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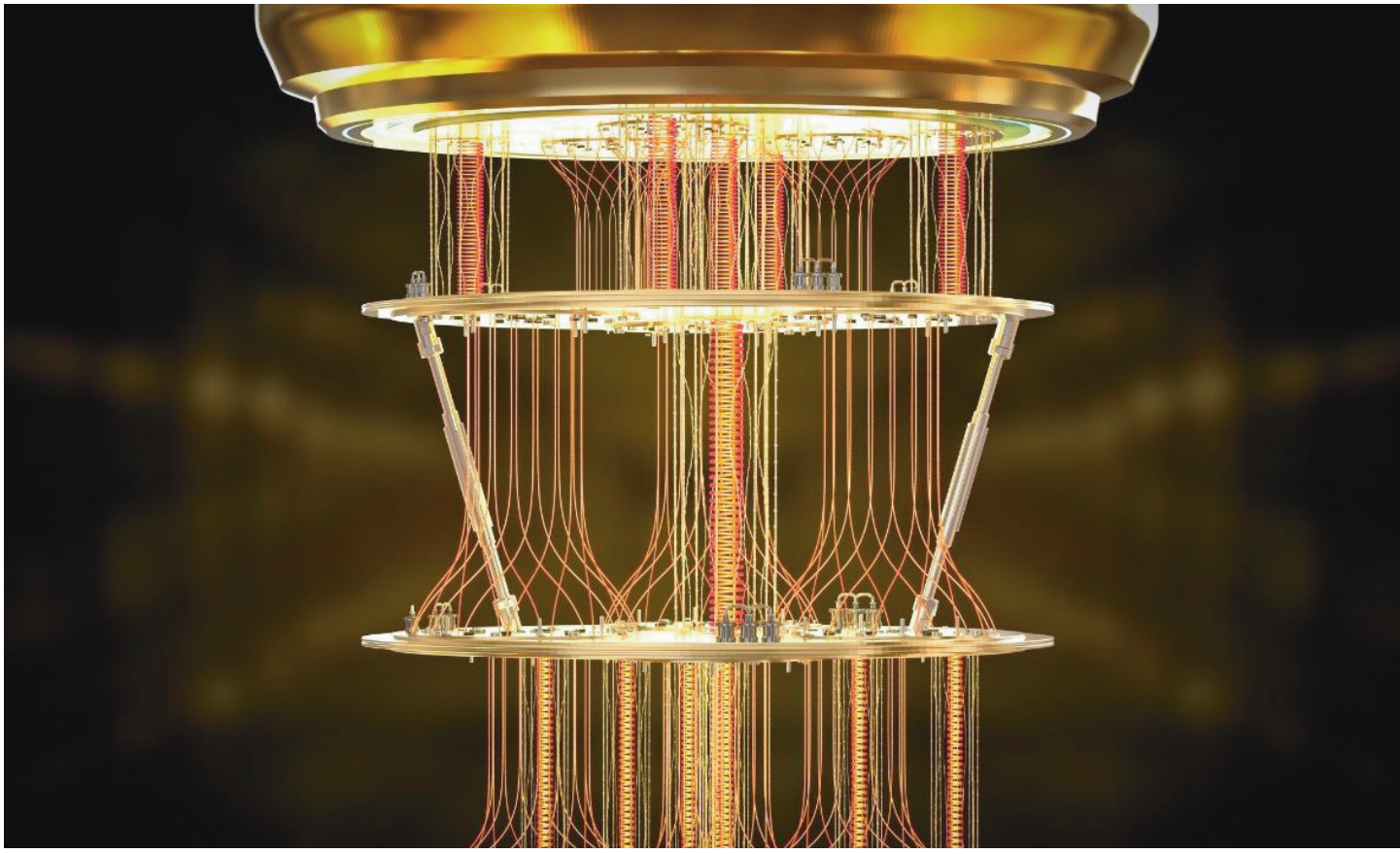
Delivering on Draghi after Munich: A quantum perspective

Ulrich Mans



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ABOUT THE AUTHOR

Ulrich Mans is Strategic Partnerships Lead at Quantum Delta NL.

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Executive summary

In light of shifting transatlantic relations, Europe must assert greater technological sovereignty, with quantum technology emerging as a key strategic domain. The EU already has a strong foundation in quantum, but risks falling behind due to fragmented policies, low private investment, and supply chain dependencies. While recent public investments and initiatives like the Quantum Flagship and Quantum Pact are promising, Europe needs a bold commercialisation strategy and coherent regulatory framework. To secure leadership, the EU must accelerate industry adoption, align member state efforts, and foster global partnerships, including with the U.S., UK, and Switzerland. Quantum presents a defining test for Europe's innovation agenda—and a critical opportunity to deliver on the Draghi Report's call for strategic autonomy.

