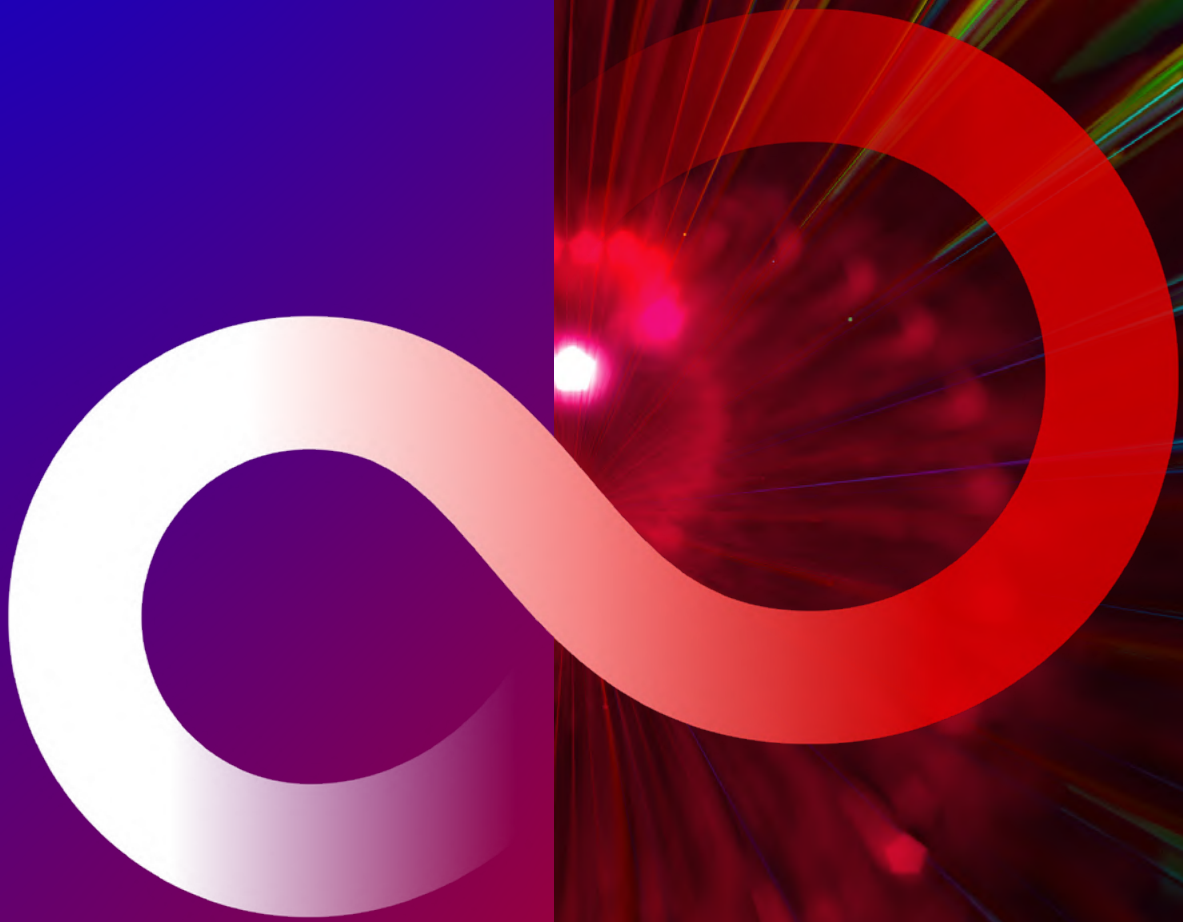


The Quantum Computing Question

What's the opportunity and how can it help me?



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Foreword

The quantum opportunity

In 1964, theoretical physicist, [Richard Feynman](#) [said](#), “I think I can safely say no one understands quantum mechanics.” Feel familiar?

In 1964, theoretical physicist, Richard Feynman said, “I think I can safely say no one understands quantum mechanics.” Feel familiar?

It's true that discussions about quantum mechanics have often sat alongside those of science fiction, ranging from cryogenics to electrons floating on liquid helium.

