The Other Direction: How AI Could Become the Operating System for Quantum Computing

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Key Takeaways

- AI is likely to accelerate quantum computing well before quantum accelerates AI, making today's AI infrastructure providers a compelling way to gain exposure to the theme.
- NVIDIA's Ising, CUDA-Q and NVQLink suggest the race for quantum leadership will be driven as much by AI infrastructure as by qubit breakthroughs.
- Rather than betting on hardware winners, investors can gain diversified exposure through the WisdomTree Artificial Intelligence and Innovation Fund and WisdomTree Quantum Computing Fund as AI and quantum technologies increasingly converge.

When NVIDIA announced Ising, a family of AI models designed specifically for quantum calibration and error decoding,1 it was easy to file the news under 'interesting research project.'

In our view, it deserves to be thought of as a strategic declaration.

The company that became the infrastructure layer of classical AI is methodically positioning itself as the infrastructure layer for quantum computing. That repositioning, more than any single qubit milestone, is what this piece is about.

In part 1 of this series, we explored how quantum computing could extend the so-called 'AI trade' in equities, adding new layers of demand to the component suppliers, cybersecurity vendors, cloud providers, and classical compute architects already benefiting from the AI buildout. That framing deliberately ran counter to the conventional narrative, which tends to ask how quantum might eventually help AI. This piece takes on that conventional question directly. But our answer, we think, is less conventional than it first appears.

The short version

AI is likely to help quantum computing sooner, and more concretely, than quantum computing will help AI. That asymmetry in timing is, itself, the investment insight.

NVIDIA's product roadmap, including Ising, NVQLink, and CUDA-Q, is a clear piece of evidence. It may be that sitting with the uncertainty rather than resolving it prematurely turns out to be the more intellectually honest, and also strategically useful, posture for investors trying to navigate both themes.

It is not immensely helpful to ask simply, 'will AI help quantum?' The more precise framework of questions could be:

1. In what sequence?
2. Through what mechanisms?
3. With what investable expression at each stage?

NVIDIA, characteristically, is not waiting for the answer.

Why AI Helps Quantum First

Quantum computers are, at their core, extraordinarily fragile physical systems. Qubits lose coherence due to thermal fluctuations, electromagnetic interference, and the unavoidable disturbance introduced by measurement. Building a useful machine means fighting that fragility continuously. For example, by measuring errors, correcting them, recalibrating drifting hardware, and doing all of this faster than the errors accumulate. This is precisely the kind of high-dimensional, noisy, pattern-recognition problem where AI has demonstrated consistent practical value in other domains.

There are four concrete pathways through which AI is already contributing.

Figure 1: AI May Already Be Helping Quantum Computing

AI Contribution	What It Does	Investment Implication
Error Correction	AI-based decoders identify qubit mistakes and direct corrections in real time, operating within microsecond latency windows that rule-based algorithms struggle to meet at scale.	Graphics processing unit (GPU) providers, quantum-control software, Field-Programmable Gate Array (FPGA)/Application specific integrated circuit (ASIC) designers.
Calibration	Quantum hardware drifts. AI can continuously tune laser pulses, microwave frequencies, and cryogenic readout electronics without constant human intervention.	Control-stack vendors, test equipment, photonics suppliers, high-performance computing platforms.
Hardware & Materials Discovery	AI accelerates the search for better superconductors, photonic components, chip layouts, and packaging architectures—effectively compressing experimental iteration cycles.	Semiconductor equipment, electronic design automation software, foundries, advanced packaging.
Circuit & Algorithm Design	AI can identify efficient quantum circuits and hybrid quantum-classical workflows, reducing the expertise barrier to using quantum hardware productively.	Cloud quantum platforms and developer toolchains.

Sources: Bausch, J., Senior, A. W., Heras, F. J. H., Edlich, T., Davies, A., Newman, M., Jones, C., Satzinger, K., Niu, M. Y., Blackwell, S., et al. (2024). Learning high-accuracy error decoding for quantum processors. *Nature*, *636*(8040); NVIDIA. (2026, April 14). *NVIDIA launches Ising, the world's first open AI models to accelerate the path to useful quantum computers*. NVIDIA Newsroom; Alexeev, Y., Farag, M. H., Patti, T. L., Wolf, M. E., Ares, N., Aspuru-Guzik, A., Benjamin, S. C., Cai, Z., Cao, S., Chamberland, C., Chandani, Z., Fedele, F., Hamamura, I., Harrigan, N., Kim, J.-S., Kyoseva, E., Lietz, J. G., Lubowe, T., McCaskey, A., Melko, R. G., Nakaji, K., Peruzzo, A., Rao, P., Schmitt, B., Stanwyck, S., Tubman, N. M., Wang, H., & Costa, T. (2025). Artificial intelligence for quantum computing. *Nature Communications*, *16*, Article 10829.

