The Nexus of Quantum Computing and the AI Trade

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Key Takeaways

- Quantum computing could extend the AI investment theme by creating new demand for low-latency processors, memory systems and control electronics already embedded in today's AI infrastructure, benefiting companies held across the WisdomTree Artificial Intelligence & Innovation Fund (WTAI) and the WisdomTree Quantum Computing Fund (WQTM).
- While fault-tolerant quantum computing remains a longer-term opportunity, adoption of post-quantum cryptography is accelerating today following NIST's 2024 standards, creating a near-term cybersecurity growth driver alongside AI.
- With a 23% holdings overlap as of April 2026, WTAI and WQTM offer complementary exposure to the shared pursuit of greater computing power and efficiency.

The 'AI trade' has become the organizing principle of global equity markets. Investors parse order backlogs at chip makers, model power consumption at hyperscalers, and debate whether the buildout cycle has years left or months. Into this conversation, a different question deserves more attention:

Not whether the AI trade continues, but whether quantum computing could meaningfully extend it, thereby adding new layers of demand, new beneficiaries, and new narratives to a theme that investors already understand.

We believe the answer could be yes. And the most interesting entry point is one that (almost) nobody is writing about yet. **There is a classical computing system that will sit beside the quantum processor, doing the work that makes the whole machine function.**

Start With the Decoder

Every serious discussion of fault-tolerant quantum computing eventually arrives at the problem of error correction. Quantum bits (qubits) are extraordinarily fragile. They lose coherence due to thermal noise, electromagnetic interference, and the simple act of being measured. To build a useful machine, you have to run error correction continuously, identifying errors faster than they accumulate. The quantum processor

does not do this alone. It is paired with a classical system (think AI) called ‘the decoder’, whose job is to monitor the error signals coming off the qubits, identify what went wrong, and instruct the system on corrections in real time.

This *sounds* manageable until you consider the speed at which it must happen. For superconducting qubits, the architecture pursued by IBM, Google, Rigetti, and others, error measurement cycles run on the order of microseconds, or millionths of a second. The decoder must complete its analysis and return a correction instruction within that window, or errors cascade faster than the system can handle them. This is not a software bottleneck that Moore's Law will quietly fix. It is a hard physical constraint that shapes every design decision about the classical hardware layer.

The beneficiaries here are companies like AMD (through its Xilinx acquisition) and Intel (with its Altera division). These are names already embedded in the AI infrastructure trade; quantum error correction is a potential second vector of future demand.

Memory architecture is another open question. A decoder tracking errors across a large qubit array needs to retain history, because prior error states provide context for current corrections. How much memory, of what type, at what latency, co-located with what processing elements, are unanswered engineering questions. But those answers will eventually define procurement decisions worth paying attention to.

It’s a Cold World Out There

The decoder sits at room temperature, but it does not sit alone. Between the qubits operating near absolute zero and the classical processing layer sits a chain of amplifiers, signal conditioners, and control electronics that have to function across a dramatic temperature gradient, going from roughly 10 millikelvin at the qubit stage to the 4-kelvin and 77-kelvin intermediate stages, and finally to room temperature. Each stage requires specialized components:

- Low-noise amplifiers that do not add thermal noise to the signal
- Coaxial cabling and microwave components that maintain signal integrity
- Control electronics that can be pushed closer to the qubit layer to reduce the wiring bottleneck that currently limits how many qubits can be controlled simultaneously.

Within that highly technical discussion lies the component opportunity. The same logic that applies to data center build-outs—the so-called ‘picks-and-shovels’ demand for specialized suppliers—applies here, except the customer base is smaller and the specifications are far more demanding.

Companies supplying precision photonics, microwave components, low-noise amplifiers, and cryogenic-compatible signal processing are in an analogous position to the fiber optic and laser suppliers serving hyperscale data centers. Several of these suppliers already operate in both markets.