But as it exists today, quantum mechanics, is the foundation of quantum technologies. And it presents a very real opportunity for businesses in the form of compute power.

Whether that's material science development or the defence of critical national infrastructure, the power of quantum computing is creating new, accessible possibilities for many industries.

Because, at its core, quantum computing has the ability to process considerable amounts of data both faster and with less physical equipment than classical computation.

And now, we've entered a new chapter where usable and scalable quantum computing is available directly through the data centre.

So, what does this mean for industries today? Who's set to benefit from the quantum computing industry? **And what does this mean for your business?**

In this eBook, we'll be answering these questions – exploring the landscape and the current benefits available, while also considering the future potential for organisations and industries that embrace quantum technology.

We'll also consider the practical applications as they exist today as well as how businesses can get started with quantum computing – turning fiction into fact, with real benefits today and tomorrow.

David Snelling,
Global Fujitsu Distinguished Engineer

Understanding quantum computing

Nearly two thirds (65%) of business and technology decision-makers and influencers worldwide believe quantum computing will be important to their organisation, according to [Forrester's Priorities Survey 2022](#).

Though development of the technology started at the turn of the millennia, we've only just started to see the early stages of commercial adoption.

But if this adoption is to increase, there needs to be an increase in accessibility: both in how we use and talk about quantum computing.

And while there is a lot of research and information out to digest on quantum computing, not all of us can – or might want to – be physicists.

So, to understand the opportunities made available by quantum computing today, it's important to first reflect on its founding principles:

Qubit: the quantum building block

Otherwise known as a 'quantum bit,' a qubit is the elemental unit of quantum information.



Superposition

Through qubits, objects can exist in multiple states at the same time – otherwise known as superposition.

Another way to think of this is as Schrödinger's cat. While the box is closed, the cat is both dead and alive, existing in a superposition of the two states.



Entanglement

Quantum entanglement is when two particles become tied together – closely connected even when separated by vast differences.

When entangled, changing the state of one qubit will instantaneously change the state of another paired qubit – rapidly improving processing speeds.

These three concepts form the foundation of quantum computing. Together, these concepts enable the immense power of quantum to tackle problems that are otherwise too impractical or time-consuming for conventional computers.

Simon Philips at Oxford Quantum Circuits (OQC) uses the analogy of processing a caffeine molecule to demonstrate the sizable curve of data manipulation made possible by quantum:

“Simulating one caffeine molecule would require the processing power of classical transistors 1/10 the size of the earth, compared to just one quantum computer.”

Philips’ example underscores the potential of quantum computing to revolutionise traditional computation processes, but there’s still a lot to understand about its full potential.

Namely, how do we translate quantum phenomena into something tangible?

For David Snelling at Fujitsu:

“When it comes to quantum computing, it’s currently like we’re trying to convince people they can watch television... it’s early days, but the profundity of the revolution we face means planning for the future now, not tomorrow, to avoid problems.”

And that’s why partnerships between leaders in the space, such as Fujitsu and OQC, are critically important to help businesses and wider industries see the true potential of quantum computing and welcome in a new era where traditional rules no longer apply.

H2: How can quantum computing help me now, and tomorrow?

According to McKinsey, quantum computing is likely to have the earliest economic impact across the automotive, chemicals, financial services and life sciences sectors – with potentially \$1.3 trillion in value to gain by 2035.

It's clear the ability to rapidly accelerate information processing and R&D means quantum computing could drive significant economic advantages worldwide.

As further research and development continues, the technology available could help us solve some of the biggest problems facing the world today – from drug research breakthroughs to carbon capture.

But what does this really mean for individual businesses? And how could we see these benefits manifest practically across these industries?

When applied in a commercial setting, quantum computing can currently offer businesses:

A new generation of problem-solving

Quantum computers operate according to entirely new rules, unlocking the potential for unprecedented problem-solving capabilities – with the ability to perform tasks faster and tackle problems far beyond the reach of classical computers.

Support to achieve sustainability goals

The ability to process information and develop new applications at accelerated pace can be used to address sustainability goals for businesses across the globe – from battery development to carbon capture and reducing the energy impact of data centres.

