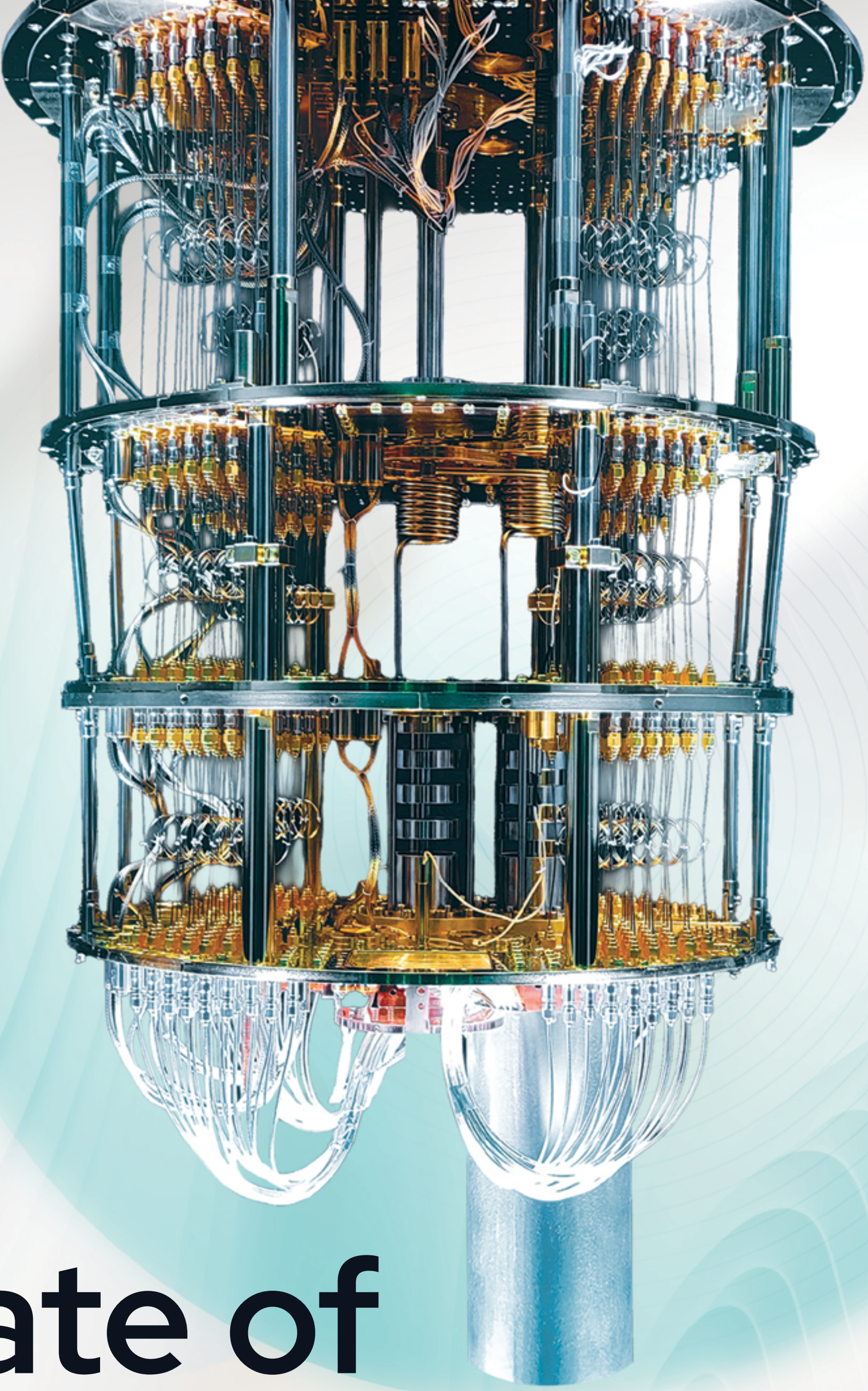

Third edition

State of Quantum

The latest trends in quantum featuring first-hand insights from global practitioners

IQM

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Foreword

When we published this report last year, people still talked about a “quantum winter” as investments in technology were slowing down. However, since then many things have changed. We saw large investment rounds, major announcement about tech milestones, and the sales and deployment of quantum computers globally. This study arrives at a time when quantum technology is making the critical leap from promise to production—an inflection point not only for researchers and developers but for entire industries poised to be reshaped by this transformative paradigm.

Over the past few months, the team conducted interviews with researchers, technologists, and enterprise users about their use of quantum computers and their applications. These conversations reveal a telling trend: quantum devices are no longer simply proving their principles—they are starting to accelerate timelines for innovation. However, delivering on quantum’s full promise will demand more than incremental advances. The next wave of progress hinges on platform integration—maturing hardware, control systems, error correction, and software environments together. In quantum, the system is only as strong as its weakest layer. Better qubits without robust pulse control, or error-corrected circuits without usable toolchains, cannot drive adoption. It is this interdependence—this orchestration of innovation across layers—that will determine whether quantum computing matures into a foundational technology or remains a niche research tool.

In this context, the industry is shifting its focus from raw qubit counts to more meaningful metrics of computational capability. A composite measure that accounts for qubit number, coherence, gate fidelity, and circuit depth—is needed for benchmarking system performance. Researchers and practitioners alike are asking for a metric that truly matters: usable computational power.

In the near term, quantum computing’s greatest impact will likely be in “small-data, high-complexity” problems—those where the challenge lies not in data volume, but in computational complexity. Chemistry, materials modeling, financial optimization, and aerodynamic simulation are consistently ranked as high-priority domains, not only for their practical relevance but for their alignment with quantum’s strengths.

Yet significant barriers remain. When asked to identify their biggest hurdles, users consistently pointed to problem selection and circuit formulation—not execution or data analysis. The lack of intuitive abstractions and domain-specific tooling means that only highly specialized experts can currently design useful quantum algorithms. As in the early days of classical computing, we are still building the languages, libraries, and workflows that will democratize quantum development.

Compounding this challenge is the current fragmentation of quantum software. Most SDKs—Qiskit, Cirq, PennyLane, t|ket⟩—are closely tied to specific hardware, limiting portability and creating friction in multi-vendor environments. However, promising alternatives are emerging. High-level languages like Qrisp are showing how hardware-agnostic, “write once, run anywhere” quantum programming can reduce complexity and drive broader adoption.

A powerful new dynamic is also unfolding between artificial intelligence and quantum computing. On one hand, **AI is catalyzing quantum development,** auto-generating circuits, optimizing pulse sequences, and even proposing novel error-correction techniques. On the other hand, **future fault-tolerant quantum processors may become critical enablers for AI,** offering efficient pathways for training large models and solving combinatorial problems. These two transformative technologies are beginning to accelerate one another.

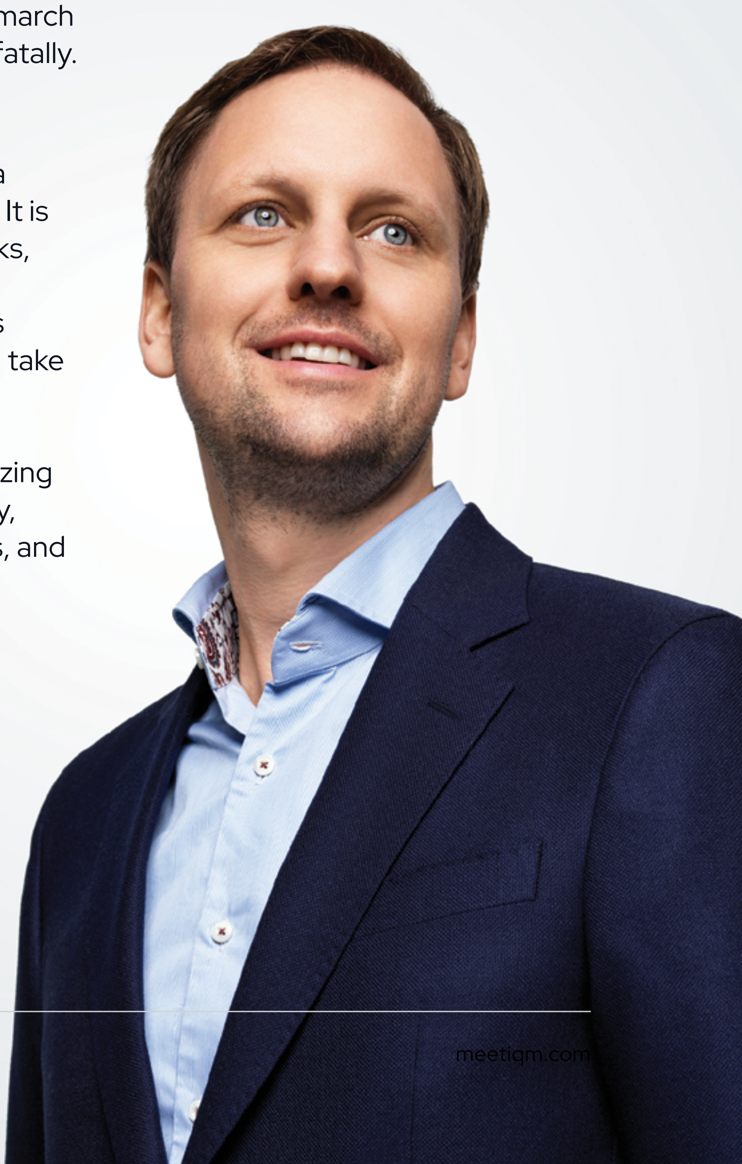
In high-value scientific computing, hybrid quantum-classical workflows are becoming essential. Institutions like EuroHPC, RIKEN, and Oak Ridge National Laboratory are actively developing architectures that integrate quantum processors into high-performance computing (HPC) clusters. Low-latency interconnects, job scheduling systems, and unified APIs are under development to ensure both quantum and classical resources are used optimally—paving the way for breakthroughs in materials science, climate modeling, and beyond.

