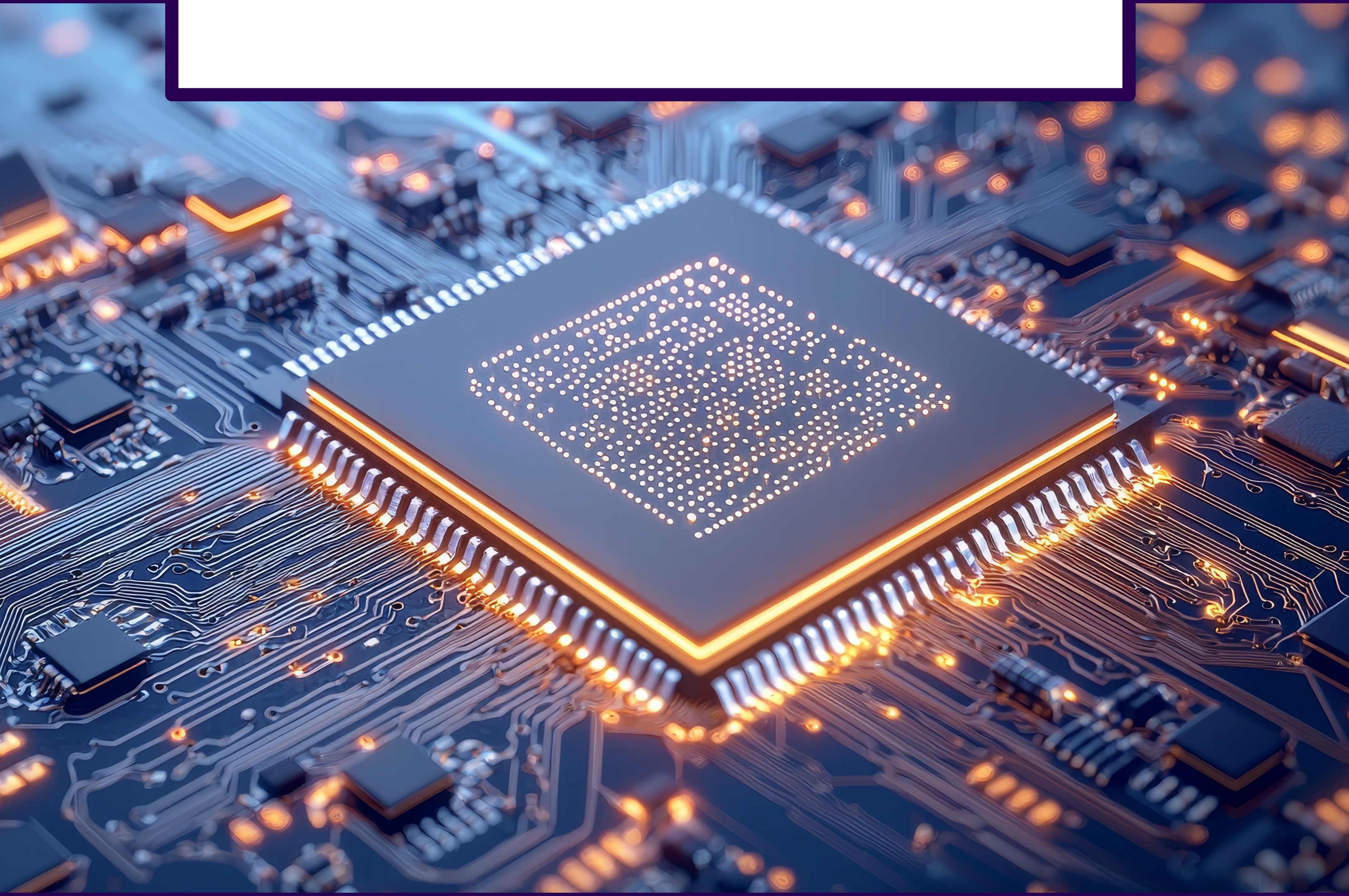
Quantum Computing and Artificial Intelligence Use Cases

March 2025



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About QED-C

QED-C is an industry-driven consortium managed by SRI. With a diverse membership representing industry, academia, government, and other stakeholders, the consortium seeks to enable and grow the quantum industry and associated supply chain. For more about QED-C, visit our website at quantumconsortium.org.

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Executive Summary

The convergence of artificial intelligence (AI) and quantum computing (QC) holds transformational potential across the economy. AI has evolved since its inception in the 1950s and now includes a wide range of approaches and an even wider range of application areas. QC, on the other hand, is still in the early days of a long-term research and development (R&D) path but has enormous future potential that would rival what is currently unfolding for AI. QC is projected to dramatically increase the scale, complexity, and scope of problems that can be solved computationally, while AI has already demonstrated its capacity to produce value in solving problems across numerous domains. As these two fields continue to develop, their combined use may offer opportunities to go beyond the current limits of either technology.

Though independent technologies, QC and AI can complement each other in many significant and multidirectional ways. For example, AI could assist QC by accelerating the development of circuit design, applications, and error correction and generating test data for algorithm development. QC can solve certain types of problems more efficiently, such as optimization and probabilistic tasks, potentially enhancing the ability of AI models to analyze complex patterns or perform computations that are infeasible for classical systems. A hybrid approach integrating the strengths of classical AI methods with the potential of QC algorithms leverages the two technologies to substantially reduce algorithmic complexity, improving the efficiency of computational processes and resource allocation.

This report summarizes different types of synergies that may emerge between QC and AI, focused on four topics:

- Novel solutions or applications that could emerge from the synergy of QC and AI that are currently not feasible with classical computing approaches.
- Approaches for which AI could be used to identify use cases for QC.
- Opportunities to use AI technologies to accelerate development of specific QC technologies or the quantum ecosystem at large
- The technical advances needed for QC + AI integration in possible areas of their joint application.

This report also offers three recommendations for spurring the viability and adoption of QC + AI technologies.

1. **Include support for QC + AI in federal quantum and AI initiatives:** The federal government invests in a substantial and broad portfolio of quantum technology

R&D, guided by the National Quantum Initiative (NQI) Act, CHIPS and Science Act, and other legislation. Federal agencies should explicitly include support for R&D for QC + AI hybrid technologies, including for heterogeneous computing environments that comprise multiple computing paradigms, such as quantum processing units, central processing units, graphical processing units, neuromorphic computing et al.

Federal support for QC + AI R&D should also foster infrastructure and programs that bring experts together to share knowledge and learning. For example, heterogeneous computing testbeds at national labs that are open to the broad research community could support cross-sector applied research aimed at practical application. In fact, the NQI established several national quantum centers, many of which include testbeds, and these should be expanded to explore QC + AI technologies. Specific support is needed for testbeds that facilitate integration of QC with other technologies.