Delivering on Draghi after Munich – a quantum perspective

The fast pace of developments during and after events in Munich, Paris, London, Washington and Brussels have put Europe on a fast track to a totally different trans-Atlantic relationship. Within a few weeks, the new US administration made it clear to Europe's leaders that the US is no longer planning to wait for the EU to step up their nation's defence budgets and is no longer the trusted ally that views European security as a collective benefit. There is no doubt that this will have major ramifications and the question of how to revamp a continental defence industry will loom large in the coming months. Beyond this obvious shift, it is critical to look at this development through the lens of innovation. If Europe is on the verge of taking bold decisions *vis-a-vis* becoming more independent from the United States, this clearly impacts everything we do in the field of emerging technology. Quantum is a case in point.

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Europe stands at a critical juncture in the race to commercialise quantum technology. And let's start with the good news: the EU has everything that it needs to deliver on Europe's quantum promise. EU-based universities are among the best in the world when it comes to quantum. We have the largest talent pool, contribute most to academic publications and boast the highest number of start-ups in the world. Quantum technology is listed by the EU as one of four critical technologies (next to AI, semiconductors and biotechnologies) and therefore enjoys a lot of attention from policy circles in Brussels and in EU member states. Funding for quantum entrepreneurs is also on the rise. Even though it is far from matching the US in terms of private investments, the EU is at the forefront of public investments worldwide. And the European Innovation Council (EIC) recently announced € 1.4 billion Euro for deep tech. In addition, if we give the right push to convince private investors to put aside their notoriously cautious attitude towards European start-ups, we might make a dent in the US dominance when it comes to scaling up businesses to unicorns in deep tech industries like quantum.

To be clear: quantum will neither deliver digital sovereignty nor ignite an immediate digital revolution in computing, communication networks or sensing. In any event, those outcomes will certainly not be achieved in the next seven years, during which the second von der Leyen Commission will seek to secure Europe's competitiveness in the digital age.

However, with the new Commission team in place, we can speak of a novel, pivotal chapter in Europe's innovation agenda. The bloc's recently appointed Commissioner for Digital Sovereignty, Henna Virkunnen, wants to deliver on the next generation of tech champions and is working on a Quantum Strategy to further consolidate Europe's ambition to develop one of the world's most competitive quantum industry clusters. This is no doubt a bold ambition. But it can be done for quantum, if Europe gets it right this time. A recent position paper by the European Quantum Industry Consortium (QUIC) spells out the sector's collective vision in this regard.

The author believes in a frontrunner position for the European quantum ecosystem. In fact, the seeds for such an ecosystem have already been sown. There is a growing number of closely-knit networks of academics and entrepreneurs in this new, exciting technology niche. The right foundations that enable further growth still need to be put in place. If we fail to do that, quantum is set to become dominated by a few large players from outside the EU.

To avoid this, the EU must adopt a much more proactive approach to ensure that it remains competitive in this field. For Europe to lead, it must capitalise on existing successes, address emerging risks, and chart a bold policy roadmap under the leadership of the Commission.

An EU success story thus far…

In the last decade, Europe has established itself as a global leader in quantum research, creating a solid foundation for technological and commercial advancements. The EU's Quantum Flagship initiative, launched in 2018, exemplifies this success. With a €1 billion investment over ten years, the Quantum Flagship has supported groundbreaking projects across quantum communications, computing, sensing, and

enabling technologies. Initiatives like the European Quantum Communication Infrastructure (EuroQCI) aim to establish a secure quantum communication network across all 27 EU member states, including overseas territories, providing Europe with a critical edge in secure data transmission. Early successes in testing this technology confirm this ambition, even though much R&D and early adoption testing still needs to be done.

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Academic and research institutions like QuTech in the Netherlands and the Fraunhofer Institute in Germany are well-known frontrunners in advancing quantum technology. For instance, QuTech's work on scalable quantum networks has set global benchmarks, while Fraunhofer has developed cutting-edge quantum key distribution (QKD) systems to secure future communication networks. These efforts are complemented by world-class talent cultivated via EU-funded PhD and postdoctoral programmes and by a growing number of national quantum projects, ensuring a steady pipeline of expertise across all areas of quantum tech.

