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# Schrödinger's Deadline

## Why Managers Should Pay Attention to Quantum Technology Sooner Rather Than Later

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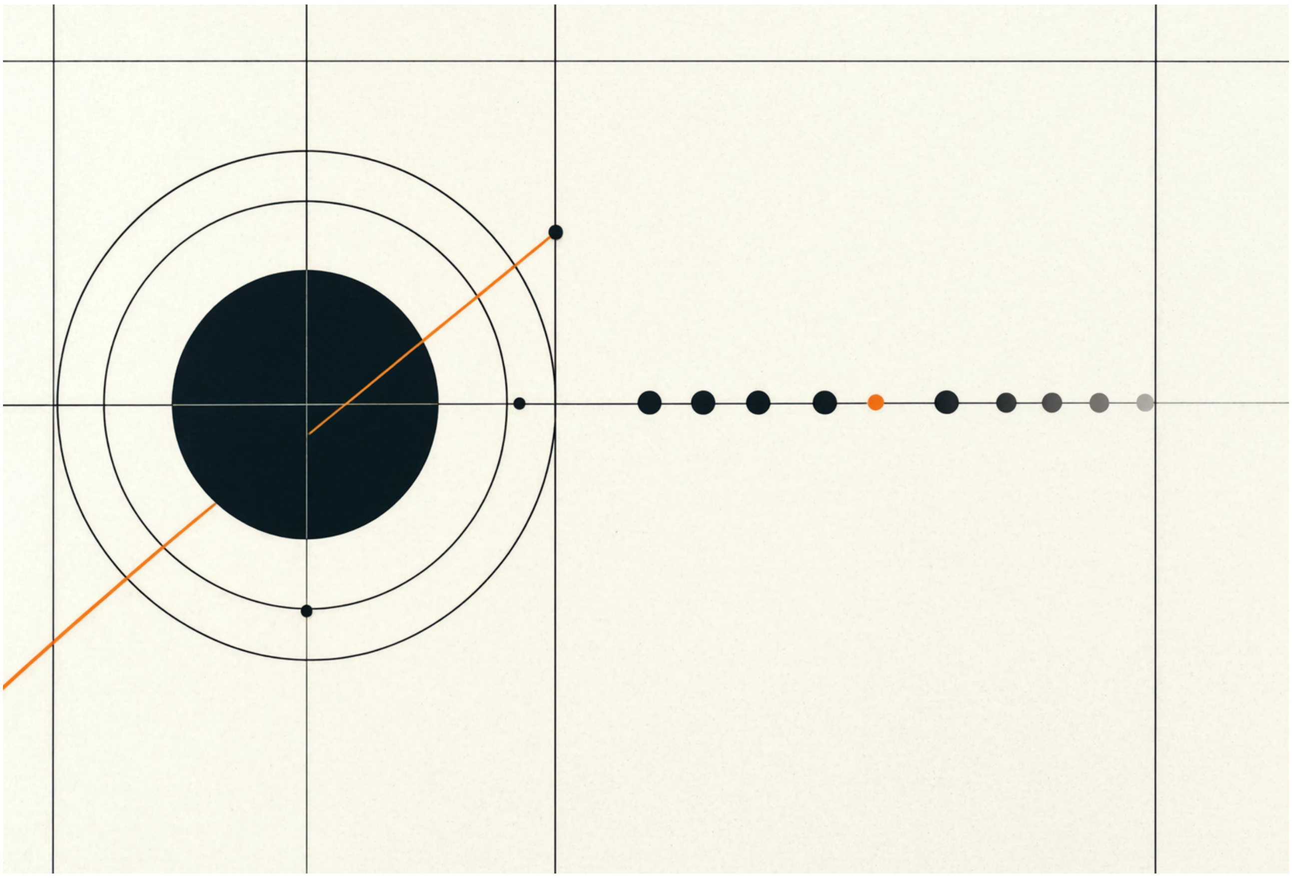


## ABSTRACT

Quantum technology is that rare case whose most important managerial consequences arrive before the machines do. You do not need a working quantum computer in your basement for quantum to be your problem. Some of its effects, on your data, your compliance calendar, your procurement, and your exposure to nonsense, are already operating on published schedules.

