QX DISCOVERY BRIEF: Finding the path to the quantum future

Quantum technologies are being developed for various applications and quantum developers are facing diverse challenges, including access to critical materials and components, rapid prototyping and scalable manufacturing, growing markets, and finding/developing a quantum workforce. These bottlenecks among others **require actions and collaboration with various stakeholders in the quantum ecosystem—including YOU!**

We created QX to facilitate participant-driven, Open Space-styled convening. It is an opportunity for you to lead the pathfinding for our quantum future. At QX, you will work together with stakeholders from across the quantum ecosystem to identify specific challenges and gaps that must be overcome on the road to a sustained quantum economy and concrete actions that will help to address them. Your voice is essential—we need to hear from you.

This document outlines several themes that have surfaced at meetings and in one-on-one conversations with our members. These will be a starting point for discussions at QX; other themes may emerge at the meeting. The aim is to define specific barriers, understand who they affect and determine how we can make progress to overcome them together. **We welcome suggestions for additional themes in advance** (please share your inputs here).

- **Theme 1: Applications, Algorithms, Markets, and Customers**

An overarching question is, “What will quantum be good for?” Beyond listing types of problems, such as modeling & simulation or optimization, what do customers need? What is the size of the market? How could the quantum algorithm discovery & development capacity and progress be boosted?

- **Theme 2: Metrics, Benchmarks, and Standards (Evidence of Progress)**

Another frequently asked question is, "When will quantum advantage be here?” It is hard to say, in part because the capability of classical technologies keeps improving. Ultimately, time and cost to solution is a key business metric. But other benchmarks or milestones can also provide evidence of progress. Mature fields such as high-performance computing use established metrics, benchmarks, and standards to assess progress and guide decisions. What would a similar framework look like for quantum technologies, and what steps are needed to build it?

- **Theme 3: A Resilient Supply Chain**

The quantum supply chain is global.[1] Components that meet sometimes stringent requirements can be difficult to source or may require testing before use. Competition with much larger markets, such as AI data centers, can make it hard to buy certain items altogether. What does the future quantum supply chain look like and how can it be developed and made resilient?

- **Theme 4: Manufacturability and Manufacturing**

Scaling from building one-off bespoke components and systems to reliable, reproducible manufacturing requires standardization across the design, fabrication, test and validation processes. How can we adopt an approach similar to the Quantum Networking Applications Roadmap (QNAR)[2], in which the technical gaps that need to be overcome can be identified and quantified?

- **Theme 5: The Quantum Workforce**

The quantum ecosystem needs a range of "quantum workers" from algorithm developers to laser technicians. The jobs, skills, and level of education that employers need run the gamut. Candidates with hands-on experience are especially sought after. How can employers and educators get on the same page?

By the end of QX, we want participants to have turned these gaps facing our members into well-defined opportunities for action. This will involve understanding who is affected, testing the assumptions behind each problem, developing creative solutions, and mapping practical pathways for implementation.

The final output of QX will be a Coordination Agenda that will be shared with public and private investors, government agencies, and QED-C members. It will inform strategies across the ecosystem—including your own—as well as the action plans for QED-C and its Technical Advisory Committees (TACs).

1 https://8441224.hs-sites.com/global-quantum-supply-chain

2 https://quantumconsortium.org/publication/quantum-networking-applications-roadmap/