Non-quantum testbeds could also be encouraged to explore potential integration of QC technologies. For example, federally funded testbeds for grid resilience and advanced manufacturing could explore how QC + AI could benefit those fields. The NSF's National AI Research Institutes could include a focus on using AI to develop new QC algorithms, which could in turn advance both QC and AI. Cross-sector collaboration and integration of different technologies are critical for staying at the forefront of QC R&D and increasing opportunities for QC + AI technology deployment.

Finally, the Quantum User Expansion for Science and Technology (QUEST) program authorized by the CHIPS and Science Act provides researchers from academia and the private sector access to commercial quantum computers. QUEST could include support for research specifically on QC + AI.

2. **Increase QC + AI research and education in academia:** AI is currently a trendy field, attracting many community college and university students to software and computer science degrees. At the same time, QC is attracting interest among physical science and engineering students. This large pool can be leveraged to advance QC + AI technologies. For example, higher education institutions can introduce more students to both fields by offering interdisciplinary courses involving physics, math, engineering and computer science. To better prepare students for careers in industry and to build AI capacity at QC companies, universities could partner with QC companies to provide internships and hands-on training. Such a program exists in Canada[1] and would be a worthwhile addition to US efforts.

[1] Quantum Algorithms Institute Training 2024, https://www.qai.ca/dwave

Government funding agencies such as NSF, DOE, and DARPA could also encourage multidisciplinary QC + AI research by creating programs that fund teams of QC and AI researchers to collaborate. For example, multidisciplinary teams could research classical algorithms to drive efficiencies in real-world quantum use cases or large-scale methods for error correction. The Materials Genome Project that funded experimental, theoretical, and computation research by multidisciplinary teams is an example of such an approach. Agencies might need to create mechanisms to bridge program offices to ensure multidisciplinary program funding and management.

3. **Connect industries to accelerate QC + AI technology development, demonstration, and adoption.** While AI is being adopted by seemingly every industry, QC + AI is still relatively early-stage, and awareness among end users is low. Better engagement and interaction among the developers of QC and AI and with end users is needed to enable creation of new capabilities, products, and services that provide real business value. QC and AI industry consortia, such as QED-C and the AI Alliance, should join forces to raise awareness among their members, create opportunities for collaboration, and identify gaps that government funding could help to fill. Together these groups can also engage end user communities to identify sectors that could be early adopters and partners to drive initial applications.

   Early applications will feed into additional and broader use cases, eventually reaching an inflection similar to that experienced by AI, after which QC + AI uses will grow exponentially. Hackathons and business-focused QC + AI challenges could push knowledge sharing and spur interest.

   Within government, there are opportunities to promote QC + AI development to achieve the goals of programs aimed at industries from advanced manufacturing to microelectronics. For example, Manufacturing USA funds 18 advanced manufacturing institutes that aim to develop diverse manufacturing capabilities. QC + AI has the potential to disrupt and allow for manufacturing innovation and could be infused into many of the institutes’ R&D programs. Similarly, the CHIPS R&D program seeks to develop capabilities for future chip technologies. In the 5–10-year timeframe, QC + AI will be poised to impact the traditional semiconductor-based computing ecosystem. The CHIPS R&D program needs to include QC + AI research to ensure this emerging technology is seamlessly incorporated into future microelectronics technologies.

Introduction

The convergence of artificial intelligence (AI) and quantum computing (QC) holds transformational potential across the economy. AI has evolved since its inception in the 1950s and now includes a wide range of approaches and an even wider range of application areas. QC, on the other hand, is still in the early stages of research and development (R&D) and has yet to achieve significant commercial application, but it consistently hints at enormous future potential that could rival that of AI.[2]

AI and QC are independent technologies that complement each other in many significant ways. For example, AI could assist QC by accelerating development of circuit design, applications, and error correction and generating test data for algorithm development. QC has the potential to solve certain types of problems more efficiently, such as optimization and probabilistic tasks, and could enhance the ability of AI models to analyze complex patterns or perform computations that are infeasible for classical systems.

This report explores synergies and potential use cases for QC and AI. How might AI accelerate progress in QC? How might QC improve the capabilities of AI? And how might the two technologies work together to enable applications that neither can achieve alone? The report is based on a workshop that brought together technical, business, and policy experts from both the AI and quantum sectors.[3] Their insights and other inputs are discussed under four related topics:

- Novel computational solutions or applications that could emerge from the synergy of QC and AI that are currently not feasible with classical computing approaches
- Approaches for which AI could be used to identify use cases for quantum technology; although QC is the main focus, approaches could also extend to quantum sensing and quantum networking
- Opportunities to use AI technologies to accelerate development of specific QC technologies or the quantum ecosystem at large
- The technical advances needed for QC + AI integration in possible areas of their joint application, such as computational chemistry and materials science, logistics optimization, and processing of data collected by quantum sensors.

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[2] For example, McKinsey's 2024 *Quantum Technology Monitor* predicts QC's market size to be worth $28–72 billion by 2035: https://www.mckinsey.com/featured-insights/the-rise-of-quantum-computing.
[3] See Appendix A for the workshop methodology, Appendix B for the workshop agenda, and Appendix C for a list of the participants.

Current State of AI and QC

Both AI and QC have the potential to dramatically increase the impact of computational tools. First conceived of in the 1950s, AI comprises computational systems designed to perform tasks that typically require human-like analytical capabilities, such as learning, reasoning, problem solving, perception, and language understanding. It spans multiple approaches, from traditional rule-based frameworks to modern machine learning (ML) algorithms, which can identify meaningful patterns in large datasets and improve performance over time without explicit programming, as well as deep neural networks that further refine these capabilities. Thanks to these features and capabilities, AI has been demonstrating its commercial value for several decades across numerous fields. Recent advances are helping AI excel in areas such as natural language processing, image recognition, and complex problem solving. While early AI relied on predefined rules, today's systems leverage large datasets and sophisticated algorithms to learn and adapt to new challenges.

QC, which harnesses the quantum mechanical principles of superposition and entanglement to process information in fundamentally different ways than classical computers, is much earlier in its development. Unlike classical bits that exist as either 0 or 1, quantum bits, called qubits, can exist in multiple states simultaneously, enabling certain computational tasks to be performed orders of magnitude more quickly than on state-of-the-art classical systems. Current quantum computers face significant challenges with maintaining qubit stability and managing errors, but show promise for transforming fields as diverse as cryptography, molecular simulation, and optimization.

The *combined use* of QC and AI accommodates several related but distinct concepts, broadly referred to in this report as "QC + AI." The use of AI to accelerate QC R&D, so-called "AI-for-QC," applies machine learning to optimize qubit designs, error correction, and QC algorithm development. Hybrid QC + AI solutions, which leverage classical AI models paired with QC algorithms, are being developed but remain constrained by the limitations of current quantum computers. AI-enabled quantum workflows, a more nascent area of research, integrate AI in repeatable quantum processes to manage and optimize computations, particularly in hybrid quantum-classical systems. Finally, the use of QC to run AI algorithms, so-called "QC-for-AI," represents the most long-term potential in this space, as it depends on the development of more capable quantum computers to support fully quantum-based AI models. As the focus of this report is on *quantum* use cases, hybrid QC + AI and QC-for-AI are discussed in depth, while AI-for-QC is only briefly discussed.

