



ENGAGE WITH QUANTUM COMPUTING NOW TO REAP EARLY ADVANTAGE



Why Quantum Computing?

Quantum computing is a unique computing paradigm that offers a substantial improvement over known classical approaches for certain types of problems. Quantum computers will complement classical computers for advanced operations like cryptography, modeling and database indexing. In Oct 2019, Google displayed quantum supremacy by pitching its 54-qubit Quantum Computer (QC) against supercomputer and claimed that its QC performed a calculation in 200 seconds that would take the world's fastest

supercomputer 10,000 years to produce a similar output. Quantum computing greatly enhances how information is stored and processed in areas like optimization problems, drug discovery, machine learning, crypto analysis, etc.

If quantum computers are so good, why don't we all have one? Well, it turns out that these are pretty difficult to make. Currently, quantum computers are at the same stage as classical computers were in the 1940s. In the 1940s, classical computers were massive, had limited bits and software was in infancy. The same is true for quantum computers currently.

One of the challenges is that QC has to keep its qubits protected from outside interference as these are extremely sensitive to any sort of external noise and electromagnetic radiation. Another problem is that qubits need to be kept at temperatures close to absolute zero, -273.15 degrees celsius, which is not easy. Due to complexity involved in housing and stabilizing the sensitive components of a quantum computer, it's expected that in the near future manufacturers will maintain them and customers will access their quantum computing capabilities via the cloud.

What is the usage in Financial Services?

In financial services, quantum computing would exponentially increase the speed of transactions powered by algorithms. It would provide significant advantage in areas such as cybersecurity, trading, asset management, AI, risk analytics and predictive capabilities and help in scaling up with much lower cost and resources.

According to Dr. Marcos Lopez de Prado, founder of Guggenheim Partners' Quantitative Investment Strategies and CEO of True Positive, "Quantum computing will become increasingly important over time," and "In 20 years, quantum computing will not be just an option. It may be our only option, from an energy perspective, let alone from a computational standpoint."

Several major players operating in the quantum computing market include - D-Wave Systems Inc. (Canada), QX Branch (US), International Business Machines Corporation (US), Cambridge Quantum Computing Limited (UK), 1QB Information Technologies (Canada), QC Ware, Corp.

(US), StationQ- Microsoft (US), Rigetti Computing (US), Google Inc. (US) and River Lane Research (US). Financial services organizations have started making major investments in quantum computing space, with Goldman Sachs and Fidelity investing in full-stack companies such as D-Wave, while RBS and Citigroup have invested in software players such as 1QBit and QC Ware. Capital market players such as JP Morgan, Goldman Sachs, Morgan Stanley, Nomura and Guggenheim Partners are spearheading the quantum computing revolution, as they feel it holds immense potential in trading risk assessments, predictions, and portfolio management. Consumer banks such as Barclays, Royal Bank of Scotland, Commerzbank, MUFG Bank, and Mizuho Financial are either investing in quantum computing firms or partnerships with vendors to focus on quantum computing.

JP Morgan Chase (JPMC) is gearing up for quantum leap by building "Quantum Culture" within the company. The bank has also established a partnership with IBM using which it can access IBM's quantum

Some of the use cases in financial services that have shown promise are:

1. *High-frequency trading (HFT)*
2. *Fraud detection*
3. *Portfolio risk optimization*
4. *Secure communications*
5. *Tokenization*

computers to test the applications and algorithms that can benefit from quantum capabilities. JPMC's research team is exploring how QC can be beneficial in various areas such as portfolio optimization, financial risk classification and option pricing.

Barclays too has partnered with IBM and is tinkering with IBM's 20-qubit prototype quantum computer via cloud. Its quantum team consisting of statistical modeling experts, physicists and computer scientists is actively writing quantum programs and executing them on IBM's QC to explore how it can provide competitive edge to the bank and help it beat the competition.

Final Thoughts - Early adoption for early advantage

Quantum computing has the potential to fundamentally transform the industry and solve problems with exponential speed. However, there is scarcity of quantum-skilled resources, so enterprises must act sooner than later. Early adopters of quantum computing will not only benefit from its diverse possibilities but will also play a key role in giving direction to the industry and set new standards. Although it would take some years before QC become mainstream, it is essential that organizations build an in-house Quantum Centre of Competency and engage now as its applications are being identified, tools and algorithms are created and, exclusive partnerships are being formed. Energy spent in this direction will amalgamate over time and provide first movers with

significant advantage.

On their journey towards adoption of quantum computing, enterprises need to identify their specific use cases where QC can offer a competitive advantage or makes business sense. Developing a quantum computing roadmap in alignment with enterprises' strategic intent will prove game changer.

As the spread of quantum computing increases, it may soon fall in the hands of people with malicious intention posing a compelling security threat that can be dealt only with quantum computers. So, getting your financial institution ready for such future risks, early adoption of quantum computing becomes all the more important. A quantum risk assessment can discover where these vulnerabilities are, their likelihood and impact, and the timeline in which these will unfold.



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