Emerging Market Quadrant for Quantum Computing — Established Vendors

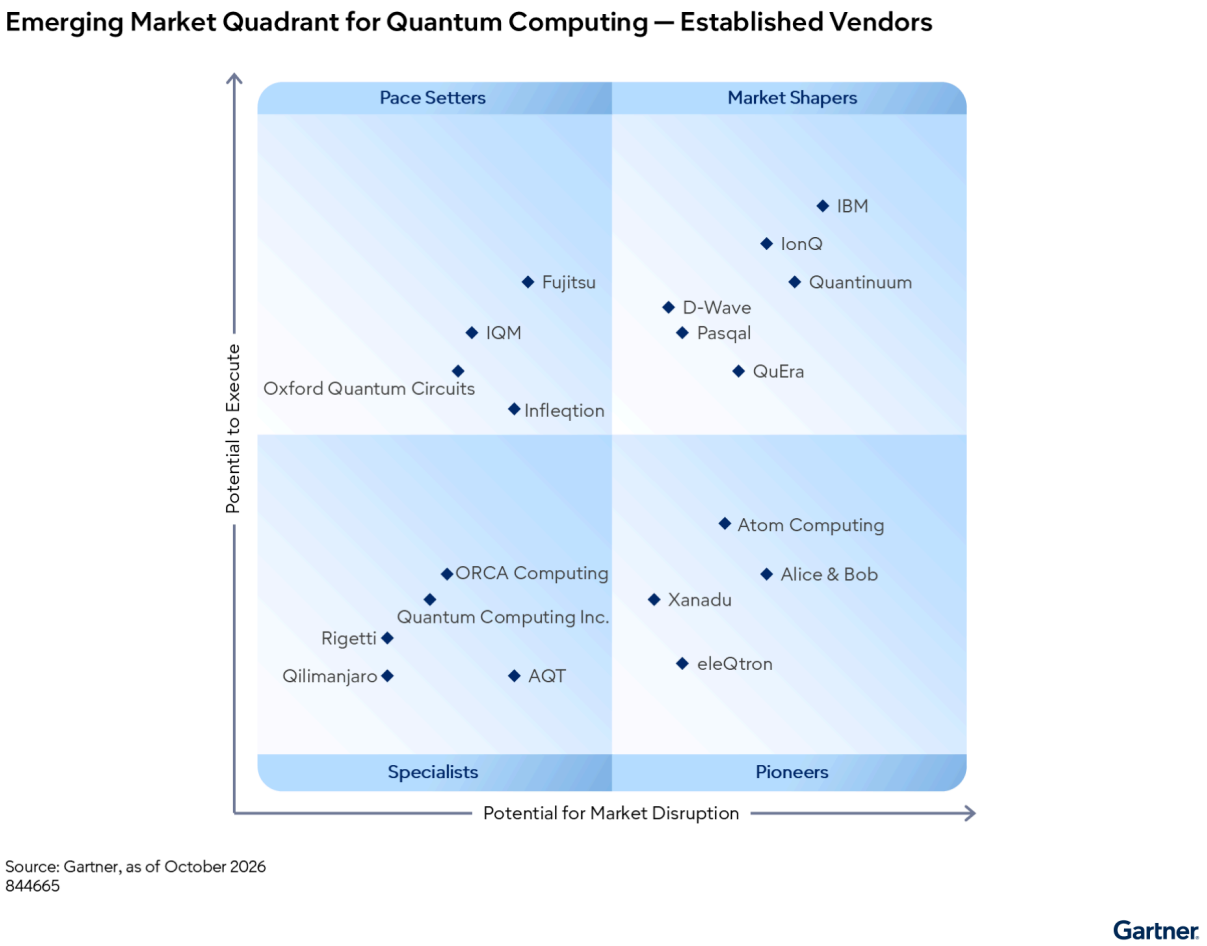
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Initiatives: Technologies and Markets

Established quantum computing vendors offer commercial services with their quantum computers, delivered either as systems or via cloud access, but their technical capabilities and transformative potential vary. CIOs should choose the vendor that supports their most critical use case.