Projected Uses, Needs, and Opportunities

The development of hybrid solutions that integrate QC and AI capabilities could allow QC researchers to use less powerful quantum computers to attack certain problems sooner. There has been extensive research to develop AI-enabled quantum workflows to accelerate end users' adoption of QC solutions. Though there are many open problems in this combined space that must be addressed before any QC + AI solutions can be scaled, particularly regarding necessary improvements in QC hardware and error correction, the potential to combine QC and AI to tackle complex problems is a promising area of research.

Integrating AI methods with QC algorithms is a key area of research to leverage the strengths of classical computing alongside QC's potential to substantially reduce algorithmic complexity and thus improve the efficiency of computational workflows and resource allocation. For example, classical solvers and other kinds of "quantum middleware software" can be used to break down a problem and send parts of it to quantum processing units (QPUs; annealing and gate-model QPUs are the most prevalent today) while other parts are addressed through high-performance computing (HPC), AI, or other kinds of classical computational capabilities. The use of classical AI methods can also facilitate the development of new kinds of QC algorithms. Reinforcement learning,[4] for example, can improve quantum circuit efficiency by identifying patterns that enhance performance. In addition, AI could be used to iterate and learn to develop QC algorithms. Hybrid approaches are valuable not only for being able to make use of current and near-term QC technology but also because they are expected to remain powerful tools as technological advances lead to more powerful quantum computers and improved modular architectures for connecting QPUs.

This modular integration echoes prior computing revolutions, where specialized hardware (e.g., central and graphics processing units) transformed the tools available to computing scientists. Likely to play a similar role, QPUs require well-developed software platforms to connect classical and quantum computing systems. These platforms are anticipated to facilitate application development among a wider pool of developers by lowering the barrier to entry for classical computing experts to engage with QC. The availability of many QPUs and eventually of hybrid systems via the cloud further facilitates broad access for users.

In fields whose fundamental components are influenced by quantum behavior, such as chemical simulations and materials science, QC is expected to help researchers achieve

[4] Reinforcement learning is an ML technique that trains software through a reward-and-punishment learning process to make decisions to achieve the most optimal results (https://aws.amazon.com/what-is/reinforcement-learning/).

greater accuracy at reduced costs compared to classical approaches. QC at scale would also be ideally suited to address the challenging computations fundamental to computational chemistry approaches and to the chemical industries that rely on advanced innovative approaches and disruptive platforms. In addition, fields such as drug discovery, smart electrical grid integration, and materials engineering have significant commercial interest in, and high costs associated with, using classical approaches. This makes them excellent candidates for exploratory work with QC + AI, albeit with dual-use risks that demand responsible frameworks, as discussed in the section below on lessons from AI.

QC also has the potential to influence AI development by offering new methods for managing computational complexity. The rates at which computational costs increase given large solution spaces are a central consideration for algorithm designers in classical computing. The extremely high computational and associated energy demands for cutting-edge AI approaches are a key factor in the limited democratization of state-of-the-art models, such as large language models (LLMs). QC's strength in simulating and optimizing problems with large solution spaces promises advantages for exploring alternative AI architectures that differ from traditional neural networks reliant on classical gradient descent techniques. Emerging research suggests that, for certain problems, QC might enable more efficient feature extraction and noise reduction in AI, paving the way for innovative solutions to longstanding challenges in model training and data synthesis.

Looking ahead, QC + AI convergence is likely to play out over decades rather than years, offering numerous open problems for researchers. Immediate efforts will probably focus on error correction, improved resource management, and refinement of hybrid algorithms. Despite the challenges of scaling QC + AI combined applications, ongoing R&D in industry, government, and academia is encouraging.

QC + AI Applications

This section explores novel applications made possible through QC + AI synergies, particularly in chemistry, materials science, logistics, energy, and environmental modeling. Novel approaches in quantum language processing may also provide avenues for greater explainability in AI (i.e., the ability to describe or understand an AI model's output). In this section, QC + AI synergies imply the combined use of AI and QC technology to solve a particular problem.

Chemistry and Materials Science Modeling and Simulation

Quantum computers hold the promise of achieving highly accurate approximations of molecular quantum states, a capability that would enable the precise modeling of complex chemical reactions, streamline the design of new materials, and significantly accelerate advances in fields such as drug discovery and energy storage. These capabilities could address some of the inherent limitations of classical computational methods, which because of constraints on classical computing resources must rely on oversimplified models that do not capture the full complexity of chemical systems. Realization of some of this potential could be accelerated by the development of new, AI-enabled QC algorithms. AI can assist quantum computers by processing noisy measurement outputs to infer quantum states — such as reconstructing, enhancing, and optimizing wave functions — and thus improve the reliability and accuracy of simulations.

When coupled with HPC systems, AI and QC could significantly reduce the cost and improve the precision of chemical simulations as well as assist with scaling simulations to larger numbers of particles, enabling breakthroughs in complex molecular modeling. Advances in these technologies, especially in conjunction with QC scaling and noise reduction, are expected to revolutionize the chemical industry, where quantum-based simulations will enable researchers to model intricate chemical reactions with unprecedented accuracy. This ability would accelerate progress and innovation in drug discovery, advanced materials development, and numerous other applications that rely on efficient chemical processes.

AI-enabled quantum simulation in chemistry could be one of the highest-value use cases in the quantum field. Estimates suggest that nearly 96% of all manufactured goods involve chemistry at some production stage.[5] Taking energy storage as an example, quantum simulations could facilitate development of next-generation batteries and enable the design of entirely new energy storage platforms. This would allow industries to overcome a primary bottleneck in the expanded use of sustainable energy generation: energy storage. Similarly, breakthroughs in (photo)catalysis simulation could be transformational in creating new catalysts and thereby advancing chemical and materials manufacturing. A breakthrough in these fields alone would justify the long-term use of quantum computers and the use case of computational chemistry.

[5] American Chemistry Council. 2019. *2019 Guide to the Business of Chemistry*. Washington. https://www.americanchemistry.com/chemistry-in-america/data-industry-statistics/resources/2019-guide-to-the-business-of-chemistry

Optimization in Logistics and Energy

Approaches using QC + AI may be well suited to solving complex optimization problems such as supply chain scheduling, route planning, and energy distribution. QC with the help of ML could tackle these problems through more effective simulation and optimization. For instance, quantum annealing — a type of QC that is especially well suited for optimization problems — may be useful to address combinatorial problems in shipyard logistics or airline routes, potentially reducing carbon impacts through more efficient resource allocation.

Another possible application of QC + AI is smart grid optimization, including energy unit commitment, and the integration of diverse energy sources such as nuclear power and renewable energies. In many of these applications, replacing only a small part of the classical computing approaches with a QC approach in a tailored fashion could provide significant advantage by improving the least efficient portions of classical optimization processes.

