange Quantum Systems	Phasecraft
PsiQuantum	Purdue University	Q-CTRL Federal
Qolab	Quantinuum	QuantroIOx
Quantum Computing Data	Quantum Computing Inc.	Quantum Design Oxford
QuantumToMarket	Rensselaer Polytechnic Institute	Rigetti
Rotonium	RTX Corporation	Rydberg Technologies
Safe Quantum	Sandia National Laboratories	SEEQC
SemiQon	Single Quantum	SLAC National Accelerator Laboratory
SRI	Stanford University	Stony Brook University
Sumitomo (SHI) Cryogenics	Tektronix	TNO
TOPTICA Photonics	TreQ	U.S. Air Force

Responding Organizations: Survey

U.S. Army	U.S. Department of Energy	U.S. Department of War
U.S. Government Accountability Office	U.S. Navy	Unitary Foundation
University of Arizona	University of California, Berkeley	University of California, Los Angeles
University of Chicago	University of Colorado Boulder	University of Delaware
University of Illinois	University of Maryland	University of Southern California
University of Washington	University of Wisconsin-Madison	Universum Labs
Vescent Technologies	Washington Institute for STEM, Entrepreneurship and Research	

Responding Organizations: Industry Discussions

Alice & Bob	Beacon Photonics	Bluefors, Inc.
Boeing	Diraq	D-Wave Quantum
Google Quantum AI	IBM Research	Infleqtion
IonQ	Northrop Grumman	PsiQuantum
Quantinuum	Rigetti	RTX Corporation
Rydberg Technologies	TOPTICA Photonics	