Drawing on critical data studies, this paper breaks the monolith of quantum technology into a family of capabilities on very different clocks, follows the money and the statecraft now reshaping the field, and shows why harvest-now-decrypt-later has already moved data exposure into the present. It closes with five moves a manager can make without a lab, a moonshot, or a physicist on payroll.

## KEY POINTS

**01 Consequences will arrive before the machines do.**

Quantum's effects on data, compliance, and procurement are already running on published timetables.

**02 Your data may already be exposed.**

Harvest Now, Decrypt Later means encrypted records captured today can be unlocked once capable machines arrive.

**03 Migration is already on the compliance calendar.**

NIST standards, a US executive order, and an EU roadmap have set firm post-quantum deadlines through 2035.

**04 Attention beats prediction.**

Three questions and a standing watching brief defend against quantum-washing without a physics degree.

# 01

## It is not a physics problem

Managers have hype fatigue, and for good reason. Over the past decade or so, they have been told, often loudly and at considerable consulting expense, to drop everything for big data, then blockchain, then the metaverse, then generative AI. Some of these mattered, and some are now digital landfill. So when quantum technology comes forward as the next candidate for mandatory executive enthusiasm, the temptation to file it under “wake me when it ships” is understandable. It is even, in its own way, rational.

It is also wrong, though not for the reasons the vendors give. Quantum is that rare technology whose most important managerial consequences arrive before the machines do. You do not need a working, world-changing quantum computer in your basement for quantum to be your problem. Some of its effects, on your data, your compliance calendar, your procurement, and your exposure to nonsense, are already operating on published schedules. That is the strange thing about this field, and it is the argument of this paper.

A promise, before we begin: I have kept the physics to one, single paragraph, and nobody will be asked to feel awestruck on command.

# 02

## A very brief primer and the state of the art

Here is that paragraph. Classical computers work with bits, tiny switches that are either 0 or 1. Quantum computers work with *qubits,* which exploit two of the better party tricks of quantum mechanics, namely superposition and entanglement. This enables a quantum computer to explore vast spaces of possibilities in ways no classical machine can efficiently imitate, and the end-result is less a faster computer than a radically different one. For most tasks (payroll, email, slide decks) a quantum computer is basically useless, and will remain so. For a few problem families it may well be transformative. This can include simulating nature itself (chemistry, materials, drug discovery), certain kinds of optimization, and, notoriously, cracking the mathematics that underpins most of the world’s encryption. That’s the primer, and anyone who tells you it must be more complicated than this is usually selling the complication.

Let’s move to the state of the art. Quantum machines are cold, noisy, temperamental, and expensive, and for years the polite consensus was that error rates would keep them ornamental for decades. That consensus has aged badly. Google’s Willow chip demonstrated in late 2024 that adding qubits can reduce errors rather than multiply them, the field’s long-sought threshold. IBM has published a roadmap it insists ends in a fault-tolerant machine by 2029, with a claimed shot at practical quantum advantage in 2026. Microsoft, this June, unveiled its Majorana 2 chip: a redesigned, lead-based materials stack, a claimed thousandfold improvement in qubit reliability, lifetimes around twenty seconds, and a scalable machine now promised by 2029. Within hours, prominent physicists pointed out that the data still does not settle whether Microsoft's exotic topological qubits exist as described. Hold that thought; we will need it later.

Closer to home for those of us in the Nordics: QuNorth's Magne, a machine built by Atom Computing and Microsoft with 80 million euros of backing from EIFO and the Novo Nordisk Foundation, is slated to come online in Copenhagen around the turn of 2026/27, offering 50 logical qubits atop 1,225 physical ones. Roadmaps are promises, and vendor promises deserve the skepticism they have earned, but note the trajectory. A century after Heisenberg's 1925 paper, quantum mechanics is quietly becoming infrastructure. Slower than the enthusiasts promised; faster than the cynics scoffed.