A final application could be in directly combining AI models with quantum optimization. For example, AI models could generate demand forecasts and quantum optimization could produce the supply chain solutions to meet these forecasts.

Weather Modeling and Environmental Science

QC + AI approaches may improve the predictive power of models to assess weather patterns, reduce the impacts of weather-related disasters, and enhance resource preservation and allocation. For example, hybrid QC + AI models could predict low-probability, high-impact weather events, enabling policymakers to implement preventive measures and helping affected citizens to prepare for destructive storms.

Hybrid QC + AI models could also play a role in farming by facilitating identification of new plant species, revealing ways to optimize soil remineralization, or informing the development of new fertilizer substrates. Fertilizer production is crucial for global food supply and requires a considerable amount of energy — around 2% of the world's total energy production.[6] Quantum computers have the potential to simulate the complex quantum interactions involved in nitrogen fixation, such as those catalyzed by nitrogenase enzymes. These simulations could provide insights for developing more energy-efficient methods for fertilizer production.

[6] Planet Tracker. 2023. *Fixing Nitrogen: Financial Markets Need to Focus on Nitrogen.* London. https://planet-tracker.org/wp-content/uploads/2023/11/Nitrogen.pdf

Signal Processing and Quantum Sensing

Another promising application of quantum and AI approaches is in the field of quantum sensing. Quantum sensors leverage the unique behaviors of quantum systems, such as discrete energy levels, spin states, or quantum tunneling, to achieve high sensitivity and precision in specific applications. In many critical situations, their sensitivity can surpass that of classical sensors. They show great promise for use in high-precision operations such as navigation and astronomical imaging. Quantum sensing techniques could also be applied to detect rare earth resources, which are invaluable to clean energy applications and the semiconductor industry. In addition, quantum sensors have significant potential in the fields of biological research and medicine with quantum imaging techniques, outlined in the QED-C report on *Quantum Sensing for Biomedical Applications* (2024).[7]

Quantum sensors can generate enormous amounts of data, which poses a challenge for post-collection processing. AI can play a crucial role in efficiently processing and analyzing these data, enabling the extraction of meaningful insights from their highly precise measurements. By leveraging advanced algorithms, AI can interpret complex outputs, identify patterns, and integrate quantum sensor data into models for environmental monitoring, medical diagnostics, navigation, and other areas, as mentioned above. This capability would bridge the gap between raw quantum sensor data and practical use, enhancing the value of quantum sensors in real-world scenarios.

Identifying Use Cases for QC with AI

The identification of impactful and relevant use cases for QC is a complex task that requires understanding across current and anticipated QC capabilities as well as practical application domains. QC modalities and qubit architectures advance at different rates, and AI may be able to help prioritize and finetune cases as the computing hardware advances.

LLMs, a classical AI tool, are quickly advancing in their technical capabilities and are being applied to more and more use cases across industries. In QC, they could be used to identify and analyze new QC applications. For example, LLMs can be trained with core QC principles, theories, and knowledge of current use cases to propose novel QC applications. AI can also be useful for identifying or designing the most suitable QC algorithm for a specific task. Furthermore, it can provide a data-driven framework to prioritize application areas for QC by analyzing a range of potential use cases: LLMs

[7] https://quantumconsortium.org/quantum-sensing-for-biomedical-applications/

can rank use cases based on criteria such as problem complexity, commercial potential, cost-effectiveness, and public benefit.

A relatively straightforward use of AI to advance QC would be to review the growing body of published studies of quantum computing use cases, demonstrations, and persistent challenges. This information could be useful in tracking applications development and end user demand to inform corporate investments — by both developers and customers. For example, an AI summary of the steps needed to facilitate widespread adoption of quantum technology in a specific use case could inform a new quantum business challenge, similar to the one by Airbus and BMW.[8]

Similarly, AI could be used to translate complex QC concepts into more accessible terms and to frame the technology in ways that align with societal needs. This could in turn increase adoption of QC by making the technology more digestible for users without significant quantum expertise. Generative AI, combined with techniques such as prompt engineering, could help articulate use cases tailored to specific private or public goals, bridging the gap between QC and practical applications.

One hindrance to QC's progress is the breadth of knowledge needed. Many employees of QC companies are experts in quantum technology hardware or software, but successfully applying QC tools in diverse sectors will also require some knowledge in domains such as chemistry, materials science, logistics, or supply chain management. This need for multidisciplinary capabilities complicates the design and implementation of appropriate QC algorithms. AI could help by identifying patterns and scenarios where QC offers clear advantages, guiding the efforts of quantum experts toward feasible and profitable applications.

Finally, AI can help validate QC use cases by reducing false positives through error rate analysis, performing feasibility evaluations, and defining the conditions required for future QC solutions to deliver meaningful outcomes.

Opportunities for AI to Accelerate QC

One of the more promising areas of QC + AI convergence is the use of AI in accelerating QC technology R&D. The development of economically useful quantum computers faces many well-known challenges where AI may be useful, such as the following.

[8] Airbus. 2024. Airbus and BMW Quantum Computing Challenge 2024. https://www.airbus.com/en/innovation/digital-transformation/quantum-technologies/airbus-and-bmw-quantum-computing-challenge

- AI could assist QC software and algorithm developers and optimize QC hardware design, including qubits and quantum circuits. Some microchip designers already use AI to develop advanced semiconductors, suggesting a natural extension of AI's role into QC hardware. AI could also help enhance the design of hardware components for quantum networks.
- AI could QC help design and refine QC algorithms to improve their efficiency and performance.
- Software developers can leverage code assistants trained on QC software development kits to both accelerate code development and increase the number of developers capable of programming such computers.
- AI could address critical QC challenges, such as error correction (e.g., by dynamical optimization of error correction codes based on real-time noise profiles) and noise reduction (e.g., by analysis of patterns of noise).

Beyond its use for technology development, AI could be helpful in the assessment and expansion of the broader quantum ecosystem in the following ways.

- Strengthen the quantum supply chain, for example, by identifying areas where support is most needed.
- Inform standards for quantum technology performance benchmarking, enabling consistent technology assessment across the industry.
- Identify promising use cases for QC and determine which quantum systems are most suitable for specific tasks.
- Monitor the ecosystem to detect potential vulnerabilities and inform policymakers' strategic decisions to bolster quantum infrastructure security.

Some QC companies have recently shifted toward AI, but this should not be taken as evidence that QC skills, expertise, and resources are readily transferable to AI. While there is some overlap in the skills required for the two fields, these transitions are primarily driven by external market forces. Venture capital investors view AI as a more immediately promising area for investment, while QC shows a longer economic return.[9]

[9] Chris Metinko. 2024. Quantum Computing Funding Hits Record High with Apparent AI Boost. *Crunchbase News*, November 14. https://news.crunchbase.com/venture/quantum-computing-funding-record-high-ai-quantinuum/

Lessons from AI

While AI has achieved a level of maturity that is enabling a growing number of real-world use cases, QC remains in the R&D phase. Both technologies represent transformational capabilities, and the QC industry can draw valuable lessons from AI's development while also recognizing the differences between the two fields and the implications of their combination.