The European start-up ecosystem has also matured over the last five years. Companies like Pasqal in France and IQM in Finland are leading the charge in quantum computing, attracting significant venture capital investments. Pasqal, for example, raised €100 million in 2023 to commercialise its neutral-atom quantum processors, while IQM has pioneered energy-efficient quantum hardware tailored for real-world applications. Others, such as Quix Quantum, eleQtron, Qblox, Alice&Bob, Quantware and Orange Quantum Systems, are worth watching too. The European Innovation Council (EIC) has further bolstered these efforts by providing over €165 million in grants to quantum-focused start-ups in 2024 alone.

Quantum sensing is another area where Europe excels. Projects like Asteriqs and MetaboliQs have achieved breakthroughs in magnetic and bio-sensing applications, enabling transformative advances in fields ranging from healthcare to geophysics. Quantum sensing companies are on the rise, with examples such as Q.ANT, Muquans or QTSense. Europe's leadership in precision and application-driven research has positioned it ahead of competitors like the US and China in this domain.

These achievements highlight Europe's potential to dominate the global quantum landscape. However, the journey from research excellence to commercial leadership is fraught with challenges that demand urgent attention.

…the EU may lose its way in the future

The bad news – and yes, we should be concerned – is that we are heading in the direction of throwing away the technological edge that we have earned in the field of quantum over the last 10 or more years. Despite its successes, the EU runs the risk of losing its quantum edge due to structural and strategic shortcomings.

Fragmented policies, uneven progress among EU member states, and growing competition from the US and China threaten to erode the EU's leadership.

One significant challenge is the lack of a unified commercialisation strategy. While the EU excels in funding early-stage research, translating these breakthroughs into market-ready products continues to be a bottleneck. European start-ups often struggle to scale up globally due to limited access to capital compared to their US counterparts. In 2024, US quantum companies raised over $1.3 billion in venture capital, dwarfing Europe's $228 million in quantum investments. This disparity hampers Europe's ability to retain talent and attract top-tier investors.

Regulatory fragmentation within the EU further exacerbates the issue. Start-ups must navigate a complex maze of national regulations, slowing down product deployment and market entry. This inefficiency stands in stark contrast to the centralised strategies employed by the US and China. The US National Quantum Initiative Act has streamlined funding and policy coordination, while China's top-down investment strategy has rapidly advanced quantum infrastructure, including the world's first quantum satellite.

Additionally, the slow roll-out of critical initiatives like post-quantum encryption standards leaves Europe vulnerable to emerging cybersecurity threats. Once fully operational, Quantum computers could render existing encryption methods obsolete, exposing sensitive data to unprecedented risks. The EU's delay in implementing quantum-safe encryption across EU member states undermines its credibility as a leader in cybersecurity. This is in itself worrying, but, if quantum computing is perceived as a risk to our cyber security, it will likely slow down private investments in quantum's commercial potential in its wake.

Supply chain vulnerabilities also pose a significant risk. Europe remains heavily dependent on external suppliers for critical quantum components, such as specialised semiconductors, refined raw materials and high-end optical systems. This reliance on non-European suppliers creates bottlenecks and exposes the EU to geopolitical risks, particularly in an era of growing tech nationalism. Instead, the EU should leverage its own strengths in quantum and start working on an agenda to create 'reverse dependencies', which make others reliant on EU suppliers.

Without immediate action, Europe's hard-earned leadership in quantum technology could be overshadowed by faster-moving competitors.

What is needed?

To secure its quantum future, the EU must transition from a research-centric approach to a commercialisation-focused strategy. This requires bold policy interventions across three key areas: promoting innovation, protecting strategic interests, and fostering international partnerships.

Promoting innovation:

1. **Accelerate alignment across EU member states:** The EU needs to speed up what it started with the Quantum Pact and shape a streamlined roadmap that aligns policies across EU member states, ensuring coherence in funding, regulation, and market development. This quantum strategy should prioritise the commercial readiness of quantum technologies and address barriers to scaling up.

2. **Leverage frontrunners:** Encourage leading EU member states like Germany, France and the Netherlands to spearhead quantum initiatives, while providing incentives for others to catch up. Many EU countries are working to launch their own quantum initiatives, which should be encouraged to start and scale up as quickly as possible. This 'coalition of the willing' approach can drive faster progress without being held back by the wish to be all-inclusive in a field that is difficult to start from scratch. This is an important distinction to software-based AI ecosystems, where scaling up can be done without capital-intensive hardware R&D.