> *A century after Heisenberg's 1925 paper, quantum mechanics is quietly becoming infrastructure.*

# 03

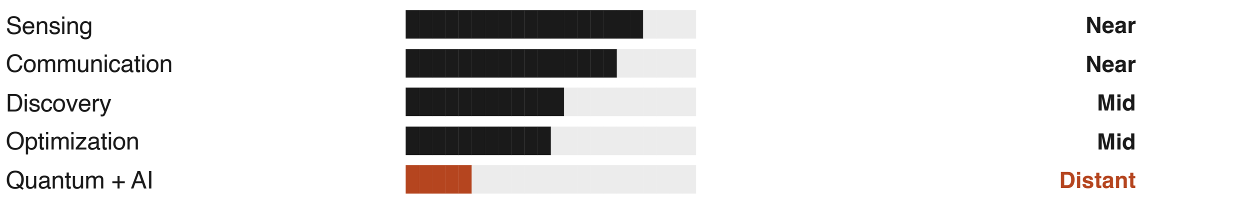
## What quantum will actually do

It helps, at this point, to break the monolith apart. "Quantum technology" is not one thing on one schedule; it is a family of capabilities on very different clocks. A recent RAND Europe overview usefully sorts the family into five areas where it could touch everyday life, and the taxonomy rewards a manager's attention precisely because each area matures at its own pace.

The first is *discovery,* i.e. simulating molecules and materials that classical machines cannot, with drugs, batteries, catalysts, and alloys as the prizes. This is the most physically credible promise (nature is, after all, quantum mechanical), and hybrid quantum-classical approaches are already probing it. The second is *optimization,* i.e. routing fleets, balancing power grids, scheduling flights, weighing portfolios etc. These are real-life problems where the best answer hides among billions and billions of possibilities, and where even modest speedups compound into real money. The third is *sensing,* the sleeper of the family. Quantum sensors can navigate without GPS by reading the Earth's magnetic and gravitational signatures (the Royal Navy has been running trials), image the body more gently and precisely, and hear seismic murmurs early. Sensors do not need error-corrected qubits, which is why they will likely reach the field years before the computers do, and why the discourse's fixation on computing keeps missing them. Any organization whose logistics quietly assume that satellite navigation always works might want to sit with that for a moment. The fourth is *communication,* i.e. quantum key distribution, lately demonstrated over a hundred kilometers of ordinary fiber without trusted intermediaries, with banks already piloting quantum-secured links. And the fifth is *the marriage of quantum and AI,* about which the only responsible thing to say is that it is early, speculative, and irresistible to people writing press releases, since it lets two hype cycles hold hands.

The managerial takeaway is a portfolio view rather than a single bet. Note that sensing and secure communication are near, discovery and optimization are midfield, quantum-boosted AI is a rumor with a research program. Different clocks, different decisions.

FIG. 1




Rough time-to-impact for the five capability areas, following the RAND Europe taxonomy. Bar length indicates an approximate horizon, not a measured quantity.

# 04

## Follow the money, note the statecraft

If the physics leaves you cold, consider the accounting. McKinsey's 2026 Quantum Technology Monitor, a document not noted for its poetry, reports that investment in quantum technology reached 12,6 billion dollars in 2025, a more than sixfold increase on the year before. Quantum computing firms have now crossed one billion dollars in collective revenue, and more than 300 organizations worldwide now report adopting quantum computing in some form, a third of surveyed adopters had quantum budgets above ten million dollars, and Europe, for once, leads the move from pilot project to production use. However, the long-range projections (1,3 to 2,7 trillion dollars of economic value by 2035) should be read as directional rather than arithmetic, as should all numbers with that many zeros.

Now add statecraft. On June 22 of this year, the White House signed two quantum executive orders on the same day: one to accelerate American quantum development, framed without embarrassment as a race with China, and one ordering the machinery of government onto post-quantum encryption, with contractors dragged along behind. Promote and protect, in a single afternoon. The EU has its own quantum strategy and a coordinated migration roadmap; Denmark's Magne is financed by a sovereign fund and a foundation, not by venture capitalists. When a technology becomes statecraft, it stops being optional reading for anyone whose organization runs infrastructure, bids for public contracts, or moves data across borders. A manager does not need to believe a single vendor timeline to respect that trajectory, in roughly the way one does not need to believe in weather forecasts to own an umbrella.