QC can learn, for example, from the pathway AI followed with respect to standardization. As the AI industry advanced, standard benchmarks were developed to measure performance, helping to validate technology and drive adoption. The current lack of recognized QC benchmarks makes it difficult to understand the capabilities of various systems. It is still early in the QC technology development, and it is difficult to create performance standards that are robust and reliable across technology platforms. However, multiple groups in the quantum community are diligently working on developing performance-based benchmarks. The Unitary Foundation has led a community-driven, open-source platform to gather results on different QC tasks to establish benchmarks.[10] Also, QED-C has published the results of several application-oriented benchmark studies and maintains an open-source repository of a suite of practically executable benchmark programs for assessing the performance of quantum computing applications.[11] More work is needed to create QC benchmarks that are relevant to end users who need to see the business case for adopting QC technology. While formal standardization is considered premature at this early stage, establishing use case-informed, industry-wide best practices for the execution of benchmark programs and reporting of their results is considered a step toward credibility and growth for QC.

There have been significant concerns related to uses of AI, such as privacy and potential misuse of personal information. While QC may not (yet) face the same level of scrutiny,[12] public conflation of the two technologies — along with the threat of QC to break certain encryption schemes — may lead to similar concerns. The QC sector could benefit from reviewing the steps AI has taken to address misuse, as well as how to communicate those issues to the public. An early focus on these concerns will help the quantum industry adopt appropriate practices as it matures and foster a well-informed

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[10] The Unitary Foundation's QC benchmarks by community contributors are reported by Metriq: metriq.info

[11] Tom Lubinski, Sonika Johri, Paul Varosy, Jeremiah Coleman, Luning Zhao, Jason Necaise, Charles Baldwin, et al. 2021. Application-Oriented Performance Benchmarks for Quantum Computing [Computer software]. arXiv:2110.03137

[12] Scott Buchholz and Beena Ammanath. 2022. Quantum Computing may Create Ethical Risks for Businesses. It's Time to Prepare. *Deloitte Insights*, May 12. https://www2.deloitte.com/us/en/insights/topics/cyber-risk/quantum-computing-ethics-risks.html

public. Generative AI and deep learning models have demonstrated clear risks of misuse, such as deepfakes for disinformation, AI-powered cyberattacks, and automated propaganda. Measures have been taken by the US Department of Commerce[13], European Union[14], UNESCO[15], and the AI industry[16], although enforcement remains challenging. The World Economic Forum has initiated similar efforts for QC[17]. Frameworks for responsible use — drawing on lessons from AI and other transformative technologies — will inform the development of QC + AI systems. Meanwhile, entities developing QC systems and considering their applications should pay careful attention to possible malicious use and strategies for mitigating the likelihood of such uses.

The QC community can also learn from the experiences of managing AI hype and expectation. AI has gone through cycles of over-promising and disappointment over the years, with corresponding impacts on public perception and investment. The QC community should work to manage expectations and avoid inflated claims by focusing on evidence-based reports on progress, achievable near-term goals, and promoting real-life use cases. This approach will help sustain credibility.

Last, accessibility is a key area for which AI can provide insight into QC's future. AI has become highly accessible, such that individuals with little technical knowledge can use AI tools. Use of QC, on the other hand, requires significant expertise and access to highly specialized resources. Broader adoption of QC will depend on accessibility for users with little to no technical understanding of the underlying technology. Indeed, many large tech companies (e.g., NVIDIA[18], IBM[19], and Microsoft[20]) are already working to develop relatively easy ways to engage with a quantum computer. Other companies (e.g., Amazon[21], D-Wave[22], and IonQ[23]) also provide access to quantum computers via the cloud. These platforms will be important for accelerating QC uptake.

The need to consider appropriate technology controls arises with all new technologies that are "dual use" and may have uses that can cause harm as well as provide benefits.

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[13] National Institute of Standards and Technology, 2024. Artificial Intelligence Safety Institute. https://www.nist.gov/aisi
[14] European Parliament. 2024. EU AI Act: First Regulation on Artificial Intelligence, June 18. Strasbourg. https://www.europarl.europa.eu/topics/en/article/20230601STO93804/eu-ai-act-first-regulation-on-artificial-intelligence
[15] UNESCO. 2022. UNESCO Adopts First Global Standard on the Ethics of Artificial Intelligence, April 8. Paris. https://www.unesco.org/en/articles/unesco-adopts-first-global-standard-ethics-artificial-intelligence
[16] Center for AI Safety. 2023. *Statement on AI Risk.* https://www.safe.ai/work/statement-on-ai-risk
[17] World Economic Forum. 2022. *Quantum Computing Governance Principles.* Geneva. https://www3.weforum.org/docs/WEF_Quantum_Computing_2022.pdf
[18] NVIDIA. 2024. NVIDIA CUDA-Q. https://developer.nvidia.com/cuda-q
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[20] Microsoft. 2024. Azure Quantum. https://quantum.microsoft.com/
[21] AWS Braket cloud access 2024 https://aws.amazon.com/braket/
[22] D-Wave Leap cloud access 2024 https://www.dwavesys.com/solutions-and-products/cloud-platform/
[23] IonQ. 2025. IonQ quantum cloud. https://ionq.com/quantum-cloud

While some AI-related concerns may be similar for QC, such as access to leading edge technology by adversaries, others may not. It will be important to communicate to policymakers and others how QC and AI differ. The recent Framework for AI Diffusion[24] is a novel approach that attempts to control the flow of advanced AI technology to countries of concern.

The need to control QC technology is motivated by the potential for a sufficiently powerful quantum computer to break encryption. In light of this known threat, the United States and other nations are already putting in place export controls. The threats to cybersecurity more broadly are detailed in the QED-C reports *A Guide to a Quantum-Safe Organization* (2022)[25] and *Quantum Technology for Securing Financial Messaging* (2024).[26]

The experience of AI points to the value of concerted, long-term investment in speculative but extremely valuable future technology. AI and QC have remarkably similar histories. The possibility of using machines to simulate human problem solving was first recognized almost 70 years ago. Intense R&D followed in parallel with exponential growth in computing capabilities, leading to early real-world applications that have steadily grown in scope, impact, and commercial value over the last several decades. Use of AI is now so widespread that it's virtually impossible to find a domain of human activity in which it is not applied. Early theoretical groundwork in physics highlighted the possibility of building computers that exploit quantum superposition and entanglement to solve problems that classical computers cannot, leading to current high levels of R&D in QC and steady advances in the scale and capability of quantum computers.