Figure 1: Emerging Market Quadrant for Quantum Computing — Established Vendors



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Summary Market Definition

Gartner defines quantum computing as a nonclassical computing architecture that operates on the quantum state of subatomic particles that represent information called qubits. This market includes well-established vendors and numerous startups, with offerings ranging from hardware to entire software suites with compilers and middleware. Some even offer use-case libraries, control electronics and integration with high-performance computing (HPC) and AI. Current users are CIOs and chief technology officers (CTOs). Performance is evaluated on scalability metrics, like qubit count, logical qubits, gate fidelity or similar vendor-defined system benchmarks. For more, see the Detailed Market Definition section below.

Emerging Market Quadrant Analysis

Key Emerging Market Trends

Established vendors jockey for position in the quantum computing market by:

- **Establishing quantum advantage:** Quantum vendors are working with their customers on specific use cases to prove quantum advantage, but the definition of quantum advantage is still murky. Vendors are claiming that customers can achieve more with quantum computing (QC) today than they can with classical computing, or that QC can help them achieve the same outcomes faster, more efficiently or at a lower cost. Be skeptical of these claims.
- **Racing toward fault-tolerant quantum computing (FTQC):** All quantum vendors are focused on achieving FTQC by prioritizing error correction and mitigation techniques. FTQC operates reliably by definition, even when its underlying hardware is noisy and prone to errors. Current roadmaps project that FTQC will become a reality between 2028 and 2030.
- **Pursuing a range of different qubit modalities:** No single qubit modality is a winner today. Each comes with its own pros and cons and has unique challenges to scale. Significant market consolidation could occur if a small number of vendors with specific qubit modalities achieve FTQC.
- **Integrating their quantum computers with AI and high-performance computing (HPC):** Quantum computing will not exist in isolation, and integration with HPC/AI and classical computing will be critical in achieving results (see Infographic: Hybrid Quantum/Classical Journey for AI and HPC Use Cases).

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- **Shifting toward manufacturing partnerships:** As quantum vendors look to scale, establishing manufacturing partnerships or acquiring that capability has become critical. This is most evident today in the Market Shapers quadrant, but we expect this dynamic to be a key characteristic of eventual market leaders. Some relevant examples are the recent acquisition of SkyWater Foundry by IonQ and the establishment of Anderon by IBM. For more, see First Take: IonQ's Acquisition of SkyWater Takes Quantum Race From Lab to Factory and First Take: Washington's $2 Billion Quantum Bet Signals an IBM-Centric Model.

- **Securing investments from governments:** Government investments in quantum computing now exceed venture capital, as nations race to achieve technology leadership. Vendors are racing to support emerging technology demand in the public sector.

- **Focusing on software, libraries and ecosystem:** Scaling quantum computing won't just be achieved by hardware maturity, but it will require a complete ecosystem with trained programmers, use-case templates and support for algorithms and the middleware stack.

Emerging Market Quadrant Analysis

Gartner's Emerging Market Quadrant is designed to help clients understand the dynamics of relatively new and fast-moving market capabilities and form shortlists of technology providers to explore when making tech buying, partnering, acquisition and investment decisions. For more information on the underlying methodology, see How Markets and Vendors Are Evaluated in Gartner Emerging Market Quadrants.

An Emerging Market Quadrant is not an exhaustive analysis of every tech provider in an emerging market. It is a focused analysis of the providers Gartner analysts believe are most indicative of the market and most relevant for Gartner's technology buyer clients who are exploring engaging in the emerging market.

Market Shapers: Delivering Transformative Solutions With Fewer Risks

The assessment of this quadrant is based on Gartner's opinion of the collective characteristics of its featured vendors: D-Wave, IBM, IonQ, Pasqal, Quantinuum and QuEra.

Analysis of Disruptive Potential

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Across diverse physical qubit architectures, these vendors maintain a distinct competitive advantage through strong technical capabilities and a vast ecosystem of partners. They are building solutions capable of fundamentally replacing classical computing bottlenecks rather than simply augmenting existing workflows.

