OPPORTUNITY 49

SCOPE WITHIN REACH

UNCERTAINTIES

Technology, Systems

MEGATRENDS

Increasing Technological and Biological Vulnerabilities

TRENDS

Advanced computing
Cross-sectoral partnerships
Data protection & privacy
Interoperability
Quantum technology

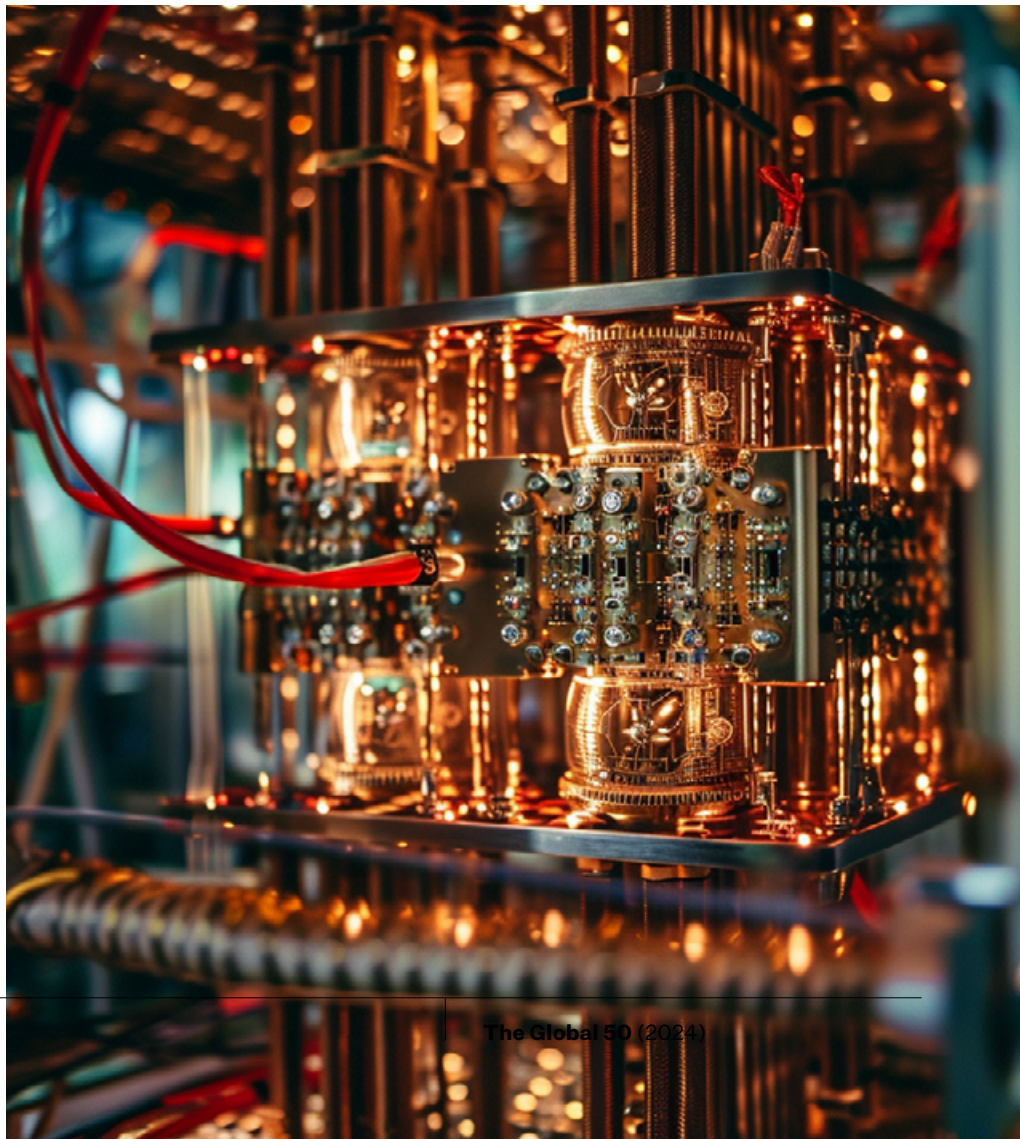
SECTORS IMPACTED

Communication Technologies & Systems
Data Science, AI & Machine Learning
Digital Goods & Services
Government Services
Health & Healthcare
Insurance & Reinsurance
Professional Services

What if we seamlessly transitioned into quantum computing?