AI pioneers understood the immense potential value of their new technology, and the need to overcome technical hurdles to realize that value. Similar progress is needed for QC to achieve utility beyond that of classical computing. Key to this progression is the advancement of core QC technology, including error-corrected qubits, QC algorithms, and technology that is scalable. Technical advances will need to be followed by demonstration of impactful, commercially viable use cases for QC, to empower entrepreneurs to pursue further technology advances and drive innovative applications. Use cases should address challenges for which QC can offer a distinct advantage over classical approaches. By concentrating on areas in which QC offers

[24] U.S. Department of Commerce, Bureau of Industry and Security, *Framework for Artificial Intelligence Diffusion*, (Washington, DC, 2025), https://public-inspection.federalregister.gov/2025-00636.pdf.
[25] https://quantumconsortium.org/guide-to-a-quantum-safe-organization/
[26] https://quantumconsortium.org/financial24/

specific benefits, QC can initially carve out specialized niches rather than competing directly with classical computers or the AI that runs on them.

Achievement of such an advantage is likely to follow a path similar to AI, which benefited significantly from advances in computing power along with growth in AI R&D and commercialization and also from government support and acceleration of upstream research and education. Broadening researcher and student access to and hands-on experience with QC resources will expand understanding of QC's capabilities and grow a skilled workforce in QC technologies, especially in algorithm development and data handling, both of which will be important for sustainable progress. Government investment and support will accelerate QC innovation by funding facilities and fostering collaboration between private and public sectors. This can be done through both direct funding and the creation of critical infrastructure, such as testbeds at universities and national labs that are accessible to private entrepreneurs and startups as well as academic and government-funded researchers. Requests for proposals should call for ideas that leverage the synergies of QC and AI. The call to expand efforts in QC recognizes that there are as yet no applications for which QC has a demonstrated advantage — just as there were no clear advantages of existing AI in its early days. Areas of advantage will reveal themselves as QC matures alongside evolving classical computing and AI.

Needs for Successful QC + AI Integration

There is immense potential for the combined use of QC and AI. To realize this potential, progress is needed in three key areas:

- Scalable, fault-tolerant QC hardware and integration with HPC and other classical computers
- Software platforms to improve the usability of and access to QC
- Expansion of the workforce skilled in developing, implementing, and utilizing QC systems for research and commercial applications

QC at scale is likely to place large demands on basic infrastructure, such as electricity usage,[27] and on the quantum supply chain,[28] including the hard-to-obtain raw materials

[27] A dilemma for the QC industry in scaling the complexity of the systems is that, absent innovation in the hardware (at all levels), fielding large-scale quantum computers becomes ever more energy intensive. Progress is being made through densification of controls and the adoption of a modular systems architecture to drive down energy use per qubit.

[28] Sourcing the raw materials and components necessary for large-scale systems hits a bottleneck as the production capabilities of vendors begin to be pushed to their limits.

needed to build QC devices. Challenges in connecting quantum computers to classical ones to create networked hybrid systems also hamper progress toward useful QC + AI.

Growth in the adoption and use of classical computers required the building of higher-level architectures (more sophisticated frameworks or systems that organize and manage the computer's components, operations, and software) and languages to separate programmers from the lower-level details of transistors and microprocessors. Success in combining QC and AI will require similar development of layered architectures that free practitioners from detailed concerns such as circuit diagrams and device-specific considerations such as the kind of quantum computer on which they are running their algorithms.

Many QC programmers today are experts in the hardware on which their code runs. But advances in middleware or intermediate representation[29] and software tools and platforms are changing this dynamic and could enable greater specialization between hardware-focused experts and those who are working above the hardware level. Higher-level QC + AI specialists will need to be able to focus on their area of expertise without needing to devote significant attention to how their code is executed at the hardware level. Development of more advanced software that integrates QC + AI lower in the stack would benefit application developers by providing access to their combined capabilities without needing to be knowledgeable of or responsible for implementation.

Finally, successfully bringing together QC and AI will require an expanded pool of experts, developers, and community resources to create and then leverage a more democratized set of QC + AI capabilities. While the quantum community is highly aware of AI and many see the benefits that synergy could mean for the two fields and for society, there is less familiarity in the AI community with QC and the potential for combining AI and QC. Development of hybrid architectures and algorithms that can exploit these combined systems effectively will require domain experts from both areas.

Areas of highest potential impact of QC + AI

Numerous potential areas for development and impact of QC and AI were proposed by experts at the workshop. Among the ideas with the highest potential for success at scale were (1) applications that leverage hybrid algorithms and (2) the use of AI with quantum sensing data. Both have the benefit of leveraging technology that is more mature than other technologies and are not reliant on the existence of fault-tolerant quantum computers. Many commercially available quantum sensors have effective

[29] Elaine Wong, Vincente Leyton Ortega, Daniel Claudino, Seth Johnson, Sharmin Afrose, et al. 2024. A Cross-Platform Execution Engine for the Quantum Intermediate Representation. arXiv:2404.14299

error correction mechanisms and mature supply chains. The use of quantum sensors with non-AI classical systems is likely to yield transferable tools for integrating quantum-generated data into classical computing environments.

Hybrid algorithms not only have high potential overall but also are well positioned for success in the near term. Hybrid algorithms for chemistry and materials science in particular have high potential for success because these fields inherently involve quantum phenomena (e.g., electron interactions and molecular bonding) that quantum computers are well suited to model. Additionally, these applications are expected to require fewer qubits to achieve meaningful results compared to other areas, such as cryptography or large-scale optimization, making them more feasible with current and near-term quantum technologies.

Quantum processors may enhance modern ML architectures by generating rich distributions of samples quickly, which could contribute to more compact and efficient generative AI models.[30] However, current capabilities remain limited, and achieving significant improvements in energy efficiency and sustainability will depend on advances in QC hardware and hybrid system design.

Unlike areas such as cryptography, optimization, and quantum chemistry that place high demands on precision, many AI applications are not targeted at finding single "correct" answers to problems. Rather, they often focus on finding patterns, classifying data, or making predictions where approximations are expected and valuable. Neural networks, for example, converge on solutions through iterative optimization and are tolerant of noise or small inaccuracies. Similarly, reinforcement learning often explores a probabilistic space of possible actions and outcomes. This lower threshold for precision makes QC ideally suited for many AI applications, especially for large, high-dimensional compute spaces. Other potential areas of near-term success are in position, navigation, and timing applications (e.g., based on quantum sensing data) and non-commercial areas such as education and basic research.

Measures of Success

To evaluate success in the QC + AI space, it is essential to identify the key measures of success currently used in each field and analyze how they can be integrated for combined applications. These measures can be broadly categorized as performance-focused and justification-focused.

[30] Note that quantum computers face potential competition from emerging energy-efficient computing paradigms, sometimes referred to as "thermodynamic computers." These approaches, which leverage thermodynamic principles or stochastic processes, are much less mature than quantum computing but could play a role in addressing energy challenges in computation.

Performance metrics relevant to both QC and AI include accuracy, speed, performance, cost, and energy use. While these metrics are critical in both domains, the emphasis on each varies significantly depending on the unique challenges and opportunities of QC + AI technologies. AI, the more mature technology, measures success through the introduction of new capabilities (e.g., speech processing), incremental improvements in accuracy and performance, enhanced speed, and lower cost and energy demands.