They demonstrate both high depth and breadth of market impact by tackling foundational computational challenges across diverse sectors, while focusing on specific areas that can deliver near-term ROI. *They are moving past pure research experiments to deliver scalable fault-tolerant architectures, high-fidelity logical qubits, long-term roadmaps, and enterprise quantum software stacks that redefine what is computationally possible.*

> **Case Example: Scaling Quantum-Centric Supercomputing for Complex Molecular Simulations**
>
> **Goal:** Apply quantum-centric supercomputing to complex molecular systems and advanced energy materials by efficiently distributing calculations across quantum and classical resources.
>
> **Situation:** A research team attempted to simulate a 303-atom protein by splitting the calculation into smaller problems assigned to quantum or classical resources. However, scale became a significant challenge because the computational cost of building each molecular fragment grew with the total size of the whole molecule and the complexity of the interactions modeled.
>
> **Implication:** Without overcoming this scaling barrier, simulations of larger, more complex systems, such as advanced protein-drug interactions or materials necessary for fusion energy, would remain computationally prohibitive and effectively out of reach.
>
> **Resolution:** The collaborative research partners removed the scaling ceiling by redesigning how a fragment captures its molecular surroundings, making the computational cost dependent only on the local environment rather than the entire molecule. This breakthrough enabled simulations of protein-drug systems exceeding 12,000 atoms (more than 40 times the previous scale) and successfully extended exactly the same methodology to support critical fusion energy research involving molten salt.

Analysis of Potential to Execute

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These vendors have deep financial backing, mature leadership and extensive critical partnerships that allow them to successfully scale and deliver their technologies and to sustain their market positions. These characteristics also insulate them from the operational risks that Pioneers and Specialists face. Market Shapers have proven their ability to reliably deliver and support cutting-edge systems in commercial environments, making them generally less risky bets for technology buyers seeking transformation.

They have built strong partnerships with major public cloud platforms to offer quantum computing as a service (QCaaS), and they have the operational capacity to maintain aggressive technology roadmaps, support global client deployments and successfully navigate complex supply chains. These vendors are low-risk, high-impact leaders of the emerging quantum market.

Recommended Actions

- Select Market Shapers for core, mission-critical transformation projects where replacing classical computational bottlenecks is necessary to achieve near-term ROI.
- Use these vendors as low-risk, scalable partners to derisk quantum adoption through their cloud-accessible infrastructure (i.e., QCaaS), robust partner ecosystems and proven operational stability.

Pace Setters: Consistently Bringing Steady, Augmentative Innovation

The assessment of this quadrant is based on Gartner's opinion of the collective characteristics of its featured vendors: Fujitsu, Infleqtion, IQM and Oxford Quantum Circuits.

Analysis of Disruptive Potential

These vendors prioritize steady, evolutionary change with lower implementation risks and costs, offering solutions designed to augment current enterprise technologies and workflows. Rather than attempting to immediately replace classical computing paradigms, their priority is to offer near-term utility, *such as by integrating quantum processors into existing HPC centers, data center colocation facilities and hybrid classical-quantum workflows. They also have enterprise IT experience to deliver production-grade hardware.*

As a result, these vendors offer stable, predictable adoption pathways that minimize operational friction for tech buyers.

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Case Example: Integrating Quantum-Classical Infrastructure for Hybrid Workflows

Goal: Deliver immediate business value and prepare organizations for next-generation computational advantages by building an end-to-end, integrated quantum-AI-HPC platform.

Situation: A superconducting quantum computer was deployed to a national research institute as part of a comprehensive quantum-classical infrastructure. The deployment integrated quantum processors, GPU supercomputers, quantum-inspired computing technologies and specialized platform software to support hybrid workflows.

Implication: Treating quantum computing as a stand-alone technology limits its practical utility, delaying organizations from building necessary skills and applications for the FTQC era.

Resolution: By bridging quantum processors, GPU-based simulation, AI and HPC to create a unified platform, the infrastructure enables advanced hybrid workflows. This allows organizations to validate future quantum applications today and build critical technical skills ahead of FTQC.

Analysis of Potential to Execute

These vendors demonstrate operational maturity, with robust resources and partner ecosystems. *Some Pace Setters have supercomputing infrastructure experience, while others have specialized human resources and targeted capital to deliver production-grade hardware into enterprise environments.* Their potential to execute is driven by strategic partnerships, including direct deployment into commercial data centers, national supercomputing hubs and public cloud networks.

