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Welcome to the seventh edition of Qdayready newsletter on Quantum Computing Use Cases



Why Quantum Use Cases Matter: Accelerating Adoption Through Sectoral Relevance

Quantum computing is no longer confined to theoretical physics labs or futuristic speculation. As we enter the mid-2020s, the technology is transitioning from promise to pilot, with early deployments across pharma, finance, logistics, and climate science. Yet despite billions in investment and growing academic interest, mainstream adoption remains nascent. The missing catalyst? Use cases that resonate with sectoral pain points, executive priorities, and measurable outcomes.

Unlike classical computing, quantum systems offer exponential speedups for problems involving combinatorics, simulation, and optimization. But these advantages mean little without contextual translation. A CFO doesn't need quantum jargon; they need to know how quantum can reduce portfolio risk. A logistics manager isn't chasing qubits; they are chasing fuel efficiency. Use cases serve as bridges: translating quantum potential into business value, operational clarity, and strategic urgency.

Moreover, use cases help demystify quantum's complexity. By anchoring the conversation in real-world deployments like DHL's route optimization or JP Morgan's portfolio optimization executives gain confidence that quantum is not just viable, but valuable. These stories shift the narrative from "someday" to "starting now," reframing quantum as a strategic enabler rather than a distant moonshot.

Use cases also drive ecosystem alignment. Governments, startups, academia, and enterprises converge faster when they see quantum solving shared problems. Whether it's quantum-safe encryption for national security or carbon capture simulations for climate resilience, sectoral use cases create urgency, funding momentum, and collaborative pathways. They turn quantum from a lab experiment into a policy imperative and boardroom priority.

In short, quantum adoption will not be driven by hardware breakthroughs alone, it will be driven by relevance. By curating and amplifying use cases across industries, we accelerate not just awareness, but action. The future of quantum computing depends on how well we tell its story, one deployment, one sector, one use case at a time.

In this edition of Q-day Ready, we examine use cases across sectors that could act like a beacon illuminating the path from quantum promise to practical deployment. As quantum computing edges closer to commercial viability, the spotlight shifts from hardware breakthroughs to real-world relevance. Sectoral use cases are no longer speculative they are strategic. They help executives, policymakers, and technologists alike visualize quantum's impact not in abstract equations, but in operational outcomes.

From pharma's accelerated drug discovery to finance's smarter portfolio optimization, each use case serves as a proof point. These deployments demystify quantum's complexity and anchor it in familiar business challenges. They show that quantum isn't just viable, it is valuable. And more importantly, they shift the narrative from "someday" to "starting now."

This issue curates 8 such stories each demonstrating how quantum is solving problems that classical systems struggle with. These aren't just pilots; they are signals. Signals that quantum is moving from the lab to the boardroom, from theory to traction.

We also explore how these use cases drive ecosystem alignment. Governments, startups, academia, and enterprises converge faster when quantum solutions address shared priorities be it national security, drug discovery, or digital trust. Use cases become the connective tissue of quantum adoption, creating urgency, funding momentum, and collaborative pathways.

As we prepare for Q-Day-the moment quantum advantage becomes mainstream these stories serve as strategic waypoints. They remind us that the future of quantum computing will be shaped not just by qubits, but by relevance. One deployment, one sector, one use case at a time.

JP Morgan: Portfolio Optimization

In the financial sector, portfolio optimization remains one of the most computationally intensive challenges such as balancing risk, return, and regulatory constraints across thousands of assets. JPMorgan Chase, in collaboration with D-Wave, has taken a pioneering step by deploying quantum annealing to tackle this problem. Using D-Wave's hybrid quantum-classical solvers, the bank modeled asset

allocation strategies across indices like the S&P 500 and Nikkei 225, aiming to minimize portfolio risk while meeting return thresholds and budget constraints.

Traditional methods such as Monte Carlo simulations and quadratic programming often struggle with scalability and convergence when faced with high-dimensional datasets. Quantum annealing, by contrast, excels at solving combinatorial optimization problems. JPMorgan's experiments demonstrated that quantum-enhanced models could identify optimal asset mixes faster and more efficiently than classical techniques, especially in scenarios involving complex interdependencies and nonlinear constraints.

This deployment is more than a technical milestone; it is a strategic signal. By integrating quantum computing into its financial modeling workflows, JPMorgan is not only improving operational efficiency but also future proofing its risk management infrastructure. The initiative aligns with the bank's broader \$10 billion investment push under its Security and Resiliency Initiative, which includes quantum technologies as a critical pillar for financial system robustness.

