

Get ready for the quantum impact

Start planning and experimenting
with quantum computing today.

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Quantum computing technology is advancing rapidly, on track to enable vastly more complex business problems to be solved through enhanced optimization, machine learning and simulation.

This is bringing transformation potential to multiple industries, making it possible to discover new remedies in life sciences, improve wealth management scenarios in financial services, reroute supply chains in real time and more. However, a haphazard enterprise approach to quantum—such as researching only a single use case or proceeding without a cohesive strategy—yields exactly what you would expect: innovative sparks with no lasting business value.

Innovation is now table stakes for the modern business; companies must harness technology to outmaneuver uncertainty and meet new customer and business ecosystem expectations. Quantum computing stands to be one of the most disruptive technologies of all time, and competitive advantage will be based on which companies can leverage the potential of quantum to solve key business problems and generate important insights about customers, operations and strategies to transform their business.

According to Tractica, spending on quantum computing will surge from

\$260M in 2020 to **\$9.1B** by 2030

Enterprises should start preparing now as the technology continues to mature. Waiting until quantum computing is mainstream will be too late. Your preparation should include developing a business and IT strategy that enables quantum innovation at speed and scale.

To capture value while reducing risk, consider these steps:

- 1** Learn what quantum can do and decide where it applies to your business
- 2** Build a quantum innovation roadmap
- 3** Evaluate quantum hardware and software and start experimenting
- 4** Source or develop quantum talent

True innovation—both visionary and applied—requires a comprehensive approach and the right partnerships across the quantum ecosystem.

Now is the time to shape and accelerate your enterprise journey to improve performance in a quantum-powered future while creating lasting value.

Two approaches, three fields of application



To capture value while reducing risk, consider these steps:

In **analog quantum computing**, information is processed continuously. Analog quantum simulation is a well-known application, in which a fully controllable analog quantum computer is used to efficiently simulate the complex evolution of a targeted quantum system. Adiabatic and quantum annealing computers belong to this category.

In **digital quantum computing**, information is processed by a quantum algorithm, which is a discrete sequence of logical quantum gates. Many existing quantum algorithms are known to hold advantage in algorithmic complexity over their classical counterparts. Information in digital quantum computers can be protected by quantum error-correcting codes, which lays a promising future for a fault-tolerant quantum computer.

*In addition, specially designed classical computers known as **quantum-inspired hardware** are able to process problems that are natural to certain quantum computational methods, but they do not use any quantum-mechanical phenomena to arrive at a solution.*

Some enterprises are taking a hybrid systems approach, deploying quantum hardware to solve certain parts of a large business problem and using high-performance classical computing to address the rest.

1

Optimization

(traveling salesman, decision/planning in logistics, scheduling)

2

Machine Learning Algorithms

(feature mapping, solving linear equations, clustering, regression)

3

Sampling and Simulation

(chemistry, material science, structural design)

From Exploration to Industrialization

Before diving into the specific steps, consider why haphazard quantum exploration produces only short-term sparks, not long-term business readiness. Such exploration requires a shift in enterprise approach.

They usually make a bottom-up request for funding and start with a single business challenge that defies existing computing models or takes too long to solve with classical computing.

Currently, this exploration is done in conjunction with a small ecosystem of companies with true quantum hardware that they make available for other companies to test solutions. For example, a pharmaceutical company might invest in quantum within its computational drug research lab and try teaming with a quantum hardware vendor to build knowledge. Or a financial services company might invest within its quantitative analysis

group (because an expert in the area has started to research quantum) and seek a quantum hardware company to help test assets for future use.

While this approach can be educational, it tends to produce “hit-and-miss” sparks.

On the plus side, it may generate intellectual property in the form of research papers.

To date, most companies that have begun exploring quantum computing have conducted niche R&D in lab settings.

Or it may inspire a new approach that can be run today with classical computing hardware.

However, exploratory R&D is labor intensive, time consuming and siloed. It does not consider the larger applicability of quantum across many other aspects of a corporate strategy, and the outputs are generally not reusable by other parts of the company.

In order to solve real-world business problems at scale—for example, in financial portfolio optimization, manufacturing efficiencies and more—the management of quantum computing must shift toward IT services that are integrated into the enterprise infrastructure.

90%

of organizations will partner with consulting companies or full-stack providers to accelerate quantum computing innovation through 2023, according to Gartner.²

Today, Accenture sees increasing enterprise demand for quantum computing programs that provide long-term business value, beginning with a detailed understanding of how quantum impacts companies in a broader sense—across the business, R&D, IT and security practices.

Ideally, this business-centric, IT-driven approach will use a modern consumption model that is abstracted from the underlying hardware and fully integrates with enterprise services and data sources. Designating quantum leads from both the business

and IT departments and extending the availability of quantum methods across the organization will encourage engagement, increase understanding and create more opportunities for innovative sparks that can turn into fire (i.e., business value). In the future, this approach could also use quantum architecture stacks that automatically select the most appropriate compute power to solve a given problem. Taking this top-down and industrialized approach to quantum computing is the pathway to innovating at speed and scale.

This piece is an excerpt of Accenture's Get Ready for the Quantum Impact perspective. To read the full report, please visit <https://www.accenture.com/us-en/insights/technology/quantum-impact>.

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