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Quantum Economic Advantage:

Where the impact is already being felt

- **Investment is translating into infrastructure:** With more than $30 billion committed globally, quantum funding is shaping national research centers, supply chains, and industrial strategy long before full-scale quantum computing arrives.
- **The economic impact is already visible in near-term applications:** Quantum sensing, advanced timing, and quantum-safe cybersecurity are influencing the defense, energy, and telecommunications sectors today, not just in theory, but through contracts and pilot deployments.
- **Workforce and partnerships are the real leading indicators:** Hiring patterns, university-industry collaborations, and federal research programs reveal where economic momentum is concentrating first.
- **Regional ecosystems determine advantage:** States with strengths in aerospace, advanced manufacturing, and defense, including South Carolina, are participating through adjacent capabilities and applied research rather than waiting for a breakthrough moment.
- **Advantage compounds early:** Quantum economic leadership will belong to regions that treat it as infrastructure and build deliberately, aligning talent, research, and industry before the technology fully matures.

Quantum technology is still too often framed as a distant turning point, a dramatic day when fault-tolerant quantum computers eclipse classical systems and the world abruptly changes. While that storyline is compelling, it is incomplete. The economic impact of quantum is not a single breakthrough moment. It is already taking shape through capital flows, infrastructure build-out, and applied deployment.

The three pillars of quantum technology (computing, communication, and sensing) could generate up to $97 billion globally by 2035, potentially reaching $198 billion by 2040. Quantum computing revenue is projected to grow from about $4 billion in 2024 to as much as $72 billion by 2035. Quantum communication, already a $1.2 billion market in 2024, is expected to expand to $10.5–$14.9 billion by 2035, representing annual growth of roughly 22–25 percent (McKinsey, 2025). While funding cycles fluctuate, the sustained presence of private capital signals belief in near- to mid-term commercial pathways, particularly in quantum sensing, quantum-safe cryptography, and enabling hardware.

What is equally important is where capital is flowing. Even as funding cycles fluctuate, sustained private investment continues to concentrate in areas with clearer commercial traction. That signals confidence not in distant possibility, but in near- to mid-term application.

Economic advantage does not begin when a technology achieves mass adoption. It begins when regions build the capabilities that make adoption inevitable. In quantum, that capability-building is already visible at multiple levels, in national research programs, in university, industry partnerships, in specialized workforce training, and in regional clusters aligning aerospace, defense, manufacturing, and advanced materials with quantum-adjacent innovation.

> **Right now, the most relevant question for leaders is not whether quantum will matter. It is where economic momentum is already forming and how quickly they recognize it.**

This article examines how quantum economic advantage is already emerging through investment, infrastructure, and applied deployment rather than waiting for a single technological breakthrough. It highlights how global funding, U.S. federal coordination, and sustained private capital are building research centers, supplier ecosystems, and commercial pathways today. It also shows how near-term applications in sensing, timing, and quantum-safe cybersecurity are influencing defense, energy, and telecommunications decisions now. With South Carolina as a grounded example, the piece explains how regional alignment of research, workforce, and industry is where quantum momentum is actually taking hold.

Global Positioning: Investment = Economic Signaling

All over the globe, quantum technologies have moved from academic exploration to national strategy. According to data compiled by McKinsey & Company, governments worldwide have committed more than $30 billion in public funding to quantum technologies, spanning computing, sensing, and communications (McKinsey, Quantum Technology Monitor, 2023).

China, the European Union, the United States, the United Kingdom, and Canada are allocating sustained multi-year funding streams. These are not symbolic research grants. They are coordinated industrial strategies.

The European Union's Quantum Flagship program, launched in 2018, represents a €1 billion long-term initiative integrating academia and industry (EU QT, 2018). The United Kingdom's National Quantum Technologies Programme has committed over £1 billion since its inception (NQTP, 2026). Naturally, this level of capital allocation points towards something deeper than research curiosity. It reflects recognition that quantum capability will shape supply chains, cybersecurity, sensing infrastructure, and national security systems. Nations investing today are not merely chasing future breakthroughs. They are positioning for economic leverage tied to talent, intellectual property, and high-value manufacturing.

Economic advantage forms early in these ecosystems. It forms in hiring patterns, research contracts, supplier networks, and capital formation.

United States: Capability Before Commercial Scale

In the United States, the National Quantum Initiative Act of 2018 formalized federal coordination around quantum information science (US Government, 2018). Since then, federal agencies including the Department of Energy, the National Science Foundation, NIST, and DARPA have significantly expanded quantum-related programs.

The Department of Energy established National Quantum Information Science Research Centers at laboratories including Oak Ridge, Argonne, and Brookhaven (US Department of Energy, 2026). Altogether, these centers represent concentrated hiring, procurement, infrastructure build-out, and university collaboration.

DARPA continues to fund applied quantum sensing, navigation, and communications programs that push technologies toward deployable capability (DARPA, 2026). NIST maintains leadership in quantum measurement science and standards development, which quietly underpins commercialization readiness (NIST, 2026).

> **Quantum's economic footprint is already extending well beyond computing. Quantum sensing systems are shaping defense capabilities and critical infrastructure monitoring, while quantum-safe cybersecurity is actively influencing how governments, utilities, and telecom operators prepare for post-quantum threats.**

The impact is not paused until fully error-corrected quantum computers arrive. It is materializing now through applied deployments, procurement decisions, and infrastructure upgrades that quietly embed quantum capability into existing systems.

Regional Momentum: Where Clusters Form

Economic advantage crystallizes regionally. Talent clusters, university research strengths, and state-level policy alignment determine where quantum ecosystems take hold. Colorado, for example, has developed one of the most visible U.S. quantum clusters anchored by the University of Colorado Boulder, NIST laboratories, and private firms. Illinois has invested heavily in quantum research through the Chicago

Quantum Exchange (University of Chicago, 2026). New York's investment in quantum research centers at Brookhaven National Laboratory and related institutions reinforces regional capacity.