And yet, for all this momentum, systemic challenges persist. The supply of quantum-literate engineers is far below projected demand. Regional disparities in late-stage capital investment threaten to create lopsided progress. Without sustained investment in education, infrastructure, and equitable funding, the march toward fault-tolerant platforms could slow—perhaps fatally.

This study presents a detailed and grounded view of quantum computing as it exists today: no longer just a science experiment, but not yet a mature technology. It is a landscape defined by breakthroughs and bottlenecks, opportunity and uncertainty. Our goal is to help policymakers, investors, technologists, and educators understand where the field is heading—and what it will take to get there.

The quantum future is closer than it appears. But realizing its full potential will require not only scientific ingenuity, but sustained collaboration across disciplines, sectors, and borders.

Jan Goetz
Co-Founder & co-CEO
IQM Quantum Computers



Executive summary

Quantum computing and HPC practitioners, investors, and users interviewed by Omdia during March and May 2025 were clear on two major issues for the future of quantum computing - hardware industrialization, meaning moving from crafted laboratory devices to manufactured, reliable, and scalable products, and software platforms, meaning moving from low-level methods of specifying circuits of physical qubits to high-level programming using logical qubits, with greater support for simulation, portability between quantum modalities, and exploration before committing to a solution.

The biggest problems they foresaw at a user level were identifying challenges that could be solved advantageously with quantum computing, and setting up the problem for execution on the quantum computer. The relevance of the software issue to this ought to be obvious. HPC practitioners are enthusiastic about integrating quantum machines into their services and are actively conducting outreach to their users to inform them about quantum computing and encourage them to trial it. At a technical level, the main integration issue seems to be job-scheduling the combination of CPU-based machines, GPUs, and quantum devices. Interviewees do not expect one true way to quantum computing to emerge – instead they expect at least two and possibly more of the physical modalities to coexist, with a considerable degree of specialization between applications and modalities.

Funding seems to be much easier to access in North America than either Europe or Asia & Oceania, although on the other hand there is an impressively vibrant ecosystem of European startups. The typical deal in Europe is considerably smaller and there seems to be a mismatch between a requirement for growth-stage capital to help with hardware industrialization and enthusiasm for seed funding hardware startups, while on the other hand, investors seem to expect software startups to be further along towards commercialization than they are.

Background & methodology

Omdia developed this report on the basis of its extensive survey research into quantum computing adoption plus a series of semi-structured in-depth interviews with quantum computing practitioners from national high performance computing (HPC) centers and research institutions, investors, and others in US, Finland, Germany, Italy, Poland, Czech Republic, Japan, and Australia. Qualitative fieldwork was carried out during March and May 2025.

The data triangulation method was used to ensure consistency and eliminate bias in the analysis, combining qualitative insights from the interviews with the broader, quantifiable trends from the surveys.

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Introduction: why quantum computing?

Quantum computers take advantage of superposition, the physical principle that a quantum-scale particle can occupy **multiple states at once**, to accelerate certain kinds of computations.

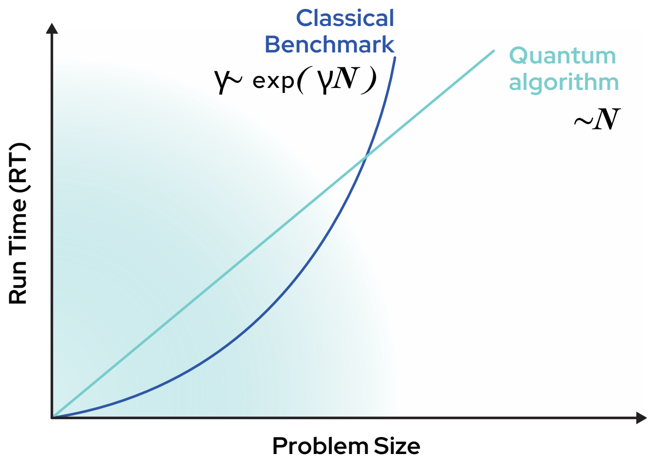
Many of these are not solvable in useful time without the speed-up from the quantum computer. These problems include physical simulation of chemical and biochemical processes, certain kinds of combinatorial optimization, some cryptographic operations, and some approaches to machine learning.

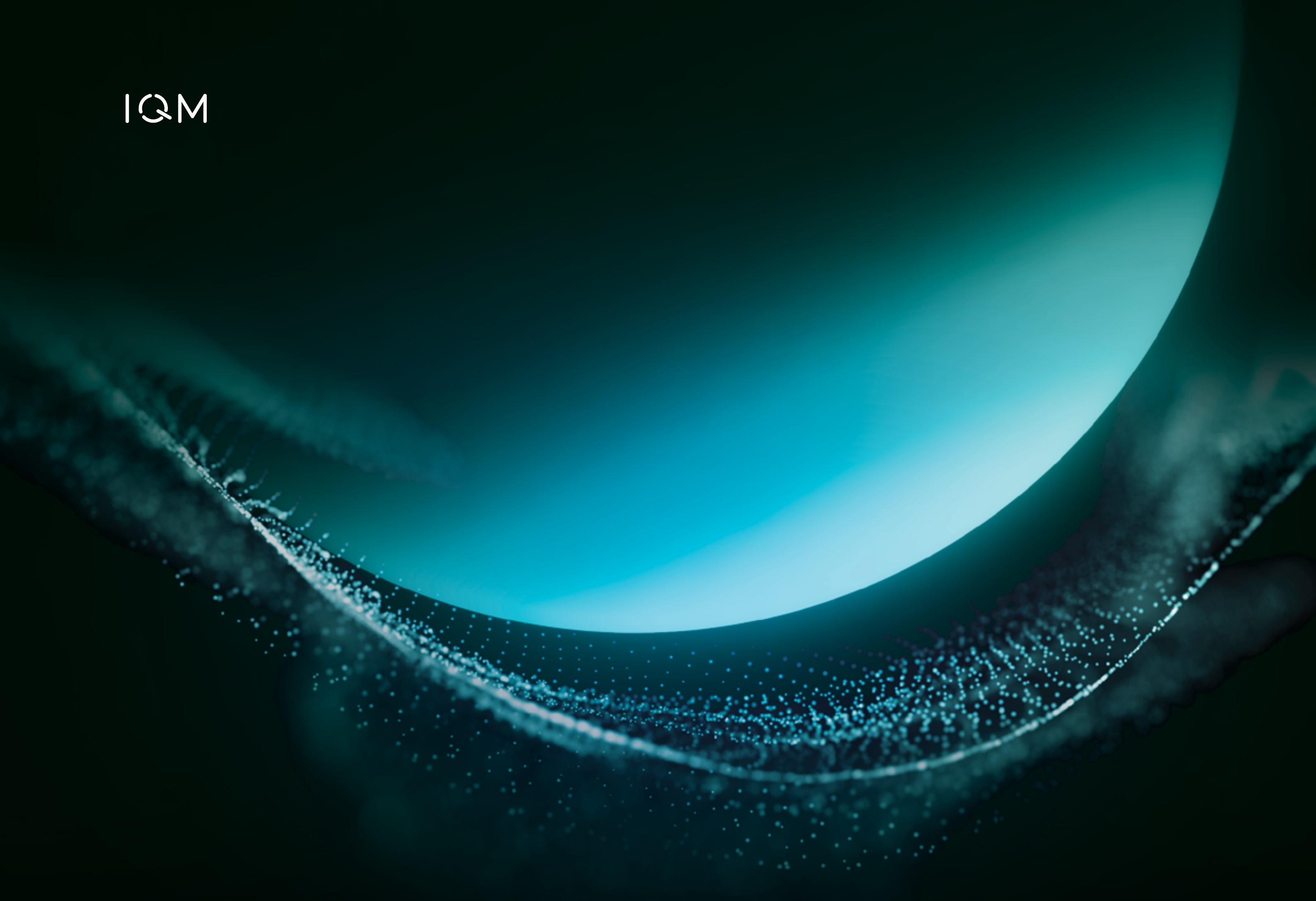
For a specific class of problems, known as BQP for “bounded error, quantum, polynomial time”, an adequately large quantum computer will always be faster than a classical one once a threshold problem size is reached.