05

## Your data is already in the quantum age

Now to the part that should reorganize your priorities, and the part closest to what we study at CODES. Two decades of datafication have made organizations into hoarders. Customer records, contracts, negotiations, health data, intellectual property, the accumulated exhaust of organizational life, all of it stored, and all of it protected by encryption whose security rests on mathematics that a sufficiently capable quantum computer is expected to break. Further, the estimates of what "sufficiently capable" means keep shrinking; recent work has cut the projected hardware requirements for breaking standard encryption by an order of magnitude.

This would be tomorrow's problem, except for one detail. Numerous entities (some criminal, some interested state actors, some more akin to entrepreneurs) have realized they can record encrypted data today and decrypt it once the machines arrive. The practice even has a name, HNDL (Harvest Now, Decrypt Later), and it means the exposure date of your data may have been last Tuesday. If information in your care must remain confidential for ten years, and the machines arrive within that horizon, you are not early to this problem. You may, realistically speaking, already be late, as your data may be resting on a hard-drive in wait for the machine that can crack its encryption.

> *The exposure date of your data may have been last Tuesday.*

Regulators have done the maths on this. NIST finalized its first post-quantum encryption standards in August 2024 and added a backup algorithm in 2025. The June executive order gives US federal systems until the end of 2030 to move to post-quantum encryption, with authentication to follow by the end of 2031. The EU's coordinated roadmap tells member states to begin national strategies and cryptographic inventories by the end of 2026, to secure high-risk systems no later than 2030, and to complete the transition by 2035. Denmark, like its neighbors, is writing its national strategy now. The precise dates matter less than the pattern, which is that post-quantum migration has moved from cryptographers' hobby to compliance calendar.

Herein lies the management punchline. This is not an IT ticket. A cryptographic inventory touches every legacy system, every vendor contract, every retention policy, every acquisition whose systems were never fully integrated. Previous migrations of this kind, each far smaller, took the better part of a decade. The question "where does our cryptography live, and who owns replacing it" turns out to be, like most infrastructure questions, a question about governance, budgets, and organizational memory. Boards that ask it in 2026 will look prescient in 2031. Boards that do not will fund the answer at emergency prices.

# 06

## Quantum-washing, or the ethics of the adjective

The second consequence that arrives ahead of the machines is nonsense. Wherever money flows, adjectives follow, and "quantum" is currently being applied to software, consultancy offerings, and (this is real) wellness products with entrepreneurial abandon. We have seen this movie before; the AI version is still in theaters. Expect quantum slop in your inbox well before quantum value reaches your operations.

The defense is not a physics degree. It is three questions, asked calmly. First: what, precisely, is quantum about this? If the answer is "quantum-inspired," you are looking at a classical algorithm with good marketing; occasionally useful, never magic. Second: against what classical baseline was the claimed advantage measured? Announced quantum speedups have repeatedly evaporated when classical researchers bothered to compete, and a benchmark against a lazy baseline is mere "quantum theater". Third: what happens if we simply wait a year? Sometimes waiting is the right call. Sometimes, as the previous section argued, it is precisely the wrong one, and knowing which is which is the actual skill.

Consider the summer's marquee example. Majorana 2 arrived with a thousandfold reliability claim, a halved timeline, and the flourish that the chip was designed with the help of agentic AI, a collector's item of a press release. All of it may prove true. But the foundational question, whether the topological qubits at the heart of Microsoft's approach exist as described, has been openly contested in the physics community since the first Majorana chip, and the skeptics declared themselves unconvinced within hours of the sequel. The lesson is not that Microsoft is wrong; this paper has no standing in condensed-matter physics, and if you read this, you're unlikely to know either. The lesson is that at the frontier, even blue-chip announcements are claims in an ongoing scientific dispute, not settled facts, and that markets and ministries respond to the announcements anyway. Three weeks after that launch, Washington signed its quantum orders. Correlation is not causation, but attention is attention, and the announcement economy runs on it. A manager cannot adjudicate the physics and does not need to. The three questions, plus patience, will do. The job is to keep the organization from buying into pre-proof nonsense at hype-cycle prices.