Revolutions for industries and economies

The quantum sector now contributes an estimated £1.7bn to the UK economy and holds the potential to deliver much more. Currently, the industries most likely to benefit include financial services, operations, logistics, pharmaceuticals and security – with worldwide economic advantages.

Across industries, however, the opportunities quantum computing provides – from supporting sustainability to economic advantages – are vast and nuanced. What

works for one company or industry, might not be the right application of quantum technology for another. Here's some examples:

Example:

Chemical research

Quantum computing enables better models to simulate how atoms interact with one another – delivering precise results to help us understand molecular structure. From drug production to the energy industry, the predictive power of quantum computers could impact how new products are developed – with both efficiency and accuracy.

Example:

Financial modelling

Modelling the behaviour of investments is critical to many financial services organisations and quantum computing can help at scale – and with better accuracy. Not only could this help reduce risk, but it could also support trend and movement analysis across the global financial economy.

Quantum spotlight:

HSCBC

HSBC is using quantum computing to help the financial services institution solve problems that are intractable with current computing

By using our Quantum Value Assessment to first assess its organisation, HSBC was able to establish its quantum-readiness, the areas that could benefit most, and how to drive results in the short and long-term.

“Quantum computing has become an important part of our innovation agenda,” shares Philip Intallura, Quantum Computing Business Lead HSBC. “What we’re looking for is the sweet spot between quantum feasibility, commercial and customer impact and timescale advantage.”

With Fujitsu's engineering capabilities and quantum knowledge, HSBC was able to narrow down its potential quantum use cases – identifying and taking forward only the opportunities set to have the biggest impact on the organisation.

[Watch the full story here.](#)



Discover your quantum future now with our Quantum Value Assessment:

Contextual exploration:

Collaborate with our experts and your domain specialists to delve into the unique threats and opportunities of quantum technology in your business context

Use case unveiling:

Uncover potential use cases and analyse them for real business value. We bring together the best minds, including our quantum specialists and partners, like OQC, to ensure comprehensive exploration

Experiments and validation:

We don't stop at analysis. We develop and run experiments to validate the possibilities, ensuring tangible and actionable insights – this is where potential aligns with opportunity.

The Quantum Value Assessment equips you with insights that are not just accurate but have a higher likelihood of being embraced by your organisation.

Ready to unlock your quantum advantage? Find out more here and schedule your Quantum Value Assessment.

Why now?

Navigating the quantum landscape is far from simple. And maintaining quantum states, from initiation to readout, requires specialist skills.

Navigating quantum complexity

What makes quantum computing both unique and demanding?

Cryogenic conditions	Cooling with helium	Ideal quantum platform
Quantum computers operate in a vacuum and in cryogenic conditions. This is because thermal energy can excite vibrational motion that can disturb computing operations.	The superconductivity of chips is enabled by dry fridges and helium pulse tube cryocoolers to achieve temperatures colder than space.	Electrons floating on liquid helium provides an ideal platform for quantum computing to be realised – free from impurities and defects.

The delicate dance of stability needs a cryogenic environment – with temperatures maintained at around -273 degrees Celsius – thermal noise minimisation and sustained coherence.

That’s where specialists, like Fujitsu and OQC, come to the fore. For us, it’s all about harnessing superconducting qubits, with faster gate speeds, solid-state fabrication and maturity – with superconductors leading the quantum technology forefront.

Our specialist knowledge in the area – alongside extensive research and continuous development – helps organisations with the tools and support to actually make quantum computing opportunities possible today.