This concept, shown in Figure 1, is related theoretically to the distinction between polynomial-time and nondeterministic polynomial (P and NP) problems. Some problems that do not have a polynomial-time solution in classical computing do have one on a quantum computer with an adequately large number of qubits. Classical computers can arrive at an answer by simulating the problem, but this will take more time, and in fact, it might take infinitely more time.

As a general rule, problems that might benefit from quantum computing can be described as **“small data, big compute” problems**. Traditional machine learning methods can be remarkably fast and efficient, even over big data sets, while modern artificial intelligence models such as Transformer can work well for an astonishing variety of problems so long as there is enough data to train the model. Also, **quantum computing tends to lose some of its attraction on very large data sets**, as computation is no longer the limiting factor and the **time taken to run the problem is dominated by input-output (I/O) operations**. The sweet-spot is the subset of HPC problems where there is both computational complexity, ruling out compute-efficient solutions, and insufficient data to train an AI.

Figure 1:





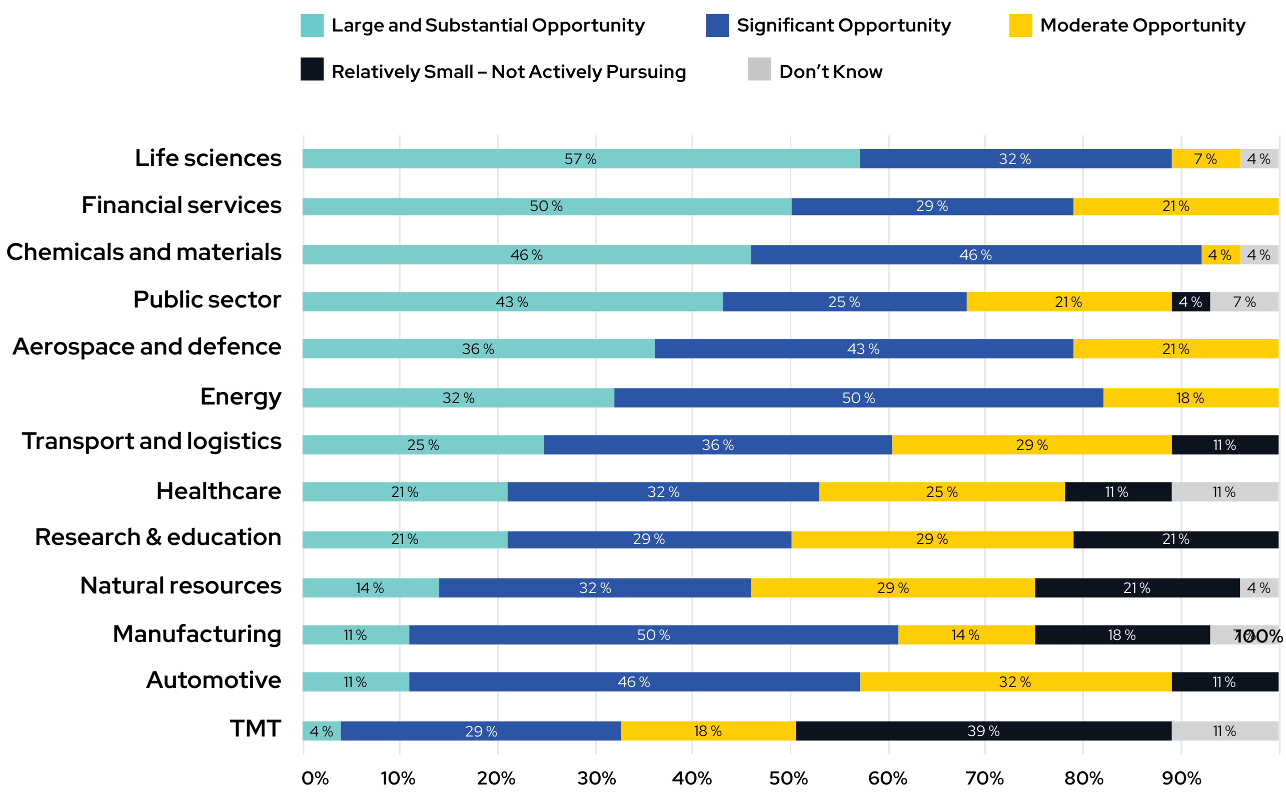
Key findings

Respondents to Omdia's Quantum Computing Vendor Sentiment Survey see the **biggest opportunity** – in a sense, the **biggest concentration of such problems** – in the **life sciences** and **pharmaceutical** sector, followed by **financial** services, and **chemicals**.

Chemicals & materials science actually topped the poll, with 92 per cent, if we consider the second highest "significant" category as well as the highest; seeing as simulation-intensive aerospace is also in there, it looks like physics-based simulation is probably ***the*** quantum computing application. The main public sector use case is almost certainly cryptography and cryptanalysis, with some contribution from positioning, navigation, and timing.

Figure 2: Sectors heavy on scientific computing and physics-based simulation top our poll

How significant an opportunity does each of the following industries represent for QC technology?



Source: *Omdia Quantum Computing Vendor Survey*

When Omdia analysts spoke with the qualitative survey respondents, we heard a very clear message as to what needs to change if these opportunities are to be realized.

The first issue could be summed up as hardware industrialization – making the fundamental quantum devices reliable, scalable, and less dependent on highly specialized infrastructure and support – and the second could be described as the need for a software platform – creating reusable software tools with a common interface for different quantum machines using different physical principles.

The two issues, though different, are interrelated, in that software-level error correction requires the hardware to achieve a minimum scale. The intuition here is Shannon's law; error correction requires redundancy, and the required redundancy increases rapidly with more noise. Without better software support, it will be difficult for many of the hardware options to gain the critical mass of operational experience needed to become reliable. Additionally, the quality of software tools affects the performance of the hardware, as respondent Johansson points out:

> " Larger qubit counts and greater reliability are crucial for error correction. Then it's the software packages. We need efficient compilation and transpilation, making circuits short enough that they can do useful work in the coherence time, and then comes better post-event analysis. Using AI tools to enhance quantum computing, such as generating circuits, is a possible opportunity "

Another respondent, Mariusz Sterzel, Polish EuroHPC GB delegate, Academic Computer Centre Cyfronet AGH, mentions two major obstacles to the progress of quantum computing:

> " There are two key challenges. First, quantum chips are still developing and currently lack the reliability needed for consistent results. Second, the software ecosystem — particularly middleware and math libraries — lags behind. Compatibility issues, such as frequent changes in tools like [a common quantum computing SDK], make it difficult for developers to keep up. It would be beneficial if hardware and software development progressed more in tandem, and if more attention were given to comprehensive documentation to support the community. "

Ekaterina Almasque, a long-term investor in quantum computing pioneering companies, also pointed out the need for a platform layer, while suggesting that there is a significant misalignment of risk-return expectations across the quantum computing stack:

> One of the major challenges is the absence of complete, end-to-end solutions. While hardware vendors can provide quantum machines, the supporting software ecosystem is still underdeveloped - there's no standardized operating system for quantum computing, and writing usable code remains difficult. Interestingly, early-stage investment is biased towards creating usable hardware, while growth-stage funding is heavily focused on quantum-inspired software as the risk of investing in software is perceived to be lower. This reveals a disconnect: meaningful progress in software depends on more mature functional hardware, which would require much more substantial growth investment beyond the early stages. "

To put it another way, the hardware companies need to scale up and industrialize, but instead investors are funding even more new hardware options, while the software companies are attracting investors who expect them to be closer to practical usefulness than they really are. One way of looking at this is in terms of people; Antti Vasara, former CEO of the Finnish Technical Research Center VTT, observed that researchers in HPC and quantum computing were more than enthusiastic to tinker with quantum computer systems, but the problem was that the great majority of users aren't quantum computing researchers:

> For them to be useful and operational in a data centre, of course they need to start being more reliable without an army of PhDs taking care of them...it's of course OK for a Research Institute like us. Our folks are eager and inspired that they can go and tinker with the machine and keep them going. "

Our conclusion is that the future of quantum computing hinges on the development of a robust platform - one that combines reliable infrastructure-as-a-service with a software environment, enabling researchers across diverse fields to run experiments quickly and with minimal need for machine-specific adjustments. The conversation about quantum computing tends to be dominated by which of the fundamental technologies is going to win. This is the wrong question. Not only are several different options likely to coexist for different applications, but the platform is more important..

> For them to be useful and operational in a data centre, of course they need to start being more reliable without an army of PhDs taking care of them...it's of course OK for a Research Institute like us. Our folks are eager and inspired that they can go and tinker with the machine and keep them going. "

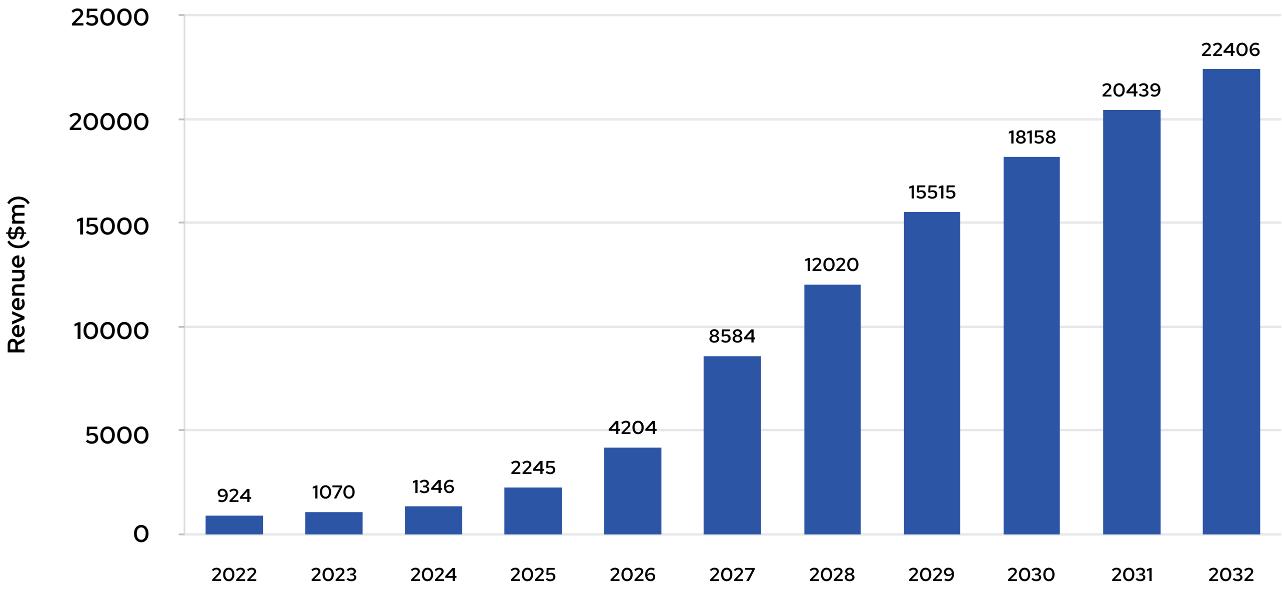
> **– Pascal Elahi,** Quantum Supercomputing Research Lead, Pawsey Supercomputing Research Centre, Australia

Market overview and forecasts: $22bn by 2032

Omdia's Quantum Computing Market Forecast estimates that quantum computing vendors' revenue might exceed $22bn globally by 2032.

This market will only be a subset of the HPC market, but a subset containing some of the highest value workloads. There is substantial uncertainty. Any attempt to forecast the size of the market must make the assumption that it does eventually take off, which is not guaranteed. However, the content of the interviews we carried out for this project was reassuring, in that nearly everyone could mention cases where quantum computers were helping scientists with real research in their own fields.

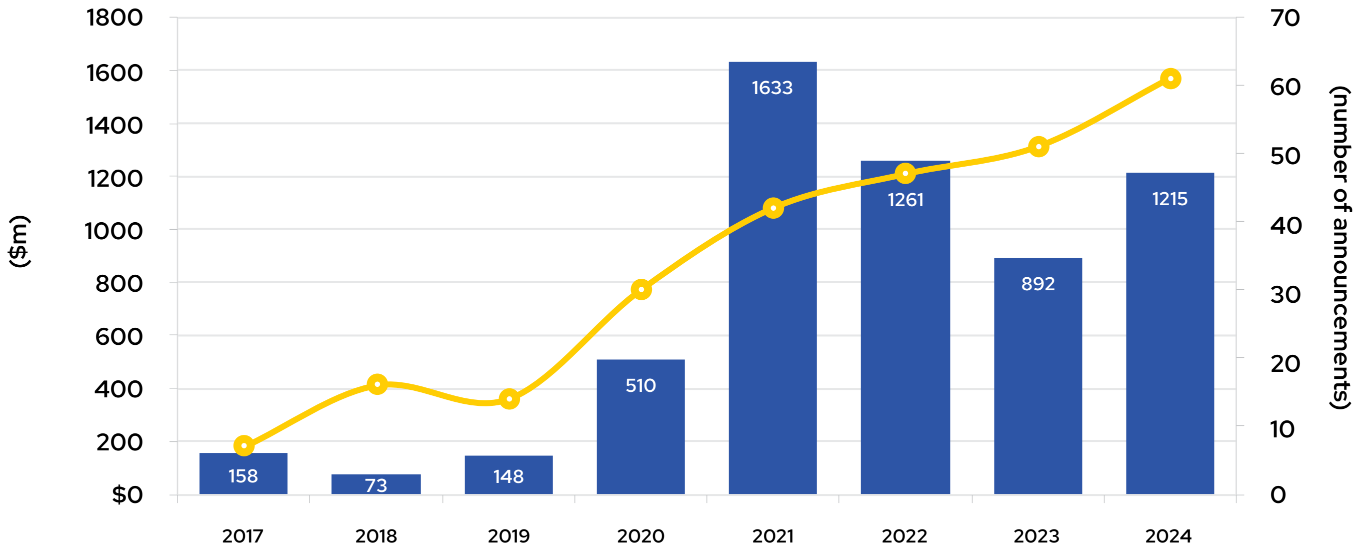
Figure 3: Overall size of the quantum computing market



Source: *Omdia*

Investment in the quantum computing ecosystem is accelerating, mirroring the broader resurgence of venture capital interest in hardware and deep tech since 2019-2020. The peak year of 2021 set records, alongside AI and semiconductor projects, followed by a cyclical downturn in 2023 and a rebound in 2024.

