U.S. Chamber of Commerce Foundation

Winning the Race for Quantum Supremacy

In recognition of World Quantum Day, the U.S. Chamber of Commerce Foundation, in partnership with the Boston Consulting Group, are sharing a high-level summary of significant findings from a war game conducted with U.S. public- and private-sector leaders.

For those interested in learning more about these findings, please contact:

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Background

The first nation to operationalize a fully error-corrected quantum computer will achieve significant advantages across corporate, military, and government infrastructures. This quantum-enabled nation could potentially break existing encryption methods, construct robust communication networks, and develop the world's most precise sensors.

Quantum computing is in its infancy, yet it's already projected to reach a staggering global market value of $1 trillion by 2035, according to the Center for a New American Security[1]. Countries that commercialize quantum technology quickly will gain a significant advantage when it comes to establishing market dominance, formulating quantum governance models, and catalyzing disruptive innovations.

Executive Summary

In December of 2023, four teams, each representing the public and private sectors of different global powers, set out with the goal of gaining an advantage in the quantum race. They adopted various strategies in an attempt to win a half-day war game simulation.

Throughout the exercise, the teams adjusted their strategies based on identified opportunities and vulnerabilities while deliberating complex questions on international relations and risks involving national security, cyber security, and financial institutions.

Methodology and Approach: War games are a powerful way to explore future states. These simulations are typically confined within specific divisions of government, military, or corporate structures. They are often used by companies to prepare for a variety of strategy-altering scenarios, such as financial crises, market entries in the pharmaceutical sector, climate change scenarios, and retail competition. However, the concept of conducting war games involving members of government and companies from diverse industries is a relatively novel and untapped solution. This approach provides a unique platform to prepare for major technological disruptions and fosters cross-industry collaboration and learning.

[1] https://www.cnas.org/publications/commentary/the-quads-quantum-leap-how-quad-countries-can-boost-cooperation-on-quantum-computing

Significant Findings

Alliance Strategies

Observations: The U.S. presumes that it holds a significant advantage over foreign nations in terms of adeptness at alliance building; however, inconsistencies in U.S. foreign policy across administrations affects quantum advancements and has the potential to undermine the foundation of American alliance structures related to quantum.

Takeaways: The fluctuating nature of U.S. foreign policy, with its shifts and changes across different administrations, poses a significant risk not just to the country's progress in quantum technology but also to the stability and reliability of its international alliances in this strategically important area.

While the Europeans have the most diverse menu of global alliances at their table, Australia, India, Japan, and Korea also surface as highly valued and sought-after allies being courted by global powers.

Recommendations: The U.S. should commit to a long-term, bipartisan quantum strategy. This strategy should include clear guidelines and objectives that remain consistent across administrations, ensuring a stable and predictable environment for both domestic and international partners. Furthermore, enhancing communication and collaboration mechanisms within existing alliances, specifically around quantum technologies, will be crucial. Establishing a dedicated quantum diplomacy initiative could facilitate these efforts, focusing on building trust, fostering technology exchange, and coordinating policies with allied nations to support collective advancement in quantum science and applications.

Furthermore, the courtship and competition for partnerships emphasize the need for aggressive alliance building, especially during times when the U.S. is perceived to be leading the quantum race. It is crucial to leverage this position of strength now, as the future landscape of quantum technology is dynamic and such a position of dominance is not guaranteed to last. Building robust alliances while ahead can provide a critical advantage against future uncertainties and shifts in the global quantum landscape.

Cybersecurity Implications

Observations: Private and public sectors in the U.S. both consistently underestimate the pace at which adversaries can exploit vulnerabilities introduced by advancements in quantum computing. These vulnerabilities could potentially compromise even today's most secure technology systems.

Takeaways: The security implications of quantum computing advancements are critically important for both technology and economic systems worldwide. As quantum technology progresses, it introduces new vulnerabilities into the most secure systems. This evolution necessitates a heightened focus on developing quantum-resistant security measures to protect critical infrastructure and sensitive information. For the U.S. and its global competitors, maintaining an advantage in quantum security is not just about technological superiority; it's about safeguarding economic stability and national security.

Recommendations: The rapid pace, dynamism, and inherent uncertainties in the race for quantum supremacy highlight an urgent need for prioritizing security measures specific to quantum technologies. It is imperative for the U.S. to prioritize the development and implementation of quantum-resistant security measures. This involves investing in quantum encryption technologies and secure quantum communication systems to protect against the unique threats posed by quantum computing capabilities.

Talent Acquisition and Retention

Observations: Despite the vibrant quantum startup community in the U.S., attracting and retaining quantum talent persists as a consistent challenge.

Takeaways: Adversaries can swiftly acquire quantum startups and talent at an unmatched pace. Such acquisitions accelerate quantum advancements and reshape the global leader board of quantum patents.

Recommendations: There is a critical need for policies and programs to attract and retain quantum talent such as a Quantum DARPA, an open visa program with allied nations, or extending H-1B and EB-1 visas for graduates in quantum-related fields.

The Commercial and Consumer Sides of Quantum

Observations: There is an overwhelming emphasis on the development of technology and research applications, leaving the wider commercial and consumer potential of quantum computing largely unexplored.

Takeaways: There's opportunity to expand quantum computing's use cases through a focus on consumer and commercial applications. This approach can drive financial growth within the quantum sector, creating a cycle of investment and innovation that accelerates technological advancement and market penetration.

Recommendations: To foster innovation and breakthroughs, especially those akin to what the U.S. startup ecosystem has historically achieved, it is crucial to prioritize the consumer side of quantum computing. This means not only focusing on the applications of quantum technology in research or industrial settings but also exploring ways to make quantum technologies accessible and beneficial to a broader consumer audience. Encouraging the development of consumer-focused quantum applications can stimulate a wave of innovation, potentially leading to significant breakthroughs. This approach requires engaging a wide array of stakeholders, including startups, to understand and integrate their unique insights and needs into the quantum development roadmap. By doing so, the quantum community can unlock new avenues for application, driving both technological advancement and market growth.

The Underutilization of the Private Sector

Observations: There is a keen desire from U.S. companies to revolutionize public-private partnerships to gather unclassified intelligence on adversaries' quantum industries and protect the U.S. against cyber-attacks. Policymakers often address the national security implications of quantum computing, yet similar discussions with private sector companies eager to contribute solutions are notably less frequent.

Takeaways: Fragmented responses by the U.S. public and private sectors pose a threat to quantum dominance, especially in the face of more unified actions of foreign governments in tandem with their private sectors.

Recommendations: As the U.S. navigates increasingly complex operating environments relative to quantum computing, public- and private-sector leaders need to recognize the importance of partnering to protect national security interests. To facilitate this collaboration, more frequent forums that bring together stakeholders from both sectors must be established. Additionally, initiatives such as federal grants can play a pivotal role in advancing research and collaboration on quantum technologies, fostering an ecosystem where shared goals, particularly in national security, can be more effectively pursued.

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