Opening Statement

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Regarding Quantum and AI Technology

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Chairwoman Mace, Ranking Member Connolly, and distinguished Members of the subcommittee, thank you for this opportunity to testify before you today.

Today, I represent IBM Quantum, where we have two goals: 1. to bring usable quantum computing to industry and research, and 2. to make our digital infrastructure quantum safe. We have a network of over 200 industry and research partners exploring the use of quantum computing for business and science, and have developed technology to make the transition to quantum safe cryptography easier.

There is a common perception that classical computers can solve any problem if they are just big enough. That is not the case. There are a whole class of exponential problems that classical computers are not good at, and never really will be.

When I talk to leading US companies about their unsolved problems that if solved could bring them huge economic benefit --- these exponential problems turn up everywhere. Some of these longstanding problems could be solved with a combination of quantum computing and artificial intelligence.

Quantum computing is a rapidly advancing and radically different computing paradigm which could launch a new age of human discovery. Just seven years ago, the notion of a quantum developer did not exist. IBM was the first to put a real quantum computer on the cloud, and at the time, it was just five qubits. Today, IBM has systems of over 400 qubits. If we continue on our technology roadmap, by the middle of this decade we will have 4,000 qubit systems and will demonstrate the first practical use of quantum computing.

IBM has deployed over 60 systems, and our 500,000 registered users have published over 2,000 research papers. One key thread in this research is the application of quantum computation within artificial intelligence. Many of our partners have published research results using quantum machine learning techniques with IBM Quantum. Examples include financial institutions exploring quantum algorithms for improved fraud detection[1]; Boeing exploring optimization of composite materials for airplane wings[2]; and CERN exploring applications in high-energy physics[3].

[1] https://arxiv.org/abs/2208.07963

[2] https://mediacenter.ibm.com/media/Boeing+seeks+new+ways+to+engineer+strong%2C+lightweight+materials/1_xwi1ev1p

[3] https://www.ibm.com/case-studies/cern/

One primary reason quantum computing has benefit for artificial intelligence is because it uses a different method to find patterns in data. For example, in fraud detection a quantum algorithm may be better at detecting true fraud and reducing false positives. A data scientist may choose to use either a quantum fraud model or a classical AI fraud model or a combination for the best results. Put simply, quantum will be another computational tool to use to improve AI results.

Generally, we see the future of computing as a combination of classical, specialized AI and quantum computing resources. It will not be based solely on classical bits, but rather built upon bits and neurons and quantum bits or qubits. This will enable the next generation of intelligent mission critical systems and accelerate the rate of science-driven discovery. Researchers, companies and governments that leverage this technology will have a distinct competitive advantage.

That leads to a critical point: when one examines the financial commitment other countries are making in quantum computing, our belief is the US government investment in driving this critical technology is insufficient to stay competitive. At its inception in 2018 the $1.27B National Quantum Initiative (NQI) stood as a leading public investment. Today, the planned global public investment in quantum technology is estimated to exceed $30B, with China at $15B.[4] It is critical that we not only reauthorize the NQI, but also

[4] https://qureca.com/overview-on-quantum-initiatives-worldwide-update-2022/

increase its investment levels in the research of use of quantum computers for mission critical applications.

The same importance for ethical and trustworthy AI applies whether classical compute or quantum compute underpins the solution. At IBM, we know that trustworthiness is key to AI adoption, and that the first step in promoting trust is effective risk management practices. Companies must have strong internal governance processes, including, among other things, (1) designating a lead AI ethics official responsible for its trustworthy AI strategy; and (2) standing up an AI Ethics Board as a centralized clearinghouse for resources to help guide that strategy.[5] IBM has implemented both. We continue to advocate others in industry do likewise.

Additionally, it is important to establish best practices for AI bias mitigation, similar to BSA's framework published in 2021.[6]

It is difficult to pinpoint the precise benefits, and possible challenges, presented by any new emerging technology. Quantum computing is no different. However, those countries that make investments in this transformative technology today will reap benefits in the years to come. Those countries that do not, will be at a competitive disadvantage in the future. At the same time, countries will also need to invest time and energy in developing an appropriate regulatory environment that

[5] https://www.ibm.com/policy/ai-precision-regulation/

[6] BSA | The Software Alliance "Confronting Bias: BSA's Framework to Build Trust in AI." https://ai.bsa.org/confronting-bias-bsas-framework-to-build-trust-in-ai/

supports the adoption of trustworthy AI regardless of the underlying compute technology.

Thank you again for inviting me to testify, and I look forward to today's discussion.