These are not speculative projections.

- Google DeepMind and Google Quantum AI have introduced AlphaQubit, an AI-based decoder for quantum error identification, bringing machine-learning expertise directly into the error-correction stack.
- NVIDIA has launched NVQLink, an architecture connecting quantum processors with GPU supercomputers, and released Ising as a family of open AI models for quantum calibration and decoding.

Taken together, these products outline a GPU/QPU integration platform, effectively the same playbook NVIDIA ran with CUDA for classical AI, now being run for quantum.

The near-term thesis, then, is relatively direct: AI infrastructure, such as GPUs, control software, HPC interconnects, and cloud orchestration layers, becomes a required input for scaling quantum hardware. Investors already own much of this for AI reasons. Quantum adoption represents a second demand vector from the same underlying assets.

The Harder Question: How Quantum Might Eventually Help AI

The reverse leg, quantum improving AI, is where careful framing matters most. The temptation is to oversell a future that is technically plausible but practically distant. Quantum computers are not going to train the next generation of large language models more cheaply next year. The more defensible thesis is that quantum computing could eventually help AI applications in specific domains where the hard problem is physical simulation, combinatorial optimization, or high-dimensional probabilistic sampling, not general-purpose pattern recognition.

The strongest eventual use cases may cluster around a few areas.

Figure 2: Where Quantum Computing May Contribute to AI

Quantum Contribution	Where It Could Matter	Why AI Benefits
Molecular & Materials Simulation	Drug discovery, battery chemistry, catalysts, specialty chemicals, semiconductors.	Better simulation data improves scientific AI models and reduces expensive physical trial-and-error.
Combinatorial Optimization	Logistics, energy grid management, portfolio construction, manufacturing scheduling.	AI systems that recommend actions could benefit from a more powerful optimization layer behind those recommendations.
Probabilistic Sampling	Finance, risk modeling, generative AI, complex systems.	Some AI workflows depend on hard sampling problems where quantum may eventually offer structural advantages.
Quantum-Safe Security	AI data centers, cloud infrastructure, government systems, financial networks.	AI infrastructure must be protected before large quantum machines can threaten current encryption standards.

Source: Alexeev, Y., Farag, M. H., Patti, T. L., Wolf, M. E., Ares, N., Aspuru-Guzik, A., Benjamin, S. C., Cai, Z., Cao, S., Chamberland, C., Chandani, Z., Fedele, F., Hamamura, I., Harrigan, N., Kim, J.-S., Kyoseva, E., Lietz, J. G., Lubowe, T., McCaskey, A., Melko, R. G., Nakaji, K., Peruzzo, A., Rao, P., Schmitt, B., Stanwyck, S., Tubman, N. M., Wang, H., & Costa, T. (2025). Artificial intelligence for quantum computing. *Nature Communications*, *16*, Article 10829.

McKinsey's 2026 Quantum Technology Monitor projects that the internal quantum computing market—covering hardware, software and services—could reach $43 to $71 billion by 2035, with broader economic value creation potentially far exceeding that figure.2 These figures should be treated as directional rather than precise. Academic reviews of quantum machine learning remain cautious, and practical advantage is constrained today by hardware limitations, benchmarking challenges, and the difficulty of state preparation at scale. The honest framing is that quantum may not replace GPUs for general AI workloads, but could make specific AI-driven industrial workflows meaningfully more powerful.

A Framework for Living with Uncertainty

One of the most important things an investor can do in this space right now is resist the pressure to resolve the uncertainty prematurely. The architecture of useful quantum computers is not settled. The winning qubit modality, by which we mean superconducting, trapped ion, neutral atom, photonic, silicon spin, annealing or topological, is genuinely unknown. The U.S. Department of Commerce's recent $2 billion in proposed

CHIPS Act incentives for quantum companies deliberately spans multiple approaches, which is itself a signal.3 The government does not know which architecture wins, and neither does the market.