In contrast, QC places less direct emphasis on speed given its theoretical potential to outperform classical algorithms by numerous orders of magnitude for specific problems. Accordingly, QC measures of success are often justification-focused, e.g., they assess where QC has an advantage over classical computing. When evaluating the feasibility of adopting QC for a specific use case, many companies will perform an end user-informed cost-benefit analysis of implementing QC + AI technologies. That is, success will likely be in the eye of the beholder, as different end users prioritize different factors when evaluating a QC + AI workflow. Key questions end user executives might consider when deciding whether to adopt a new technology include: What are the upfront and recurring costs of developing and operating these systems? How can companies generate profits, or how can non-commercial entities create enough value to justify the expense? Are slowdowns in terms of absolute runtime acceptable given increases in tractable problem sizes?

The starting points for these measures differ markedly between QC and AI. AI has already demonstrated its ability to create significant value across a wide range of applications, with proven profitability in many industries. QC, by contrast, is still awaiting the concrete demonstration of a "quantum advantage" — a clearly discernible superiority over purely classical systems in practical applications.

Despite the challenges, the rapid progress in hybrid approaches shows promising potential for meaningful benefits. By focusing on areas where QC can complement AI — such as handling high-dimensional data spaces or enhancing precision in complex simulations — the QC industry is moving closer to the realization of "quantum advantage."

Recommendations

The following recommendations for spurring the viability and adoption of QC + AI technologies are based on outputs from the workshop and subsequent discussions with quantum industry stakeholders.

1. **Include support for QC + AI in federal quantum and AI initiatives:** The federal government invests in a substantial and broad portfolio of quantum technology R&D, guided by the National Quantum Initiative (NQI) Act, CHIPS and Science Act, and other legislation. Federal agencies should explicitly include support for R&D for QC + AI hybrid technologies, including for heterogeneous computing environments that comprise multiple computing paradigms, such as quantum processing units, central processing units, graphical processing units, neuromorphic computing, and others.

   Federal support for QC + AI R&D should also foster infrastructure and programs that bring experts together to share knowledge and learning. For example, heterogeneous computing testbeds at national labs that are open to the broad research community could support cross-sector applied research aimed at practical application. In fact, the NQI established several national quantum centers, many of which include testbeds, and these should be expanded to explore QC + AI technologies. Specific support is needed for testbeds that facilitate integration of QC with other technologies.

   Non-quantum testbeds could also be encouraged to explore potential integration of QC technologies. For example, federally funded testbeds for grid resilience and advanced manufacturing could explore how QC + AI could benefit those fields. The NSF's National AI Research Institutes could include a focus on using AI to develop new QC algorithms, which could in turn advance both QC and AI. Cross-sector collaboration and integration of different technologies are critical for staying at the forefront of QC R&D and increasing opportunities for QC + AI technology deployment.

   Finally, the Quantum User Expansion for Science and Technology (QUEST) program authorized by the CHIPS and Science Act provides researchers from academia and the private sector access to commercial quantum computers. QUEST could include support for research specifically on QC + AI.

2. **Increase QC + AI research and education in academia:** AI is currently a trendy field, attracting many community college and university students to software and computer science degrees. At the same time, QC is attracting interest

among physical science and engineering students. This large pool can be leveraged to advance QC + AI technologies. For example, higher education institutions can introduce more students to both fields by offering interdisciplinary courses involving physics, math, engineering and computer science. To better prepare students for careers in industry and to build AI capacity at QC companies, universities could partner with QC companies to provide internships and hands-on training. Such a program exists in Canada[31] and would be a worthwhile addition to US efforts.

Government funding agencies such as NSF, DOE, and DARPA could also encourage multidisciplinary QC + AI research by creating programs that fund teams of QC and AI researchers to collaborate. For example, multidisciplinary teams could research classical algorithms to drive efficiencies in real-world quantum use cases or large-scale methods for error correction. The Materials Genome Project that funded experimental, theoretical, and computation research by multidisciplinary teams is an example of such an approach. Agencies might need to create mechanisms to bridge program offices to ensure multidisciplinary program funding and management.

3. **Connect industries to accelerate QC + AI technology development, demonstration, and adoption.** While AI is being adopted by seemingly every industry, QC + AI is still relatively early-stage, and awareness among end users is low. Better engagement and interaction among the developers of QC and AI and with end users is needed to enable creation of new capabilities, products, and services that provide real business value. QC and AI industry consortia, such as QED-C and the AI Alliance, should join forces to raise awareness among their members, create opportunities for collaboration, and identify gaps that government funding could help to fill. Together these groups can also engage end user communities to identify sectors that could be early adopters and partners to drive initial applications.

   Early applications will feed into additional and broader use cases, eventually reaching an inflection similar to that experienced by AI, after which QC + AI uses will grow exponentially. Hackathons and business-focused QC + AI challenges could push knowledge sharing and spur interest.

   Within government, there are opportunities to promote QC + AI development to achieve the goals of programs aimed at industries from advanced manufacturing to microelectronics. For example, Manufacturing USA funds 18 advanced

[31] Quantum Algorithms Institute Training 2024, https://www.qai.ca/dwave

manufacturing institutes that aim to develop diverse manufacturing capabilities. QC + AI has the potential to disrupt and allow for manufacturing innovation and could be infused into many of the institutes' R&D programs. Similarly, the CHIPS R&D program seeks to develop capabilities for future chip technologies. In the 5–10-year timeframe, QC + AI will be poised to impact the traditional semiconductor-based computing ecosystem. The CHIPS R&D program needs to include QC + AI research to ensure this emerging technology is seamlessly incorporated into future microelectronics technologies.

Appendix A: Methodology

This report explores synergies between QC and AI and is largely informed by an in-person workshop organized by the QED-C Use Cases Technical Advisory Committee. The October 29, 2024, workshop took place in Seattle and was attended by 57 stakeholders from the quantum and AI technology sectors, government, and academia. The workshop agenda is provided in Appendix B and the list of participants in Appendix C.

Workshop Goals: Surface High-Impact, Feasible Ideas

1. How can AI support the identification and development of use cases for QC?
2. Are there challenge problems that AI and quantum can accelerate?
3. Are there classes of use cases (e.g., optimization) that can be achieved more readily through quantum and AI?
4. How can AI be used to accelerate progress in QC?