THE QUANTUM JUMP

A data interoperability bridge that enables a secure and seamless data transition between quantum and classical computers.



WHY IT MATTERS TODAY

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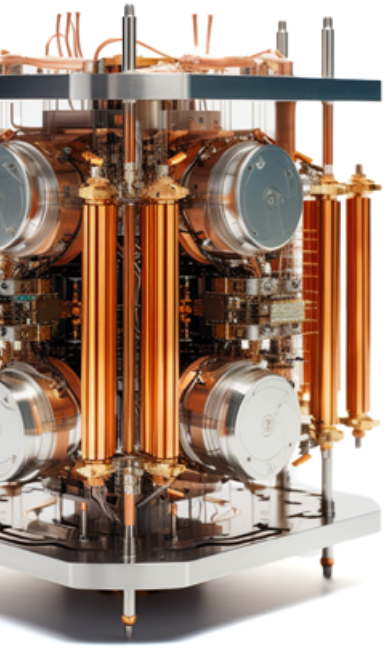
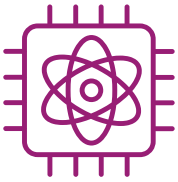


Quantum technologies have the potential to accelerate scientific discovery and innovation, radically transforming medicine, materials development, finance, and how we live, work and consume.[987] While quantum computing seems far away, some industry leaders expect it to make an impact as early as 2025.[988] The automotive, chemical, financial services, and life sciences sectors, which are expected to be among the first to benefit economically from quantum computing, could see a potential increase in value of up to $1.3 trillion by 2035.[989] The global quantum computing market was expected to reach $866 million in 2023 and is forecasted to reach $4.4 billion by 2028, growing at a CAGR of 38.3% from 2023 to 2028.[990]

Quantum computing is powerful, with computing speeds 158 million times faster than some of today's most sophisticated supercomputers.[991] Within a span of merely three years, quantum computing progressed from 24 qubits on a chip to over 400,[992] and in December 2023 IBM unveiled a new quantum computing chip of just over 1,000 qubits, laying the foundation for quantum computers reliable enough to consistently outperform conventional computers in real-world applications by 2033.[993] With this speed comes challenges and IBM have already announced that they will focus on technologies to ensure error-free operation of quantum computing given its high speed and as a result more frequent and varied errors.[994]

Perhaps the greatest impact will be when it is combined with other technologies that are themselves expected to advance. For example, combined with artificial intelligence (AI), quantum computing could, in 10 years, lead to computing power 100 times greater than today's and, in 20 years, 10,000 times greater.[995] Once available at scale, quantum computers can simulate complex chemical reactions that are difficult or impossible for classical computers, accelerating discovery of innovative materials[996] with lower computational cost while maintaining high accuracy.[997] Supply chains and logistics could be optimised, starting from better modelling in the short term to optimising logistics and analysing data in real time with edge computing.[998]

In preparation for this shift, the Open Quantum Institute (OQI) was launched at CERN and designed by the Geneva Science and Diplomacy Anticipator (GESDA) to ensure that quantum computing remains accessible to all around the world to avoid another digital divide.[999] The UAE's Technology Innovation Institute has also been working on Qibo, an open-source algorithm to enable deployment of quantum applications.[1000]



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OPPORTUNITY

A data interoperability bridge encompassing middleware[1001] solutions, amongst others, that provides unified and secure data exchange between quantum and classical computers allowing seamless connection and translation between both ensuring that specified outgoing data from classical computers are encrypted and error-free at the receiving end of a quantum computer. This is supported by a roadmap towards quantum transitions starting in areas that would have the greatest impact on society and a review of laws and regulations that would look at implications of the transition.[1002]

The shift to quantum computing will pose several challenges, including one which will be the integration with today's computers, with their different architectures, ensuring that we do not lose data or other critical information and that we achieve seamless quantum–classical communication.[1003] Otherwise, significant errors that will impact on society will occur and the expected advantages of quantum computing will fall short. Sensitive information will need to be secured through quantum-safe encryption techniques.[1004]

BENEFITS

The shift to quantum computing is seamless and data are safeguarded with minimal errors. Fast computing speeds transform medicine, materials development, finance, and other areas.

RISKS

The expensive and slow mobilisation of resources to build a data interoperability bridge could deepen the digital divide and lead to flawed quantum computing outputs and exposure of sensitive data, adversely affecting society.