Figure 4: Quantum computing venture capital funding 2017-2024



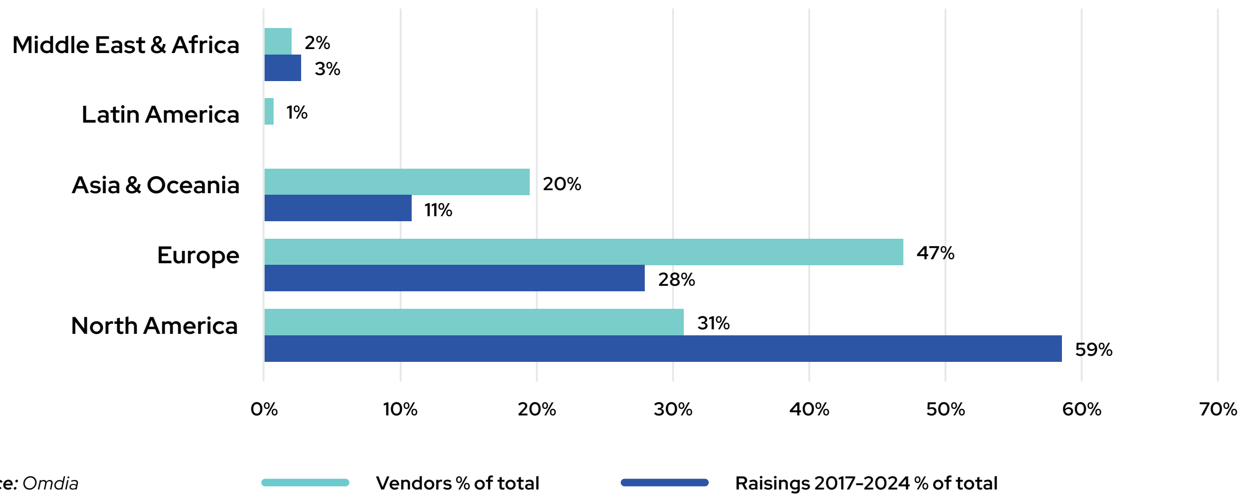
Source: *Omdia*

Funding is going heavily to startups in North America, although interestingly, the **Omdia Quantum Computing Market Tracker**, a product monitoring quantum computing announcements, actually found more companies in Europe. 58% of venture capital investment since 2017 was in North America, while only 30% of the companies were.

On the other hand, less than 30% of the funding went to European companies although well over 40% of the companies are European.

The average funding for a quantum computing startup was $38m, compared to $12m for a European startup. This suggests VC allocators are undervaluing European companies.

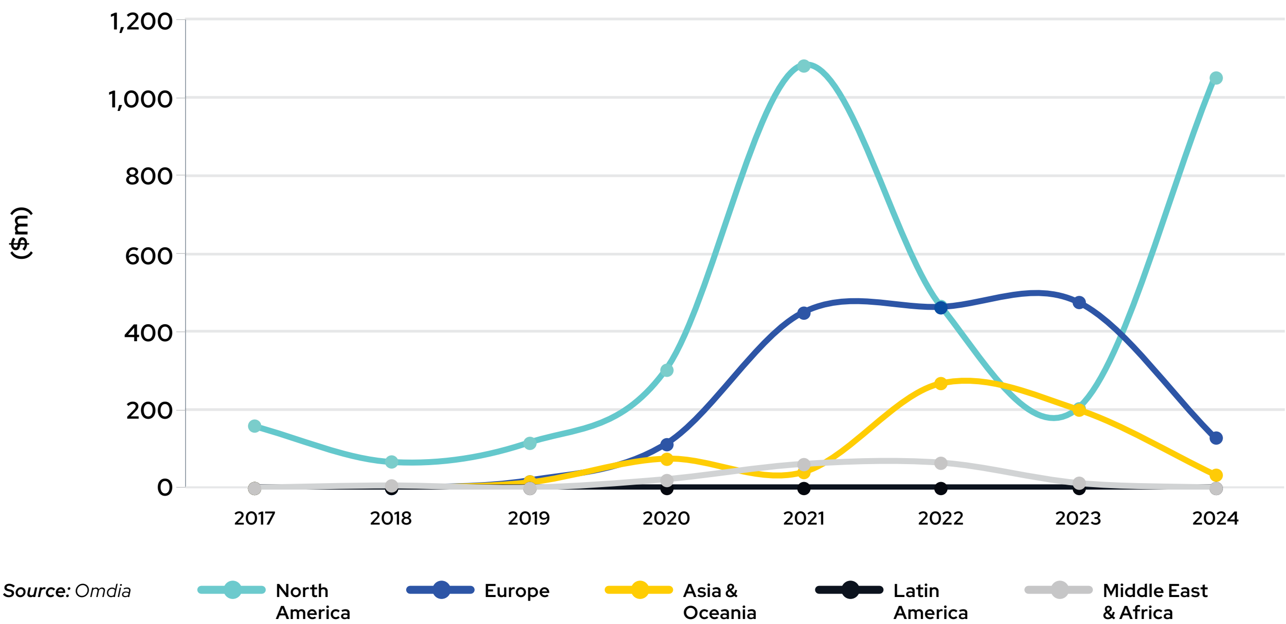
Figure 5: Comparison of quantum company startups and funding by world region



Source: Omdia

Funding for European and indeed global companies did not experience the dramatic highs and lows seen in the U.S. venture capital ecosystem. However, this offers little comfort: 2023, when European fundraising briefly outpaced North America, appears to have been an anomaly, followed by especially weak funding in 2024.

Figure 6: Distribution of quantum computing funding by world region, over time

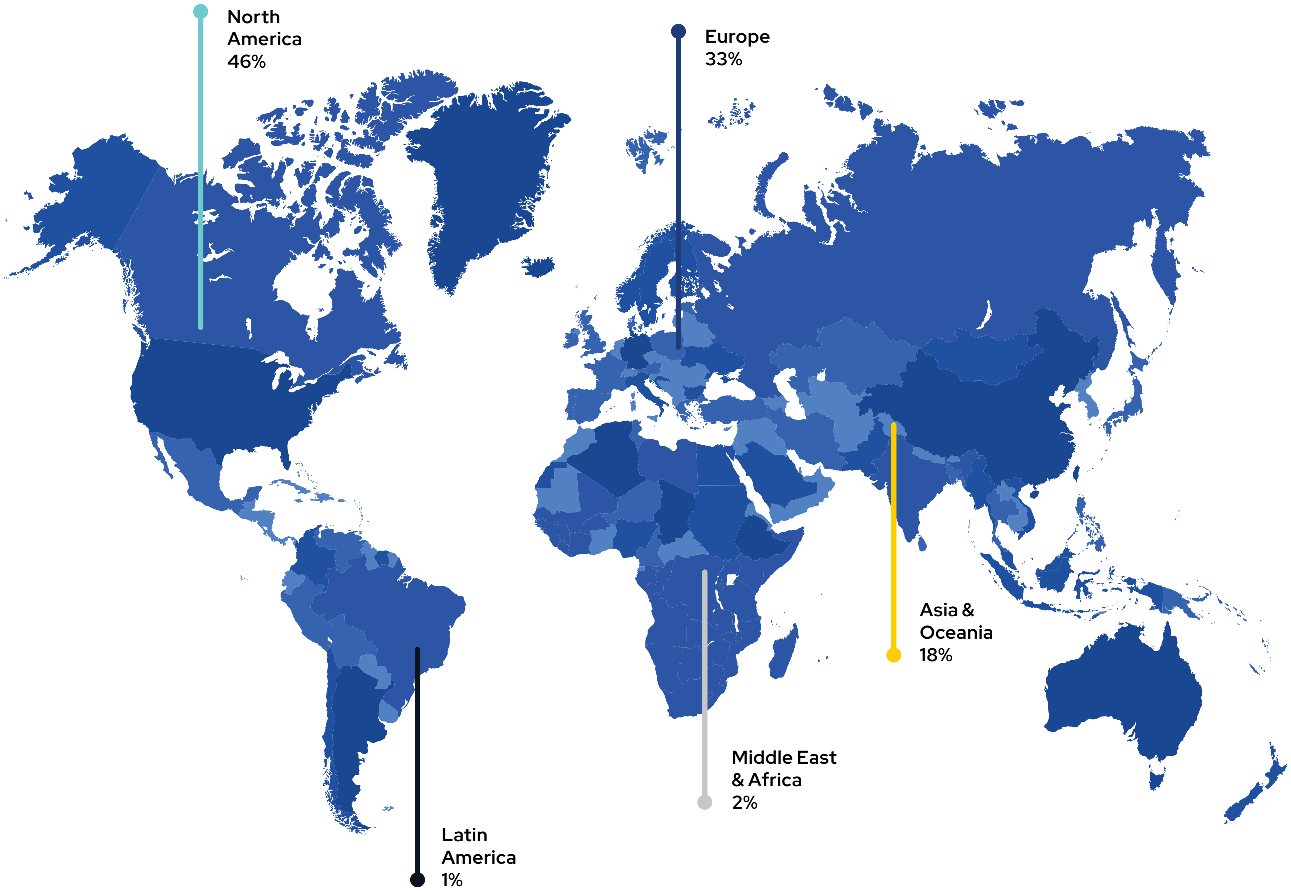


Source: Omdia

Companies deploying quantum computers are, by contrast, most likely to be based in North America. 46 per cent of the total, or 133 companies, in the Tracker's database are located in North America, with another 33 per cent in Europe and 18 per cent in Asia and Oceania. It is possible this might explain the stronger funding.