For investors, the dual-market exposure is what matters, and the same production infrastructure serving classical optical interconnects also serves quantum control systems, meaning quantum adoption represents incremental demand rather than a greenfield bet.

The Quantum Hacker Play

Of all the quantum-adjacent investment themes, post-quantum cryptography (PQC) is the most immediately actionable, and also the most frequently mischaracterized. A common framing is that PQC becomes important once a fault-tolerant quantum computer exists. This gets the timeline exactly backward. The threat driving PQC adoption today is the harvest-now, decrypt-later attack:

Adversaries are collecting encrypted data today, storing it, and planning to decrypt it once a sufficiently powerful quantum machine arrives. Data with a 10- or 20-year sensitivity horizon, which could include government communications, financial contracts, healthcare records, and intellectual property, is potentially compromised right now, regardless of when that machine arrives.

The National Institute of Standards & Technology in the U.S. finalized its first post-quantum cryptographic standards in 2024,1 providing the regulatory anchor the cybersecurity industry needed. The migration from current public-key infrastructure to PQC-compliant systems is a multi-year, organizationally complex undertaking, the kind of upgrade cycle that drives durable revenue for security vendors. Cybersecurity companies that can credibly address both agentic AI security (a near-term demand driver) and PQC migration (a medium-term demand driver) have a more durable narrative than those serving only one of these vectors. This is a quantum extension of the AI security trade, not a separate thesis.

The Floating Quantum Clouds

AWS, Microsoft Azure, and Google Cloud all offer quantum computing access today, specifically through such platforms as AWS Braket, Azure Quantum, Google Quantum AI. Current utilization is largely research-oriented, with revenue contribution that is a rounding error relative to core cloud businesses. This is neither surprising nor concerning; it mirrors how cloud GPU access looked in its early years, before training and inference workloads exploded into a defining revenue category. It is worth remembering that NVidia's early adopters for its parallel processing architecture (now critical for its AI dominance) were researchers and gamers. It was thoroughly unimportant—until it was fundamentally game-changing.

The more interesting structural question is whether cloud providers become the dominant distribution channel for fault-tolerant quantum computing, the same way they became the dominant distribution channel for large-scale AI compute. The operational complexity of running a dilution refrigerator, managing cryogenic supply chains, and maintaining the classical control stack makes on-premise quantum hardware prohibitive for most enterprises. If quantum computing follows the cloud adoption curve, and the infrastructure economics suggest it could, then the hyperscalers are arguably the best-positioned long-term beneficiaries of the quantum hardware buildout. ***They may not build the qubits, but they will likely be where most users access them***.

What about Energy?

One of the most constrained variables in the AI buildout is power. Data center energy consumption has become a serious strategic and regulatory concern, with hyperscalers signing long-term power purchase agreements and governments treating data center siting as infrastructure policy. Quantum computing

introduces a potentially important variable into this equation. Certain classes of problems, which could include combinatorial optimization, quantum chemistry simulation, and specific linear algebra operations, are candidates for quantum advantage, meaning a ***quantum computer could solve them using a fraction of the energy required by a classical system running the same computation at scale***.

This is a long-dated thesis that requires careful qualification because, as of mid-2026, quantum advantage for practically useful problems remains undemonstrated at scale. But as the AI trade matures and energy constraints become a more prominent bottleneck narrative, the argument that quantum computing could eventually offload specific high-energy workloads provides a genuine bridge between the two themes. It also provides a framing for why the AI and quantum trades are not in tension with each other, but rather structurally linked:

Both are expressions of the same underlying demand for more compute per watt.

The Investment Implication

Investors positioning for quantum's extension of the AI trade may face a familiar challenge. The most direct plays, meaning the 'pure-play' quantum hardware companies, are largely pre-revenue or early-revenue, with cash burn rates and dilution risks that require significant risk tolerance. The more immediately investable expression of this thesis is through the component and infrastructure layer, in companies whose existing product lines serve both classical AI infrastructure and quantum systems, with quantum representing an option on incremental demand. This is not a binary bet on when fault-tolerant quantum arrives. It is an observation that the buildout of quantum infrastructure draws on many of the same supply chains, many of the same engineering disciplines, and many of the same capital allocation decisions as the AI infrastructure buildout already underway.