Structure: Encourage Collaboration, Fresh Thinking

The workshop was designed to share knowledge about the current state and potential future of the integration of QC and AI and facilitate collaboration opportunities among attendees with knowledge of QC and AI. In advance of the workshop, all participants were sent the following two resources to provide foundational information about QC and AI:

- Advanced Technology Academic Research Center white paper with a basic introduction to QC and post-quantum cryptography: https://atarc.org/wp-content/uploads/2024/03/atarc-quantum-working-group-white-paper-chapter-1-1.pdf
- Bloomberg Explainer glossary of common AI terms: https://www.bloomberg.com/features/2024-artificial-intelligence-glossary

The workshop began with keynote presentations from industry leaders in AI and QC R&D to provide context, learn about the technology roadmaps of these major companies, and ensure that all participants had a baseline knowledge of the current and projected opportunities for integrating QC and AI technology. The keynotes were followed by a series of lightning talks that showcased current applications and use case examples of AI and quantum products. Following the presentations, workshop participants broke into groups to identify potential applications that could emerge from the synergies of AI and QC that are not feasible with current classical computing approaches. Many of these applications focused on the fields of chemistry, materials science, transportation and logistics, and weather modeling. Participants also discussed methods in which AI can accelerate QC and potential challenges to integrating the technologies.

Breakout Process: Ideation of Use Cases for QC and AI Synergies

The afternoon was divided into two 70-minute ideation sessions in two breakout groups. Rather than assigning groups, participants selected their own tables for the first ideation session and then were asked to shuffle themselves before the second session. Conversations during each session were guided by two activity prompts and several supplementary questions to facilitate conversation (see Table A1 and Table A2). As each participant shared ideas, the facilitators recorded them on sticky notes and pasted them to a large notepad. Following each session, a representative from each group reported out to the whole room one important takeaway from their group's discussion.

Table A1: Breakout Session 1 Activities and Questions

	Topic	Activity	Discussion Questions
1	Quantum + AI Synergies	List novel solutions or applications that could emerge from the synergy of quantum and AI that are currently not feasible with classical computing approaches	• Which of these use cases has the potential for the highest economic impact, and which for the largest societal impact? • Is there a larger requirement on advancement of AI technology or on quantum technology to achieve solution readiness? • Can you describe at which technology layer the synergies occur? (hardware, software, algorithm, etc.)
2	Creating Use Cases for Quantum with AI	List and explain approaches in which AI could be used to identify use cases for QC (e.g., pre-training, prompt engineering, etc.)	• What are the key challenges in validation and confirmation of use cases that are generated by AI? • What technical advancements or processes are necessary to overcome these challenges? • What actions can QED-C TAC groups take to accelerate the usefulness of quantum + AI use case collaboration?

Table A2: Breakout Session 2 Activities and Questions

	Topic	Activity	Discussion Questions
3	AI for Quantum	List ideas of where AI technologies (e.g., AI/ML, GenAI, etc.) can be used to accelerate development of specific quantum technologies or the quantum ecosystem at large	• What lessons are AI pioneers struggling with that the quantum ecosystem can learn from? (e.g., privacy, tech adoption, policy, standards, etc.) • Important quantum startup companies are transforming into AI companies. Does this mean quantum is readily transferable to AI already? Share perspectives and discuss. • Inspiration from the quantum ecosystem continually leads to improvements in classical systems and AI. From an AI perspective, what will it take for quantum technology to surpass classical ingenuity?
4	Success for Quantum + AI	List and describe what is needed for quantum + AI integration success for the prominent QC areas — chemistry, optimization, and ML	• Which combinations of quantum + AI have the most potential in these areas? (e.g., hybrid algorithms, quantum sensors as a data source, quantum networks, etc.) • Are any of these considered to be more viable on a shorter term than others? • What are important measures of success in AI currently and are those success measures the same for quantum?

Appendix B: Workshop Agenda

8:30	Breakfast & welcome: Celia Merzbacher, QED-C, & Carl Dukatz, Accenture
9:00	Keynote 1: Nicholas Harrigan, Product Marketing Manager, NVIDIA
9:30	Keynote 2: Ismael Faro, Vice President, Quantum + AI, IBM
10:00	Keynote 3: Hongbin Liu, Principal Quantum Engineering Manager, Microsoft
10:30	Break
10:45	Keynote 4: Tomer Lancewicki, Director of Machine Learning, Walmart Global Tech
11:15	Keynote 5: Trevor Lanting, Chief Development Officer, D-Wave
11:45	Lunch
12:45	Lightning talks on demos, applications, use case examples, etc. • Kenny Heitritter, Quantum Research Scientist, qBraid, & Pedro Lopes, Quantum Advocate, QuEra • Carl Dukatz, Managing Director, Accenture • Kathleen Hamilton, Research Scientist, Oak Ridge National Laboratory • Daniel Pompa, Partner Manager, Quantinuum • Michael Brett, Head of Business Development, Quantum Technologies, Amazon Web Services
1:45	Break
2:00	Brainstorming activities in breakout groups
4:50	Next steps and final words
5:00	Adjournment

Appendix C: Workshop Participants

Thank you to all the workshop participants for sharing their time and perspectives.

Matthew Aleksich, Aleksco
Humberto Barona, Southern University and A&M College–Baton Rouge
Torey Battelle, Arizona State University
Yuval Baum, Q-CTRL
Kelly Best, Quantum Algorithms Institute
Michael Brett, Amazon Web Services
Scott Buchholz, Deloitte
John Buselli, IBM
Damir Cavar, Indiana University at Bloomington
Cierra Choucair, Universum Labs
Abhinav Deshpande, IBM
Carl Dukatz, Accenture
Ismael Faro, IBM
Nate Gemelke, QuEra Computing
Dina Ghanai, Castle Shield Holdings
Kevin Glynn, Northwestern University
Kathleen Hamilton, Oak Ridge National Laboratory
Amy Hanlon, SPIE
Nicholas Harrigan, NVIDIA
Natalie Hawkins, Seattle Quantum Computing Meetup
Kenny Heitritter, qBraid
Jill HowardAllen, University of Arizona
Shane Jefferies, BlueSummit
Jerone Jones, The ChainBlock Company, LLC
Lisa Lambert, Quantum Industry Canada
Tomer Lancewicki, Walmart Global Tech
Trevor Lanting, D-Wave
Hongbin Liu, Microsoft
Reinhold Mann, University of Tennessee at Chattanooga
Phani R. V. Marthi, Oak Ridge National Laboratory
Celia Merzbacher, Quantum Economic Development Consortium
Jacob Miller, Zapata AI (formerly)
Nathaniel Moulton, International Trade Administration
Rima Oueid, US Department of Energy
Scott Packard, Qubitekk

Changgyoo Park, Korea-US Quantum Technology Cooperation Center
Edward Parker, RAND
Daniel Pompa, Quantinuum
Michael Rabin, Los Alamos National Laboratory
Klaus Schuegraf, Photonic, Inc.
Efrat Shabtai, NVIDIA
Keeper Sharkey, ODE, L3C
Lucas Slattery, HRL Laboratories
Siddharth Suryanarayanan, Eaton Corp.
Constanza Vidal Bustamante, Center for a New American Security
Robert Warren, Hamamatsu
Carl Williams, CJW Quantum Consulting
Rowen Wu, Q-CTRL
Muqing Zheng, Pacific Northwest National Laboratory