Figure 7: Quantum computing adopters by world region

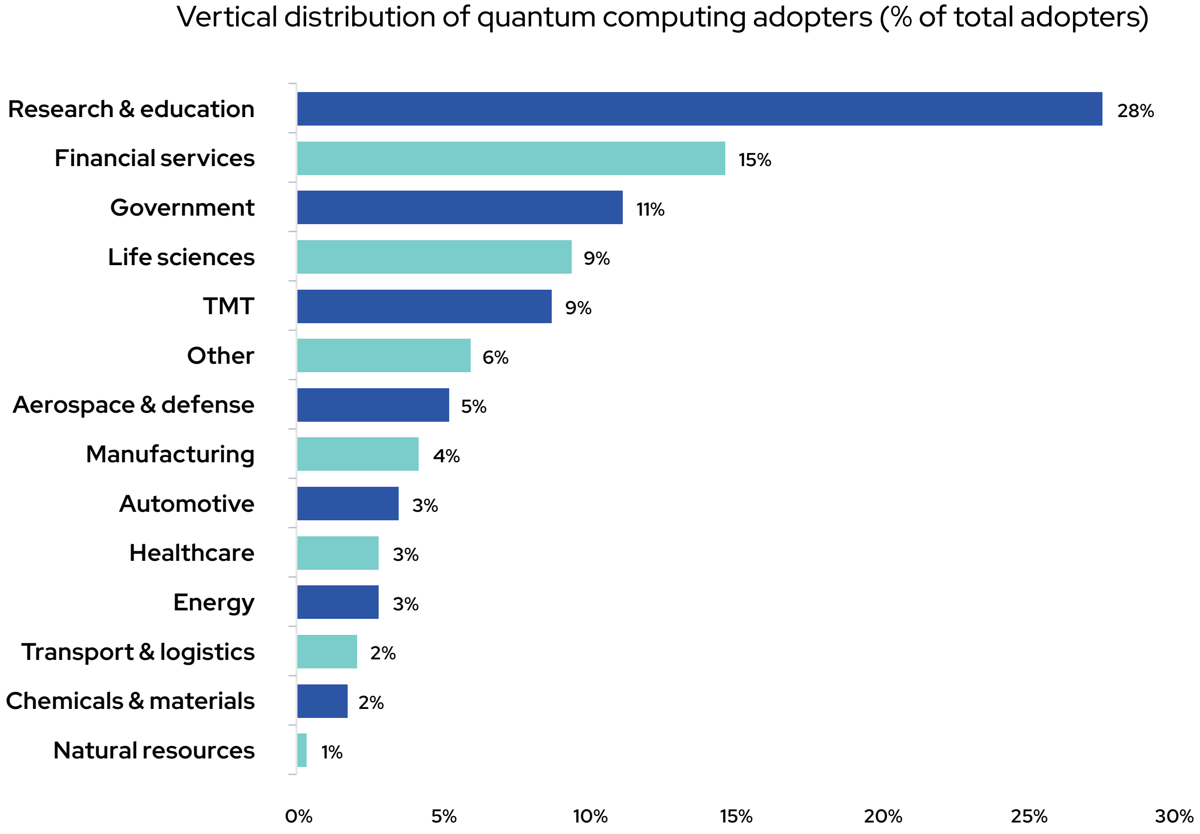
Regional distribution of quantum computing adopters (number of adopters, %)



Source: *Omdia*

The universe of adopters remains research-heavy – the research & education (R&E) sector represents 28 per cent of total adopters. This also has the effect that a surprisingly high proportion of quantum computing adoption is non-profit – 42 per cent of adopters are non-commercial, often universities, and 36 per cent are government agencies. **Figure 8** shows the breakdown of adopters by sector.

Figure 8: Quantum computing adopters by vertical

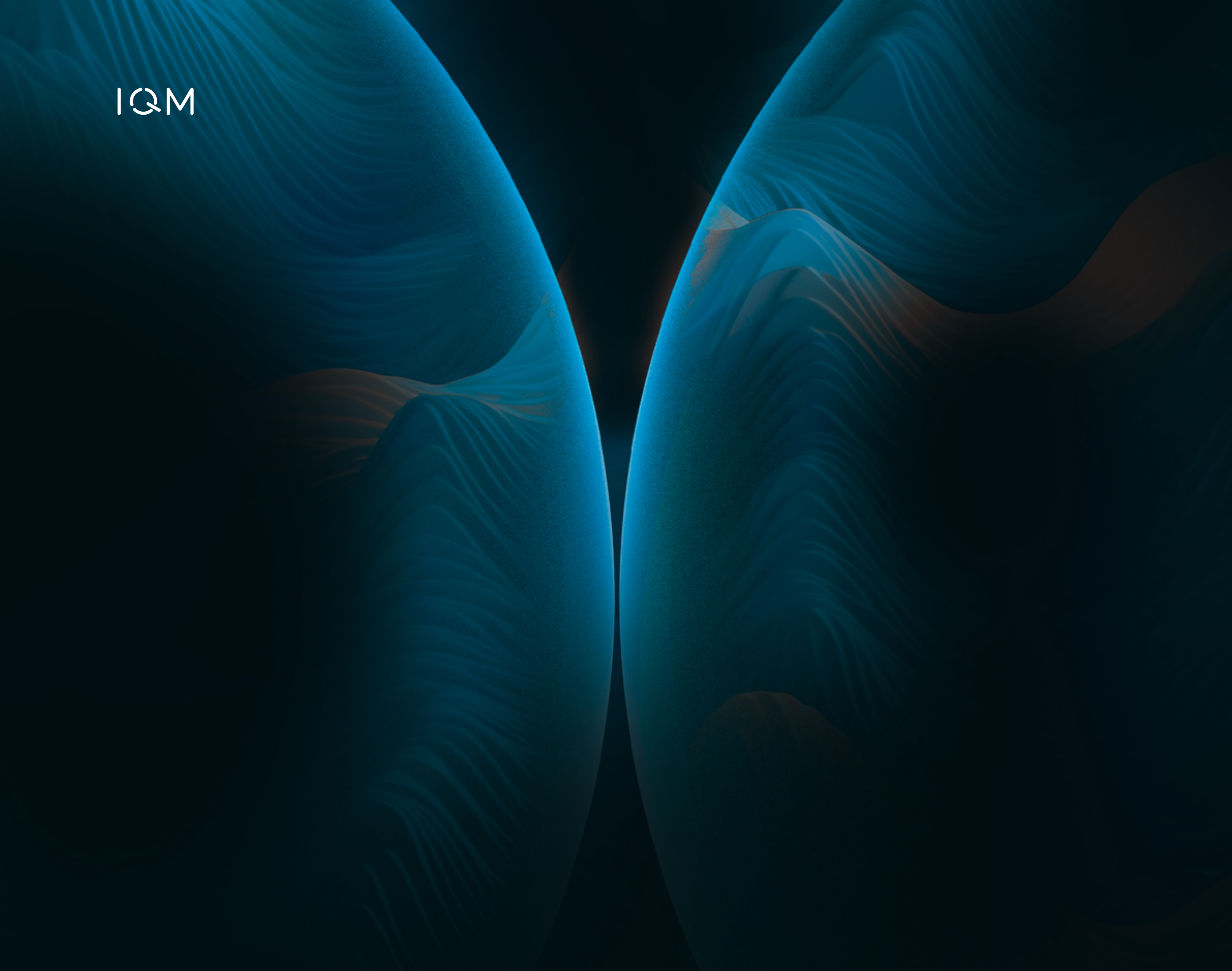


Source: *Omdia*

Note that although the "life sciences" and "chemicals & materials" verticals are among the top three opportunities according to the survey respondents, they are nowhere near as far ahead in terms of adoption. The same goes for the "transport" vertical, adoption remains at an experimental stage, but the problems being explored are concrete and computationally intensive. Manfred Rieck, Head of Quantum Tech at German train operator, Deutsche Bahn notes:

> " We conduct experiments without expecting quantum advantage at this stage. The optimization of our complex landscape - 450 ICEs and 312 stations for our high-speed trains – can't be solved with todays HPC/ Quantum systems. Therefore we are working with toy problems, working with a handful of trains and stations at a time to understand the applicability of hybrid quantum and HPC systems and prepare the organisation for its usage."