By establishing reliable delivery models, such as QCaaS and on-premises HPC integrations, Pace Setters have proven their ability to consistently bring solutions to market while maintaining low implementation costs and operational risks for their clients.

Recommended Actions

- Engage Pace Setters when seeking steady, evolutionary improvements that augment existing classical or high-performance computing workflows with near-term quantum utility and minimal operational friction.
- Use these providers to deploy reliable, production-grade hybrid solutions via on-premises HPC integrations or QCaaS models that maintain low implementation costs and operational risks.

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Pioneers: High Transformative Potential With Possible Risks

The assessment of this quadrant is based on Gartner's opinion of the collective characteristics of its featured vendors: Alice & Bob, Atom Computing, eleQtron and Xanadu.

Analysis of Disruptive Potential

These vendors are offering transformative business value, providing solutions that are highly innovative and significantly different from existing capabilities generally available in the market. *Examples of innovation in the quadrant include architectures that leverage advanced qubit architectures to solve error correction and scaling, intrinsically suppress bit-flip errors at the hardware level, or provide machine learning frameworks and proprietary control systems.* They focus on core hardware and software challenges to solve the scaling bottlenecks of current computing paradigms.

> **Case Example: Establishing a Commercial Quantum Computing Center to Accelerate Regional Ecosystems**
>
> **Goal:** Establish a commercial quantum computing center to provide researchers and industries with advanced quantum error-correction capabilities that accelerate the development of a regional quantum ecosystem.
>
> **Situation:** An on-premises quantum computer was commercially deployed in partnership with a major technology provider. However, introducing this new class of computing technology presented a challenge: establishing the prerequisite infrastructure, technical expertise and supportive ecosystem.
>
> **Implication:** Failing to build this foundational support network would prevent academic and industry organizations from conducting critical error-correction research, developing logical-qubit algorithms and achieving workforce readiness for future FTQC.
>
> **Resolution:** Hardware providers, technology partners and regional stakeholders collaborated to build the necessary infrastructure and ecosystem. This ensured users received access to leading-edge hardware alongside essential technical support, driving strong demand for early access and ensuring long-term adoption and impact.

Analysis of Potential to Execute

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Working with Pioneers carries higher risk for mainstream technology buyers, though it can potentially be less expensive and yield a higher return for those willing to partner with a vendor possessing access to highly transformative technology that is still scaling its execution capabilities. Since they lack the vast, preexisting enterprise infrastructure of Market Shapers, *Pioneers' execution relies heavily on targeted venture capital, specialized technical talent and strategic ecosystem partnerships with major technology companies. They offer early-access programs that allow enterprise clients to evaluate transformative technology ahead of mainstream commercial rollout.*

Recommended Actions

- Engage Pioneers for high-risk, high-reward R&D initiatives aimed at solving fundamental computational bottlenecks through novel, transformative quantum architectures.
- Hedge implementation risk by structuring flexible, phased partnerships that leverage venture-backed early-access programs to evaluate cutting-edge technology without making upfront enterprise infrastructure investments.

Specialists: Providing Flexible Solutions for Incremental Improvement

The assessment of this quadrant is based on Gartner's opinion of the collective characteristics of its featured vendors: AQT, ORCA Computing, Qilimanjaro, Quantum Computing Inc., and Rigetti.

Analysis of Disruptive Potential

These vendors offer solutions that provide steady, incremental improvements rather than full-scale market disruption or transformative business value. They offer more flexible solutions that favor evolutionary change, making them suitable for clients looking for complementary technologies to augment their current systems with lower implementation costs and risks. *They achieve it by using simpler hardware infrastructure and emulating quantum dynamics, or by focusing on specialized use cases. In certain cases, they deliver compact on-premises testbeds to complement current enterprise technologies and ways of working.*

> #### Case Example: Demonstrating Commercial Quantum Advantage in Production Workloads
>
> **Goal:** Achieve commercial quantum advantage by outperforming classical computing at an equivalent or lower total cost on real-world, production-scale enterprise workloads within standard data centers.