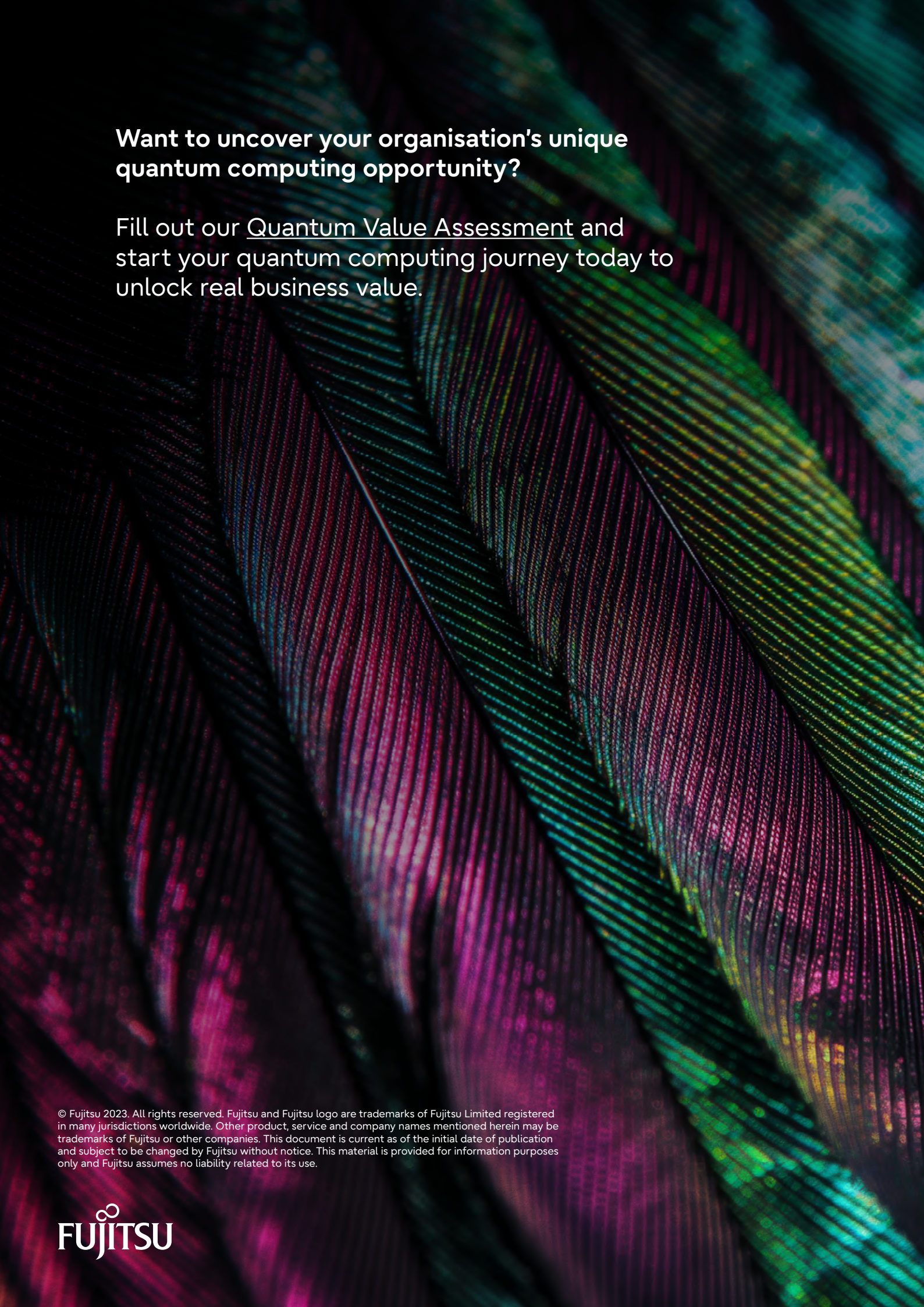
And thanks to OQC’s world-first integration of quantum into global data centres, the

accessibility of quantum computing is becoming an increasingly reachable reality for businesses.

Even though quantum computing is a big investment, it’s critically important to consider how quantum could enhance your organisation today, as well as ensure you remain competitive in years to come.

But it’s not about competitive parity. Rather, it’s about taking steps now to embrace quantum so you’re not on the back foot later – when it will be more difficult and expensive to catch up.

It’s about understanding what the quantum opportunity is, and how to take meaningful steps now to make it a reality for your organisation tomorrow.



Want to uncover your organisation's unique quantum computing opportunity?

Fill out our [Quantum Value Assessment](#) and start your quantum computing journey today to unlock real business value.

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