3. **Embrace quantum procurement:** EU member states should make it much easier to procure quantum tech from start-ups to bridge the gap between research and market-ready products. Public-sector adoption of quantum technologies – including in the military domain – leads to trust in the technology. It can create a critical early market, demonstrating feasibility and attracting private sector investment.

4. **Create incentives for pioneers:** Strong European industry sectors such as health, (renewable) energy, automotive and chemistry should be encouraged to invest in this technology early on, and to become trailblazers rather than late adopters.

5. **Expedite post-quantum encryption roll-out:** The EU must act swiftly to implement quantum-safe encryption/cyber security standards across all EU member states. This will not only protect sensitive data but also position Europe as a global leader in cybersecurity. This has to go hand in hand with a clear commitment to a 'made-in-Europe' push for quantum-enabled encryption as the next generation technologies in this field.

6. **Increase funding for supply chain gaps:** Funding mechanisms available through, e.g. the EIC, should allocate additional resources to address identified critical supply chain vulnerabilities, such as the production of quantum-specific components and materials.

Protecting strategic interests:

1. **Make it 'chefsache' to create a level-playing field:** Elevate quantum technology as a strategic priority to ensure a level playing field for start-ups and SMEs. This includes harmonising regulations across EU member states to reduce barriers to market entry. Today's investment screening procedures, export regulations and knowledge security guidelines are largely fragmented and prove highly problematic for start-ups in their quest to attract investors and scale up fast.

2. **Monitor supply chain developments:** Establish a dedicated task force to track supply chain (reverse) dependencies and mitigate risks associated with over-reliance on non-European suppliers. This should include fostering domestic production capabilities for critical components and encouraging cross-border collaboration for shared facilities such as pilot lines and cleanrooms.

Fostering global partnerships:

1. **Expand international partnerships:** Collaborate with like-minded nations, including South Korea, Japan, India, and Australia, to create a larger-than-EU market for quantum technologies. These partnerships should be pursued on a case-by-case basis, focusing on mutual benefits.

2. **Balance competition and collaboration with the US:** Treat the US under the Trump presidency as both a competitor and (yes) a partner. EU quantum companies need to have easy access to the US market in order to expand and become serious players.

3. **Embrace the UK and Switzerland as key partners** in a European partnership. The quantum expertise and commercial developments in both countries are important elements for any EU quantum strategy to succeed.

By adopting these recommendations, the EU can consolidate its leadership in quantum technology, ensuring that it not only drives innovation but also reaps the economic and strategic benefits of this transformative technology. The Draghi Report's vision must be translated into bold action, and Europe should lead the way in this respect.

And while Europe's competitiveness underpins everything, efforts relating to quantum must be carried out whilst adopting a global perspective, in close collaboration with like-minded nations, including the US. In a recent Foreign Affairs journal article on quantum, the authors (from Google's quantum team) argue that "the US and its allies would be wise to implement immigration and export control policies that allow companies in this sector to recruit the most talented scientists, engineers, and technicians".

We would also argue that this advice applies to Europe if it is to be firmly in the driver's seat in terms of global quantum. The bloc's future for this technology hinges on its ability to move swiftly and decisively in order to deliver on its ambitions for digital sovereignty and competitiveness. The EU has everything in house to get this done. Put differently: Quantum is the ultimate test case for Draghi's vision for Europe.

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The **EPC's Europe's Political Economy Programme** (EPE) is dedicated to covering topics related to EU economic governance, the single market, industrial and digital policies, and strategic autonomy in a context of deep geo-economic and technological shifts. The Programme has contributed actively to these debates over past years, leveraging its convening power, analysis and multistakeholder taskforce model. EPE analysts pioneered the concept of a 'wartime economy' following Russia's invasion of Ukraine, and the Programme is currently running projects focusing on the EU's ambitions and the private sector's capacity to deliver on the "triple" green, digital and economic security transitions. As fast-advancing components of 'economic security', digital and emerging technologies, such as quantum, are priority areas of focus. Linked to the changing international context, the Programme also focuses on trade policy, the transatlantic agenda, notably the EU-US Trade and Technology Council, China, and the EU's close economic partnerships (UK, EEA, Switzerland). The EPE Programme consists of a young and dynamic team, with recent recruitments bolstering analytical capacities linked to economic growth and crises, resilience and recovery, emerging tech and cybersecurity.

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