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> **Situation:** A next-generation system was developed and tested against a drug-design benchmark using an advanced AI model. The system required external validation of its computational capabilities and cost efficiency as graphics processing unit (GPU) counts scaled.
>
> **Implication:** Without demonstrating clear cost-efficiency and superior performance in real-world environments, quantum systems risk remaining theoretical and lack commercial viability for enterprise adoption.
>
> **Resolution:** Early tests showed that as computing power increased, the system's quantum approach outperformed traditional methods. This provided an externally validated proof point for commercial quantum advantage in practical, high-value applications, such as drug design.

Analysis of Potential to Execute

These vendors lack the deep financial resources or expansive ecosystem connections of Market Shapers or Pace Setters. However, because they focus on less risky, incremental solutions and can be potentially less expensive, Specialists remain a viable option for organizations seeking targeted, complementary innovations. Despite having a narrower commercial focus than vendors in other quadrants, their potential to execute is bolstered by targeted hardware strategies and deep engagements within specialized ecosystems.

Specialists execute by integrating standard commercial infrastructure, such as telecom networking equipment or modular server racks, to accelerate physical deployment and minimize ecosystem friction. They focus on complementing current enterprise technologies. Despite having limited resources and smaller ecosystems, these vendors successfully commercialize highly tailored, less risky solutions for clients looking to explore niche applications without overwhelming infrastructure investments.

Recommended Actions

- Select Specialists when seeking lower-cost, flexible and targeted solutions to solve niche use cases or augment existing systems with minimal hardware complexity and implementation risk.
- Partner with these vendors to run targeted trials or deploy compact on-premises testbeds without committing to heavy infrastructure investments or facing high switching costs.

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Detailed Market Definition

Gartner defines quantum computing as a nonclassical computing architecture that operates on the quantum state of subatomic particles that represent information called qubits. This market includes well-established vendors and numerous startups with offerings ranging from hardware to entire software suites with compilers and middleware. Some even offer use-case libraries, control electronics and integration with HPC and AI. Current users are CIOs and CTOs. Performance is evaluated on scalability metrics, like qubit count, logical qubits, gate fidelity or similar vendor-defined system benchmarks.

The primary purpose of quantum computing is to provide business value by solving complex computational problems that are beyond the scope of classical computers or where solutions could be faster, more efficient and more accurate than classical computers. Key areas where quantum computing could deliver significant impact include understanding interactions at the atomic or molecular level, drug discovery, carbon capture technologies and new materials for superefficient batteries.

Additionally, due to their unique properties of superposition and entanglement, quantum computers will be excellent for optimization problems, like portfolio management, traveling salesman problems, and logistics and supply chain optimization. It is important to understand that quantum computers are not general purpose computers, but for specific use cases. Product roadmaps for quantum computing should include planned system evolution, such as error correction, quantum advantage and achieving fault-tolerant quantum computing.

Mandatory Features

- A quantum computing hardware environment comprising a quantum processing system and supporting infrastructure required for operation, such as control electronics, cooling systems, vacuum systems, photonic components, readout technologies or similar architecture-specific hardware.
- Integration capability with classical systems (e.g., AI and HPC) with overarching platforms.
- A quantum software ecosystem, including application development, execution and abstraction tools, such as SDKs, libraries, compilers, middleware or platforms.

Optional Features

- Client support for writing algorithms for specific use cases that are quantum-specific or a hybrid of classical-quantum.

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- Quantum computing as a service in the cloud
- Use-case templates including support web compilers, libraries, etc.
- Professional services to leverage quantum computing for end users.

Recommended by the Authors

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Infographic: Hybrid Quantum/Classical Journey for AI and HPC Use Cases

Tool: Quantum Computing Readiness Assessment

Coolest Vendors in Quantum Computing, 2026

Executive Briefing on Emerging Technology: Quantum Computing

How to Start Building Your Quantum Computing Readiness

Roadmap for AI-Quantum Computing Convergence: Prioritize Strategy Over Hype

Forecasting the $2.3B Opportunity in Quantum Computing as Business Spending Scales

Quantum Belongs in R&D, Not in Your AI Stack Yet

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