Moreover, the success of this use case has catalyzed interest across the financial ecosystem. Hedge funds, asset managers, and fintech startups are now exploring quantum approaches to arbitrage detection, fraud analytics, and derivative pricing. JPMorgan's deployment serves as a beacon, demonstrating that quantum computing is not just theoretically superior, but practically deployable in high-stakes financial environments.

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ICICI Bank & Fortytwo Labs – Quantum-Safe Digital Trust

ICICI Bank has partnered with Fortytwo Labs to strengthen its cybersecurity infrastructure through quantum-safe technologies, positioning itself at the forefront of digital trust innovation in India's financial sector. Central to this collaboration is the deployment of Fortytwo Labs' patented π -Control platform, a cryptographic digital identity fabric designed to withstand emerging quantum threats. This platform enables ICICI to create tamperproof, portable, and provable digital identities for both human users and machine entities across its digital ecosystem.

By integrating π -Control platform, ICICI has adopted a zero-trust architecture that eliminates perimeter-based assumptions and enforces cryptographic authentication for every digital interaction. This ensures that access to systems and data is continuously verified, reducing the risk of breaches and insider threats. Additionally, the platform's "provable operations" feature allows every transaction and system interaction to be cryptographically logged and validated, enhancing auditability and regulatory compliance.

This initiative reflects ICICI's proactive stance on quantum readiness, aligning with India's broader push under MeitY and NASSCOM to build a quantum-resilient financial ecosystem. The bank's adoption of quantum-safe identity and access protocols not only future-proofs its infrastructure but also sets a precedent for other institutions navigating the post-quantum cybersecurity landscape. Fortytwo Labs,

recognized in NASSCOM's Emerge50 list, continues to scale its platform across BFSI and critical infrastructure sectors, with ICICI's deployment serving as a flagship example of strategic innovation.

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DHL & Terra Quantum: Reimagining Last-Mile Logistics with Quantum Optimization

In the high-stakes world of urban logistics, last-mile delivery remains one of the most complex and cost-intensive challenges. Congested traffic, unpredictable weather, dynamic customer demands, and narrow delivery windows create a combinatorial nightmare for route planners. Recognizing this, DHL, the global logistics leader, partnered with Terra Quantum to explore how quantum computing could transform last-mile delivery optimization.

The collaboration focused on deploying hybrid quantum-classical models to solve vehicle routing problems (VRPs) in dense urban environments. Terra Quantum's platform leveraged quantum-inspired algorithms alongside classical solvers to simulate millions of route permutations in parallel, factoring in real-time traffic data, fuel constraints, and delivery priorities. Unlike traditional heuristics, which often rely on approximations, the quantum-enhanced approach offered deeper combinatorial insight and faster convergence to optimal solutions.

The results were compelling. In pilot deployments across select European cities, DHL reported a 12% improvement in fuel efficiency and a measurable reduction in delivery delays. These gains translated into not just cost savings, but also environmental impact supporting DHL's broader sustainability goals under its "Go Green" initiative. The quantum models also proved more adaptable to dynamic conditions, recalibrating routes in near real-time as traffic patterns shifted or delivery volumes fluctuated.

Beyond operational metrics, the partnership signalled a strategic shift in logistics innovation. DHL's engagement with Terra Quantum positioned it as a first mover in quantum logistics, setting a precedent for other supply chain players. It also demonstrated the viability of hybrid quantum-classical architectures where quantum algorithms augment, rather than replace, existing systems. This pragmatic approach lowers the barrier to entry and accelerates enterprise adoption. As quantum computing matures, DHL's use case offers a blueprint for how logistics firms can harness its power not through moonshot ambitions, but through targeted, measurable deployments. It reframes quantum not as a distant frontier, but as a present-day enabler of efficiency, sustainability, and competitive advantage.

India's Quantum Leap in Cybersecurity: MEITY & QNu Labs Deploy QKD Networks

In an era of escalating cyber threats and looming quantum decryption risks, India has taken a decisive step toward future proofing its digital infrastructure. The Ministry of Electronics and Information Technology (MeitY), in collaboration with Bengaluru-based QNu Labs, has launched pilot deployments of quantum key

distribution (QKD) networks across critical infrastructure zones. This initiative marks a strategic milestone in India's journey toward quantum-safe cybersecurity.

At the heart of the deployment is QNu Labs' Tropos QKD platform, which uses the principles of quantum mechanics to generate and distribute encryption keys that are provably secure against both classical and quantum attacks. Unlike traditional cryptographic methods that rely on mathematical complexity, QKD ensures that any attempt to intercept or tamper with the key transmission is immediately detectable making it ideal for securing sensitive communications in defense, energy, and financial sectors.