Observed adoption in financial services, though, roughly matches the survey results and represents by far the biggest concentration of quantum computing adoption in the private sector. Much of the activity in aerospace & defense will eventually serve government customers or is being funded by the government directly; it is a matter of opinion where the line between quantum computing adoption and subsidy to quantum computing research is drawn.



Current barriers to adoption

Beyond getting the qubit sources to work reliably and providing a workable software development environment, the major challenge our interviewees expressed was identifying use cases and setting up the problems that arise from then to run on the quantum machine.

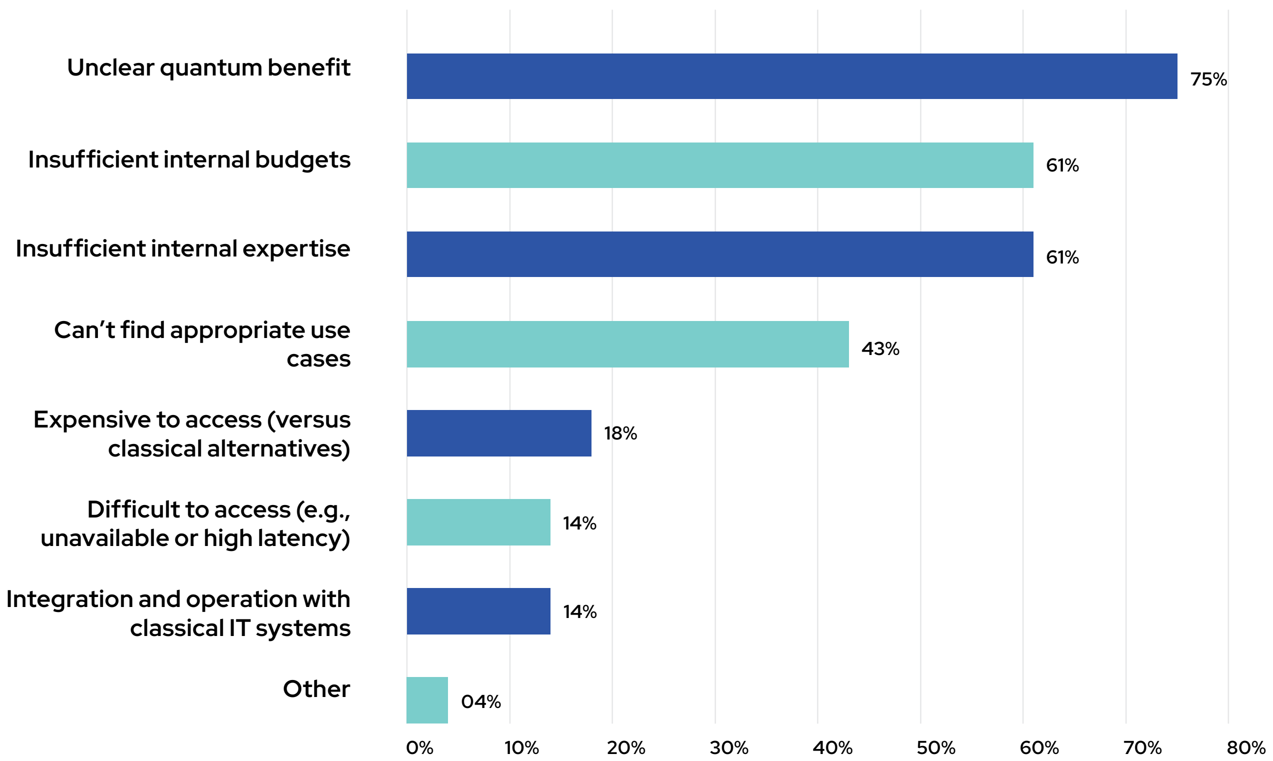
Omdia asked respondents to identify which of the following challenges were most important for quantum computing users:

Identifying potential applications for QC	**Problem setup and implementation**	Execution	After-the-fact analysis

Everyone we spoke to felt that either or both of the first two issues were the biggest barriers to user adoption. Users need to be able to identify which of their problems are likely to demonstrate quantum benefit, something more important than the technical concepts of quantum advantage or quantum supremacy. Then they need to translate them into quantum circuits that can be executed on the actual machine. **Figure 9** shows this closely mirrors Omdia's quantitative findings.

Figure 9: Demonstrating quantum benefit is the top issue for adopters

What are the primary challenges facing QC adopters? [Select three]



Source: *Omdia Quantum Computing Vendor Survey*

This point came up again and again:

> "Identifying the problems. Definitely. Then writing a quantum computing program that solves it. The set of efficiently solvable problems is not very large, so you have to make this mapping between it and problems that currently use a lot of compute capacity, and then make a method to solve them. We need more useful algorithms."
>
> **– Johansson**

> "The second - problem setup and implementation - is the major challenge today"
>
> **– Almasque**

> "I think we're still at the stage of figuring out what's the problem for which we can try to develop an algorithm that would be beneficial to run on a quantum computer. So we are still in quite the fundamental stage at the moment. Not fundamental discoveries about quantum computing but of the right problems for quantum computing"
>
> **– Vasara**

> "Execution of a quantum algorithm is not difficult – you follow the cookbook – and results analysis is part of the algorithm itself. But identifying a problem and developing a quantum solution – writing the circuits, implementing for the specific quantum computer – is difficult. You can't just take a classical code from a laptop and then send it to the machine and have it run quantum fast."
>
> **– Jansik**

> "Bioinformatics has a lot of problems that could have quantum advantage, but the scientists who might have a good scientific computing background are not quantum algorithms experts. Trying to unpack the kind of things, say, geophysicists do to find out what quantum computing could help with is difficult; trying out an idea is not trivial, you can't just grab one or six like you can with CPUs"
>
> **– Elahi**

It appears that this problem may need to be solved in the software layer. Several respondents mentioned that their HPC center put significant effort into providing advice and outreach to users, but this is a solution that only scales poorly, even if it is quite likely that more companies will emerge providing professional services to quantum adopters.

If we consider the AI ecosystem, there are several layers of well-developed software tools:

MLOps platforms, helping to manage training jobs, monitor model performance, and automate inference serving (e.g. Kubeflow)

High-level frameworks, providing algorithms, model architectures, and related tools as software libraries (e.g. Pytorch)

Software development kits, providing low-level access to the hardware accelerators (e.g. CUDA)