07

## Quantum ethics is already here

A center like ours would be derelict if it did not point out that the ethical questions are not waiting for the hardware either. Three deserve managerial attention now.

The first is concentration. Quantum computing will not be democratized in any meaningful sense for a long time; states and hyperscalers will own the machines, and everyone else will rent. That creates a quantum divide, layered atop the data asymmetries organizations already navigate, and it makes questions of access, pricing, and dependency strategic rather than philosophical.

The second is dual use. The same machine that models a battery cathode can, at sufficient scale, break the encryption protecting a hospital, a bank, or a dissident; the same sensor that navigates a container ship without GPS can find that which would prefer to stay hidden. Export controls and security reviews are already in motion, and any organization partnering on quantum work will find governance questions arriving with the term sheet.

The third is the quiet one, and the one I would like to underline. In a harvest-now world, data minimization stops being a compliance nicety and becomes risk management. Data you cannot protect tomorrow is data you should think twice about hoarding today. The datafied organization's default instinct, keep everything forever just in case, was always ethically questionable. Quantum makes it strategically questionable as well, which, cynically but usefully, may be what finally gets it addressed. Responsible governance is not a brake on quantum adoption; increasingly it is the precondition of credible adoption, because partners, insurers, and regulators have started asking new questions.

# 08

## A Checklist for the Attentive Manager

None of this requires a moonshot, a lab, or a physicist on payroll. It requires a posture, some reflection, and a bit of attention. There are five moves that most organizations should at least consider now, in rough order of urgency.

**RECOMMENDATIONS — FIVE MOVES**

**A** Commission a cryptographic inventory. Find out where encryption lives in your organization, what it protects, and how long each thing must stay secret. Your security people may be relieved someone finally asked.

**B** Starting now, buy crypto-agility. Anything procured in 2026 will still be running in 2033. Vendor contracts should ask, in writing, for post-quantum migration plans. A supplier without one is telling you something.

**C** Apply data tests. Ask what you hold that must remain confidential beyond roughly 2032, whether you can protect it, and if not, whether you need to hold it at all. Deletion is an underrated security technology.

**D** Develop a quantum-watching brief with named triggers. Decide in advance what would change your posture, review twice a year, and ignore press releases in between; as the Majorana saga shows, they are opening bids in a dispute, not verdicts.

**E** Invest in literacy, not hardware. A handful of people who can read past the adjective and brief the board without mysticism or hype will return more value this decade than any machine you could lease.

# 09

## Coda: On Attention as a Managerial Virtue

Attention is the scarcest managerial resource of all, and this has, in effect, been an argument about how to spend it. The case for attending to quantum is not that the machines are about to change everything. They are not, or at least not on a schedule anyone can give you with a straight face; even the field's own frontier claims are still being argued about by the people qualified to argue. The case is that a specific set of consequences, such as data exposure, compliance clocks, procurement lock-in, sensor deployments, vendor nonsense, and the concentration of powerful capabilities, are arriving on timetables that are already published, and that the cost of engaging early is small while the cost of a late scramble is not.

Heisenberg taught us that you cannot know a particle's position and momentum at once. The managerial corollary is gentler but very real. With an emerging technology you can know where it is or where it is heading, never both with precision, and you must act anyway. The comfortable error is to mistake "not yet" for "not ever," and its equally comfortable twin is to mistake a press release for proof. The job, as ever, is not to predict the future. It is to make sure the future does not embarrass you.

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CODES, the Center for Organizational Datafication and its Ethics in Society at the University of Southern Denmark, studies how data, AI, and emerging technologies reshape organizations and society, with particular attention to what these systems capture, what they miss, and who pays for the difference.