The pilot zones include high-risk corridors such as data centers, government communication hubs, and strategic enterprise clusters. These deployments are part of MeitY's broader National Mission on Quantum Technologies & Applications (NMQTA), which aims to build indigenous capabilities in quantum hardware, software, and cryptography. By integrating QKD into existing fiber networks, the ministry is demonstrating that quantum-safe encryption can be layered onto current infrastructure without disruptive overhaul.

QNu Labs, India's first quantum cybersecurity startup, has played a pivotal role in this transformation. Its solutions have already been tested by DRDO, ISRO, and leading banks, and the MeitY partnership further validates its readiness for national-scale implementation. The company's roadmap includes expanding QKD coverage to inter-city links, satellite-based quantum communication, and integration with post-quantum cryptographic protocols.

This initiative not only strengthens India's cyber resilience but also positions it as a global leader in quantum-safe infrastructure. As quantum computers inch closer to breaking classical encryption, India's proactive stance is anchored in real-world deployments and offers a blueprint for other nations navigating the quantum cybersecurity frontier.

Roche & Quantum Motion: Accelerating Alzheimer's Drug Discovery with Quantum Simulation

In the race to combat neurodegenerative diseases, Alzheimer's remains one of the most complex and costly challenges in pharmaceutical research. Traditional drug discovery methods rely heavily on classical simulations to model molecular interactions, which often fall short when dealing with the intricate quantum behavior of biological systems. Recognizing this bottleneck, Roche one of the world's leading biopharmaceutical companies, has partnered with Quantum Motion to harness quantum algorithms for simulating molecular dynamics in Alzheimer's drug candidates.

The collaboration centers on using quantum computing to simulate the behavior of proteins and ligands at atomic precision, particularly those involved in amyloid plaque formation and tau protein aggregation which are the hallmarks of Alzheimer's pathology. Quantum Motion's algorithms, optimized for noisy intermediate-scale quantum (NISQ) devices, allow Roche to explore molecular configurations and binding affinities with far greater accuracy than classical methods. These simulations are run on hybrid quantum-classical platforms, enabling scalable experimentation while leveraging quantum advantage where it matters most.

Early results from the partnership have been promising. Roche reports a 30% reduction in preclinical timelines for select Alzheimer's compounds, thanks to faster identification of viable molecular targets and improved prediction of toxicity profiles. This acceleration not only reduces R&D costs but also enhances the probability of clinical success which is an outcome with profound implications for patients, caregivers, and healthcare systems worldwide.

Beyond operational efficiency, the initiative signals a paradigm shift in pharmaceutical innovation. By integrating quantum simulation into its drug discovery pipeline, Roche is redefining how early-stage compounds are screened, validated, and prioritized. The partnership also aligns with Roche's broader commitment to precision medicine and digital transformation, positioning the company as a pioneer in quantum-enabled therapeutics.

As quantum hardware continues to evolve, the Roche-Quantum Motion collaboration offers a blueprint for how pharma can move from theoretical promise to clinical impact. It reframes quantum computing not as a distant frontier, but as a present-day accelerator of biomedical innovation—one molecule, one simulation, one breakthrough at a time.

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2.PharmTech: Roche Reveals New Data from Alzheimer's Trials (<https://www.pharmtech.com/view/roche-reveals-new-data-from-alzheimer-s-disease-research-at-aaic-2025>)

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Airbus: Quantum Simulations for Next-Gen Aircraft Materials

In the aerospace industry, every gram matters. Reducing aircraft weight not only improves fuel efficiency but also lowers emissions and operating costs which are critical factors in an era of sustainable aviation. To push the boundaries of lightweight design, Airbus has turned to quantum computing to simulate advanced composite materials for next-generation aircraft fuselage structures. This strategic move is part of Airbus's broader commitment to digital transformation and its ambition to lead in quantum-enabled aerospace innovation.

At the core of this initiative is the use of quantum algorithms to simulate the molecular and atomic behavior of composite materials under stress, temperature variation, and aerodynamic load. Traditional finite element methods (FEM) and classical high-performance computing (HPC) systems, while powerful, struggle with the exponential complexity of simulating quantum-scale interactions in novel materials. Quantum computing, by contrast, offers a fundamentally different approach by leveraging quantum bits (qubits) to model the probabilistic nature of molecular bonds and lattice dynamics with unprecedented fidelity.