What investors can do is build a framework for monitoring how the thesis evolves. Four concrete indicators could be worth monitoring:

4. Logical qubits, not physical qubits.
5. Real customer workflows, not pilot projects.
6. AI-controlled quantum operations in production.
7. Post-quantum cryptography budgets moving from planning to spending.

The first indicator is logical qubit progress. Physical qubit counts make headlines, but useful quantum computing depends on error-corrected logical qubits. Google's Willow work is significant precisely because it demonstrated below-threshold error rates and improved logical performance as code distance increased,4 a necessary (though not sufficient) proof point.

The second is repeatable customer revenue: chemistry, materials, pharma, optimization, finance use cases where customers pay because quantum measurably improves their answer, not because they are running a proof of concept.

The third is AI-controlled quantum operations appearing in production environments, which would be evidence that the AI-to-quantum thesis is generating real engineering value, not just research papers.

The fourth, and most near-term, is post-quantum cryptography budget growth, b because PQC migration does not require a fault-tolerant quantum computer to exist; it is already commercially urgent.

The Risks Worth Taking Seriously

Two structural risks deserve direct acknowledgment.

- The first is that classical AI continues improving fast enough to reduce the economic case for quantum in many proposed use cases. If classical hardware and software close the gap on optimization, sampling, or materials simulation faster than fault-tolerant quantum computing matures, the quantum-to-AI revenue opportunity shrinks.
- The second risk is architectural. Quantum hardware may scale more slowly than current roadmaps suggest, particularly if error correction requires substantially more physical qubits, cryogenic infrastructure, and power than today's estimates assume.

There is also a market-structure risk that cuts across both themes. The best economic returns from quantum computing may ultimately accrue to the large cloud and chip platforms rather than to hardware startups, in the same way that the largest AI profits have so far concentrated at the infrastructure layer rather than being distributed across every model developer and application company. Quantum could become another chapter in a familiar story, where the infrastructure owners capture the value, and most of the platforms built on top of them are commoditized over time.

Putting Both Pieces Together

Read alongside part one of this series, a clearer picture emerges. The AI trade and the quantum trade are not parallel stories running on separate tracks. They are increasingly entangled, sharing supply chains, engineering talent, capital allocation logic and investment narratives.

The near-term expression of this entanglement is that AI infrastructure enables quantum development:

- GPUs calibrate and decode
- Classical co-processors perform error correction
- Cloud platforms distribute access
- Cybersecurity vendors protect the full stack

The medium-term expression is that quantum-specific demand, for cryogenic components, specialized photonics, FPGA-based control systems, and eventually purpose-built ASICs, adds incremental revenue to companies already embedded in the AI infrastructure trade.

The long-term expression, more speculative but worth monitoring, is that quantum computers become specialized accelerators for the subset of AI-adjacent problems, which may include molecular simulation, combinatorial optimization, and cryptography, where classical methods hit fundamental limits.

The investment implication is not 'buy quantum stocks.' It is to own the interface layer where AI infrastructure, high-performance computing, semiconductors, quantum control, error correction, and quantum-safe cybersecurity converge, and then to hold a small, disciplined, diversified option on the hardware layer that may define the next phase.

The uncertainty is real. The scenarios are genuinely multiple. But the mental model that treats these two themes as separate bets, each requiring a binary call on timing, is likely the wrong frame. The more durable approach is to recognize that the same infrastructure buildout that is already underway for AI also could lay the physical and commercial foundation for quantum, and that the companies best positioned for one are often, by design, best positioned for the other.

At WisdomTree, we have two strategies:

- The WisdomTree Artificial Intelligence and Innovation Fund (WTAI): WTAI is designed to track the total return performance of, before fees and expenses, the WisdomTree Artificial Intelligence and 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, in our opinion, 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: NVIDIA. (2026, April 14). *NVIDIA launches Ising, the world's first open AI models to accelerate the path to useful quantum computers*. NVIDIA Newsroom.

2 Source: McKinsey & Company. (2026, April). *McKinsey quantum technology monitor 2026: A commercial tipping point.*

3 Source: National Institute of Standards and Technology. (2026, May 21). *Department of Commerce announces letters of intent with 9 companies for $2 billion to accelerate U.S. leadership in quantum computing* [Press release]. U.S. Department of Commerce.

4 Source: Neven, H. (2024, December 9). Meet Willow, our state-of-the-art quantum chip [Blog post]. Google.

Important Risks Related to this Article

There are risks associated with investing, including potential loss of principal. Please read the Fund's prospectus for specific details regarding the Fund's risk profile.

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.