The decoder problem, still largely unsolved at commercial scale, could be the clearest illustration of why this matters. When the industry settles on the architecture of the classical system that makes quantum error correction practical, it will define a new procurement category. That category will favor companies with experience in deterministic low-latency compute, cryogenic-compatible electronics, and AI-trained inference systems. Several of those companies are ones investors already own for their AI exposure. That overlap is not a coincidence. It is the structural logic of why quantum and AI, far from being competing narratives, are more likely to reinforce each other.

At WisdomTree, we have two strategies:

- **The WisdomTree Artificial Intelligence & Innovation Fund (WTAI):** WTAI is designed to track the total return performance of, before fees and expenses, the WisdomTree Artificial Intelligence & Innovation Index. This index, managed by an index committee, seeks exposure to a diversified array of companies participating in artificial intelligence.

- **The WisdomTree Quantum Computing Fund (WQTM):** WQTM is designed to track the total return performance of, before fees and expenses, the WisdomTree Classiq Quantum Computing Index. This index, managed by an index committee, seeks exposure to a wide range of companies that contribute to the advancement of quantum computing, with particular emphasis on those considered 'pure-play' and focusing their business on this topic.

As of April 30, 2026, the holdings overlap between the two funds was 23%, making a strong argument for complementarity. If the goal of society is ever stronger computation per unit of power, both strategies include companies that attack this question quite differently.

1 Source: National Institute of Standards and Technology. (2024, August 13). *NIST releases first 3 finalized post-quantum encryption standards* [Press release]. U.S. Department of Commerce.

Important Risks Related to this Article

There are risks associated with investing, including potential loss of principal.

WTAI: The Fund invests in companies primarily involved in the investment theme of Artificial Intelligence (AI) and Innovation. Companies engaged in AI typically face intense competition and potentially rapid product obsolescence. These companies are also heavily dependent on intellectual property rights and may be adversely affected by loss or impairment of those rights. Additionally, AI companies typically invest significant amounts of spending on research and development, and there is no guarantee that the products or services produced by these companies will be successful. Companies that are capitalizing on Innovation and developing technologies to displace older technologies or create new markets may not be successful. The Fund invests in the securities included in, or representative of, its Index regardless of their investment merit and the Fund does not attempt to outperform its Index. The composition of the Index is governed by an Index Committee and the Index may not perform as intended.

WQTM: To the extent the Fund invests a significant portion of its assets in the securities of companies of a single country or region, it is more likely to be impacted by events or conditions affecting that country or region. The economic, political, regulatory, and other events and conditions that affect issuers and investments in the United States differ significantly from those associated with other countries and regions. U.S. financial markets have become increasingly globalized becoming more integrated with financial markets around the world and as a result, U.S. financial markets are increasingly vulnerable to the risks that may affect non-U.S. financial markets. The Fund's investments in the U.S. are subject to the risk that they, and the U.S. economy more generally, will be adversely affected by a decrease in imports or exports, changes in trade regulations, inflation, and/or an economic recession in the U.S. The Fund invests primarily in the securities of quantum computing companies. Companies engaged in the development of quantum computing or machine learning technology may be significantly impacted by rapid technological advancements, product obsolescence, intense competition, consumer demand, and government regulation. Such companies are also heavily dependent upon patent and intellectual property rights. The Fund invests in the securities included in, or representative of, its Index regardless of their investment merit and the Fund does not attempt to outperform its Index. The composition of the Index is governed by an Index Committee and the Index may not perform as intended.

Please read the Fund's prospectus for specific details regarding the Fund's risk profile.