The surface story may focus on a flagship research centre or a high-profile startup, but the real differentiators are structural. Durable clusters share a deeper architecture that supports sustained economic growth rather than episodic innovation:

- **Sustained, multi-year research funding with institutional depth:** Successful regions are not operating on one-off grants or symbolic announcements. They have predictable funding streams tied to national labs, federally funded research centers, or state-backed initiatives that allow long-term planning. This continuity enables labs to invest in advanced equipment, recruit senior talent globally, and maintain momentum across grant cycles. Stability matters in quantum technologies because infrastructure build-out, from cryogenic systems to precision fabrication, requires capital intensity and time.
- **Embedded public–private collaboration, not superficial partnerships:** In strong clusters, industry is not merely observing research; it is embedded in it. Companies co-fund research initiatives, share personnel, sponsor applied pilot programs, and engage early in commercialization pathways. Universities design research agendas informed by real-world application constraints. National labs provide technical validation and measurement standards. The relationship becomes iterative instead of transactional.
- **Workforce pipelines aligned with quantum-adjacent skills:** Thriving regions invest early in education at multiple levels. This includes early-stage STEM literacy and community college pathways that prepare residents for quantum-adjacent careers, doctoral programs in physics and materials science, engineering tracks focused on photonics and cryogenics, and technician-level training in precision manufacturing and control systems. Importantly, not every role is labeled "quantum." Many are quantum-adjacent: advanced fabrication, high-precision electronics, vacuum systems engineering. The depth of this workforce determines how quickly research transitions into deployable systems.
- **Applied demonstration projects tied to real industry needs:** Clusters gain economic traction when research moves into controlled field deployments. This may involve quantum sensing pilots for infrastructure monitoring, secure communications tests for defense applications, or materials validation programs in advanced manufacturing. Demonstrations build credibility, attract contracts, and generate procurement pathways. They signal that a region is not only researching quantum technologies but integrating them into operational environments.
- **Growth of a specialized supplier ecosystem:** Perhaps the most underestimated signal of cluster maturity is the emergence of local suppliers. Firms begin manufacturing ultra-stable lasers, specialized photonic chips, cryogenic hardware, precision timing components, or advanced control electronics. These suppliers benefit not only from quantum demand but also from spillover applications in aerospace, defense, and semiconductor manufacturing. Economic resilience strengthens when these firms diversify across high-precision markets.
- **Policy alignment and coordinated economic strategy:** Leading regions treat quantum technologies as part of a broader economic vision rather than an isolated research priority. State incentives align with university programs. Workforce grants support industry hiring needs. Infrastructure investments anticipate lab expansion and manufacturing growth. This coordination reduces friction between discovery and commercialization.

The common thread across all these characteristics is continuity. Quantum economic advantage does not arise from isolated breakthroughs. It forms where research intensity, workforce depth, industrial relevance, and policy alignment reinforce one another over time.

South Carolina: A Grounded Case Study

South Carolina provides an instructive lens on how quantum economic impact takes shape at the state level. The state has historically built competitive advantage through advanced manufacturing, aerospace, automotive, and defense sectors. These industries are increasingly dependent on precision measurement, advanced materials, secure communications, and high-performance computing, which are all domains intersecting with quantum technologies.

The South Carolina Quantum Economic Impact study, conducted in collaboration with economist Dr. Joseph Von Nessen, provides early data on workforce activity, research funding flows, and partnership formation within the state's quantum-relevant sectors. While South Carolina may not yet be a nationally branded "quantum hub," the building blocks are present.

Research activity at Clemson University and the University of South Carolina includes materials science, photonics, and advanced computation, foundational elements for quantum systems. Federal defense contracts and industry partnerships create pathways for applied projects in sensing and secure communications.

From an economic standpoint, the impact is visible in several ways: First, workforce specialization. Hiring in physics, advanced engineering, cryogenics, and precision manufacturing reflects capability accumulation even if roles are not explicitly labeled "quantum." Second, supply chain participation. Companies manufacturing high-precision components, photonic devices, or specialized electronics may be indirectly embedded in quantum value chains. Third, applied projects. Pilot initiatives in advanced sensing for aerospace, navigation resilience, and cybersecurity contribute to local expertise and contract revenue.s

Analyzed together, these signals matter because quantum economic advantage rarely appears suddenly. It compounds through adjacent capability-building.

> **South Carolina's existing industrial strengths position it to integrate quantum-enabled technologies into aerospace, defense, and advanced manufacturing applications more quickly than states starting from scratch.**

Quantum advantage does not require a flagship quantum computing campus to begin accruing. It requires alignment between research institutions, industry partners, and workforce pipelines.

Where the Impact Is Being Felt Now

Quantum sensing technologies are already influencing defense and infrastructure projects. Atomic clocks underpin timing systems used across financial and telecommunications networks. Quantum-safe cryptography is being evaluated by financial institutions preparing for post-quantum security risks, as highlighted by NIST's Post-Quantum Cryptography Standardization effort (CSRC, 2025).

Workforce programs are expanding accordingly. The National Science Foundation has increased funding for quantum education initiatives (NSF, 2025). States that align education pipelines with industry needs are positioning themselves for high-wage, specialized employment growth.

In economic development terms, quantum technologies are following a familiar pattern.

Early federal investment stimulates research. Research attracts talent. Talent attracts private capital. Private capital fosters startups and supplier ecosystems. The present and future alignment of capital, capability, and coordination fast track quantum economic advantage. The regions that recognize that alignment early will shape the outcomes that follow.