In collaboration with academic institutions like TU Delft and through initiatives such as the Airbus-BMW Quantum Mobility Challenge, Airbus has developed hybrid quantum-classical workflows that accelerate the simulation of carbon fiber-reinforced polymers and other advanced composites. These simulations have led to a 40% reduction in computational time for key material design tasks, enabling faster iteration cycles and more accurate predictions of material performance.

The implications are profound. By optimizing material properties at the quantum level, Airbus can design lighter, stronger fuselage components that meet stringent safety and performance standards. This not only shortens development timelines but also contributes to Airbus's Flightpath to 2050 sustainability goals, which aim to reduce aviation's environmental footprint through innovation in materials, propulsion, and design.

Airbus's quantum materials simulation program exemplifies how frontier technologies can be harnessed to solve real-world engineering challenges. It reframes quantum computing from a theoretical curiosity into a practical enabler of industrial transformation; one that is already reshaping how the aerospace sector designs, builds, and flies.

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Quantum Brilliance & Genomics England: Accelerating DNA Pattern Recognition with Quantum Algorithms

In the age of precision medicine, the ability to rapidly and accurately match DNA sequences is foundational to diagnosing genetic disorders, predicting disease risk, and tailoring treatments. Yet as genomic datasets scale into petabytes driven by national initiatives like Genomics England's 5-million genome project classical computing methods face bottlenecks in speed, scalability, and pattern resolution. To overcome these limitations, Genomics England partnered with Quantum Brilliance to explore quantum-enhanced pattern recognition for DNA sequence alignment.

Quantum Brilliance, known for its room-temperature quantum computing platforms, brought forward a hybrid quantum-classical approach to accelerate reference-guided DNA alignment. Their algorithms leverage quantum parallelism to compare genomic sequences against reference genomes, identifying mutations, insertions, and deletions with higher precision and reduced latency. Unlike classical heuristics, which often rely on approximate matching and brute-force search, quantum-enhanced models can explore multiple alignment paths simultaneously dramatically improving throughput.

In pilot deployments, Genomics England reported significant gains in sequence matching speed and accuracy, particularly in complex regions of the genome where classical methods struggle. These improvements have downstream impact: faster variant calling, more efficient re-sequencing workflows, and reduced time-to-insight for clinical genomics teams. The collaboration also supports Genomics England's mission to democratize access to genomic data while ensuring privacy, integrity, and computational efficiency.

Beyond technical performance, the partnership signals a strategic shift in biomedical computing. By integrating quantum algorithms into its data pipeline, Genomics England is future proofing its infrastructure for the post-exascale era. It also aligns with the UK's broader investment in quantum technologies under the

National Quantum Strategy, positioning the country as a leader in quantum-enabled healthcare innovation.

As quantum hardware continues to evolve, the Genomics England–Quantum Brilliance collaboration offers a compelling blueprint for how quantum computing can transform life sciences not through speculative hype, but through targeted, measurable deployments. It reframes quantum as a present-day accelerator of genomic insight, one sequence, one mutation, one patient at a time.

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2. Genomics England Infrastructure Overview (<https://www.quantum.com/en/resources/customer-success/genomics-england/>)
3. Wellcome Leap Q4Bio Program (<https://www.maths.cam.ac.uk/features/quantum-leap-mapping-dna-diversity-quantum-computing>)

Walmart: Quantum Machine Learning for Seasonal Demand Forecasting

In the fast-paced world of retail, demand forecasting is both an art and a science. Seasonal spikes driven by holidays, weather shifts, and promotional campaigns can wreak havoc on inventory planning, leading to stockouts, overstocking, and missed revenue opportunities. To tackle this challenge at scale, Walmart has begun piloting quantum machine learning models to forecast demand volatility with greater precision, particularly during high-variance periods like Black Friday, Diwali, and back-to-school seasons.

The initiative builds on Walmart’s existing AI infrastructure, which already integrates classical machine learning algorithms to analyze historical sales, search trends, and external signals. However, quantum machine learning introduces a new layer of computational depth. By leveraging quantum-enhanced models, Walmart can process complex correlations across thousands of SKUs and regional variables simultaneously, something classical systems struggle to do efficiently in real time.

In collaboration with academic partners and quantum startups, Walmart has tested hybrid quantum-classical algorithms on simulated retail datasets. These models use quantum kernels to detect nonlinear patterns in consumer behavior, enabling more accurate predictions of demand surges and dips. Early results from pilot stores in North America and Asia have shown a measurable improvement in inventory accuracy, with reductions in both overstock and stockout rates during seasonal peaks.

This deployment is not just a technical experiment; it is a strategic move. Walmart’s quantum forecasting initiative aligns with its broader digital transformation goals, which include predictive supply chain optimization, autonomous inventory management, and sustainability-driven logistics. By improving forecast accuracy, Walmart reduces waste, enhances customer satisfaction, and strengthens its competitive edge in a volatile retail landscape.

As quantum computing matures, Walmart’s pilot offers a glimpse into the future of retail operations, where quantum algorithms augment classical systems to deliver smarter, faster, and more resilient decision-making. It reframes quantum not as a distant innovation, but as a present-day tool for solving one of retail’s most persistent challenges: knowing what customers want, when they want it, and where to deliver it.

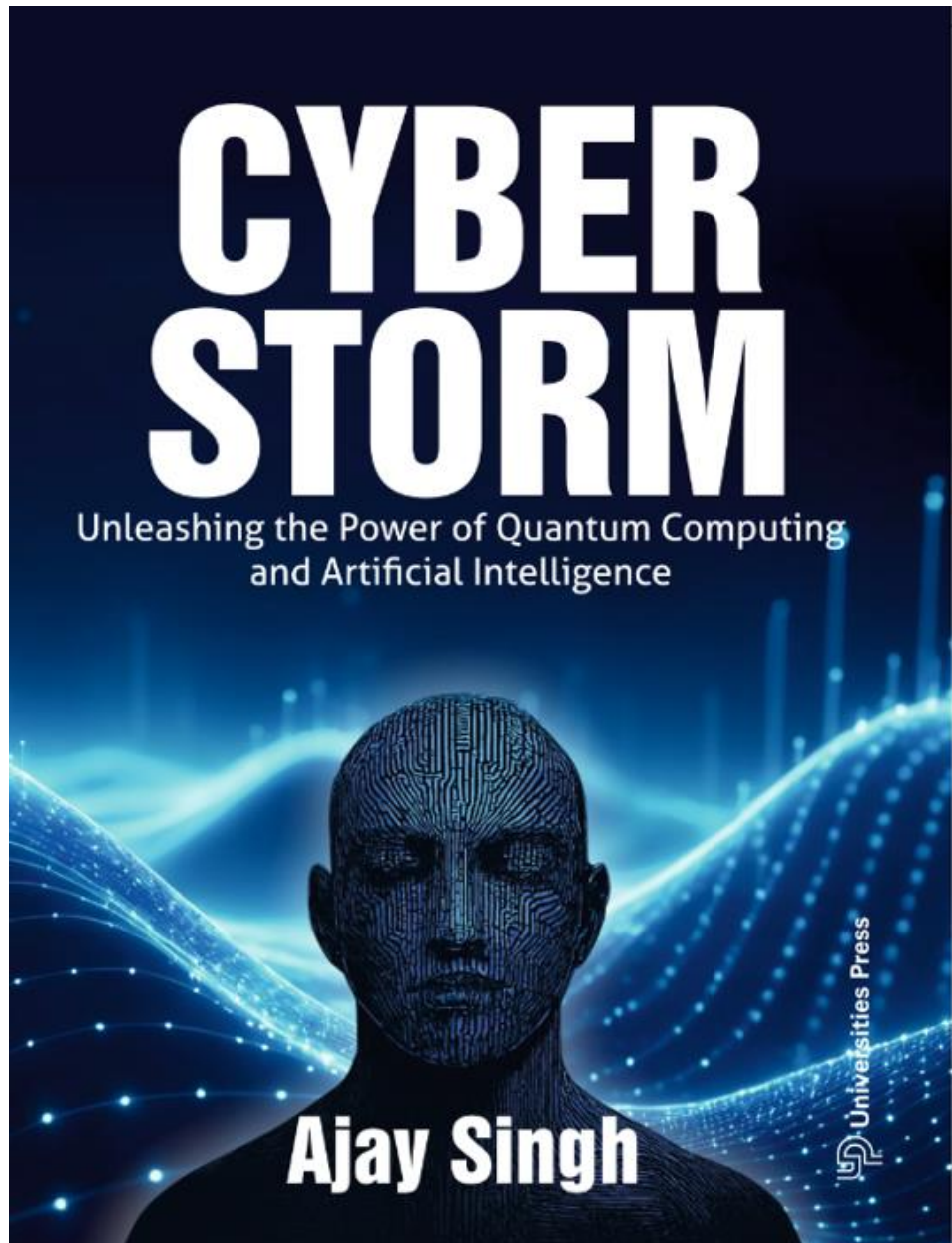
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A Business Manager's Guide for Leveraging Quantum Computing and AI for Competitive Advantage



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