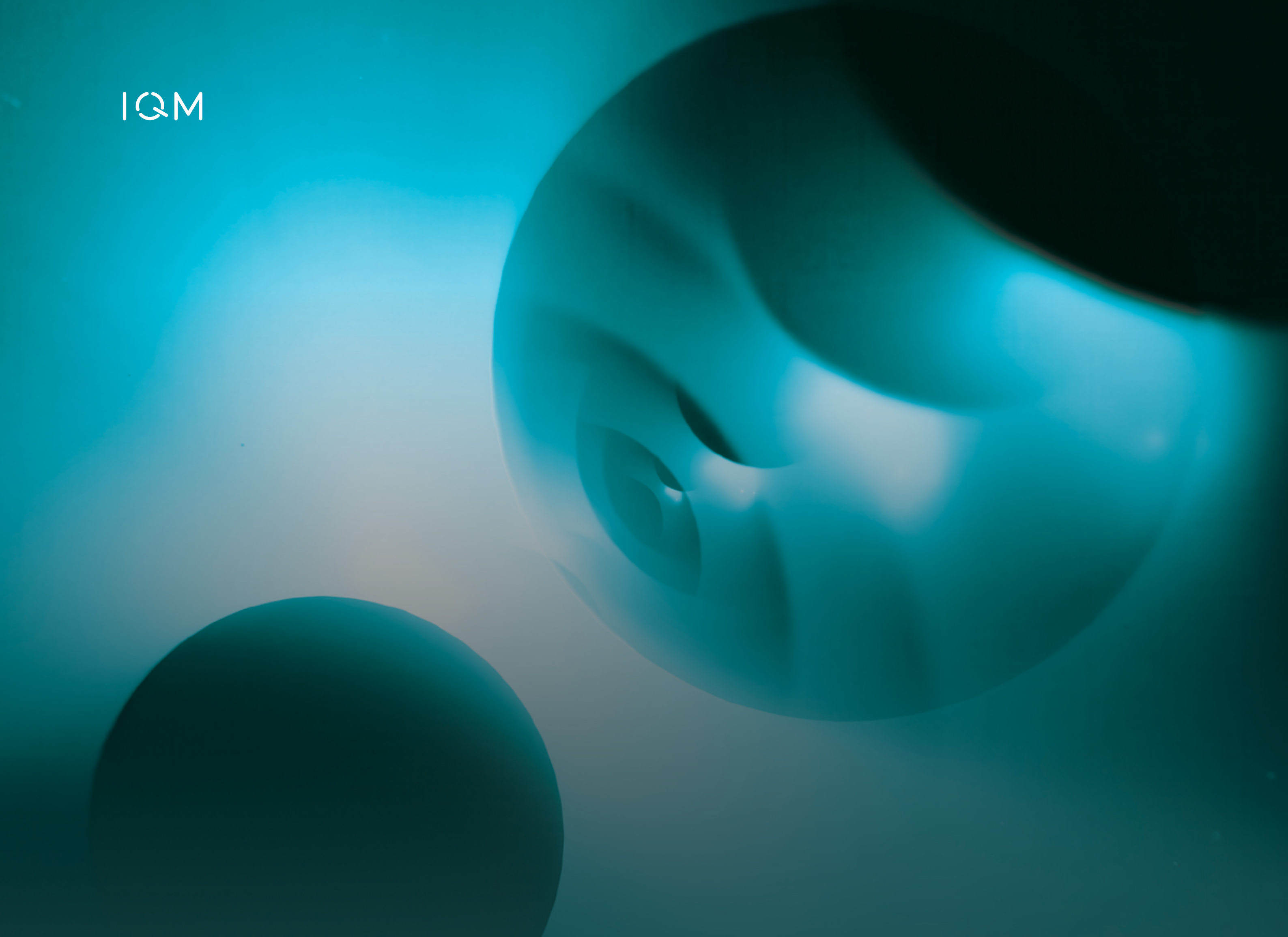
A new software platform will need to address the equivalent layers for quantum computing.

This would include:

- ✓ better algorithm libraries,
- ✓ a unifying software development framework for different quantum devices,
- ✓ improvements in compilers and transpilers,
- ✓ better simulation and emulation tools to help users experiment and prototype ideas before deploying to the quantum computer itself.

This last point is especially important as quantum computers are likely to remain limited in numbers and time on them precious, especially if the technology that eventually leads in adoption requires a cryogenic infrastructure.

> " Learning on how to handle liquid nitrogen is interesting if you usually work behind a keyboard"
>
> **– Jansik**



Understanding the technology: the key qubit modalities

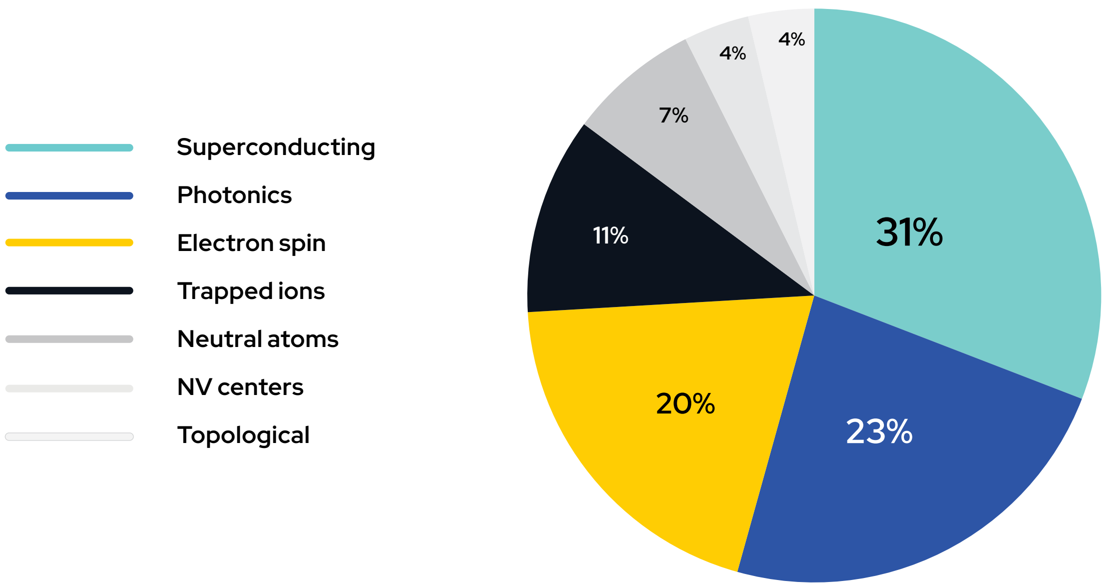
The first step in building a quantum computer is to generate a quantum phenomenon you can manipulate in order to treat it as a qubit, the basic unit of information analogous to the bit in classical computing.

Numerous different approaches are being tried, all of them defined by using a different physical principle to generate quantum effects and consequently qubits.

The fundamental problem is that interacting with the qubits in any way ends the superposition and precipitates the qubits into one of their possible states.. What can actually be achieved with a quantum computer is bounded by how long the system can run before this happens, as well as by the number of qubits. Omdia's Tracker monitors which vendors are pursuing which approaches, shown in **Figure 10**.

Figure 10: Quantum computing vendors by qubit modality

Qubit technologies used by QPU vendors (% of vendors)



Source: *Omdia*

Over half the quantum computing vendors are pursuing the two most common options, superconducting circuits (like IQM) and photonics, although there are six categories Omdia considers important enough to monitor, and one of our interviewees suggested there might be more. The options can be categorized by which fundamental particle they use as the qubit, as in **Table 1**.

Table 1: Overview of quantum computing approaches

Electrons	Atoms	Photons
Superconducting circuits	Trapped ions	Photonic
Silicon spin	Neutral atoms	
NV (nitrogen vacancy) centers		

Source: *Omdia*

Electron-based qubits

Superconducting circuit qubits are manufactured using semiconductor processes to create chips containing superconducting wires when cooled to near zero temperature. Two electrons form “Cooper pairs” when they pass through superconductors, and these pairs can carry a charge across an insulator (i.e., a barrier) via a process called “quantum tunneling.” Two superconducting wires placed on either side of an insulator create a “Josephson junction,” and the electron pairs traversing this junction form the qubit. The qubits are controlled by firing photons at the junctions. Superconducting is by far the best-studied approach and the chosen one that major players such as IBM, Google, and IQM are pursuing. It has the disadvantage that it is fundamentally dependent on the whole quantum system being extremely cold and requires extensive cryogenic infrastructure, and is not really compatible with standard semiconductor or data center infrastructure. On the other hand, it is the approach with the biggest base of knowledge and experience behind it, and the longest-running quantum computers are based on it. Superconducting quantum computers can run at higher clock frequencies than some of the other technologies, an important advantage, although the error rate tends to be higher.

Silicon spin qubits (also known as “quantum dots” or “electron spin” qubits) are manufactured using semiconductor processes. One approach to making silicon spin qubits is to create a line of single electron transistors, where microwave pulses control the single electron under the gate in the transistor, and the superposition occurs in the “spin” (up and/or down) of the trapped electron. Omdia includes EeroQ’s “electron on

Helium" approach in this category. This is probably the approach that is simplest to manufacture.

Nitrogen vacancy (NV) center qubits are made by creating microscopic defects in synthetic diamonds (nitrogen atoms missing from the lattice structure) that trap an electron and enable the electron's spin to be used for quantum computation, with control of the qubit enabled through microwave pulses. Although the diamond itself is extremely stable with regard to temperature and environmental influences generally, these devices often include both microwave and laser control; although the infrastructure is simpler, the control methodology is complex.

Atom-based qubits

Trapped ion qubits are created using lasers to strip an electron from the outermost ring of an Ytterbium or Barium atom to create an ion, then trapping the ion using an electromagnetic field and operating on the ion using lasers.

Neutral atom qubits (also known as "cold atom" qubits) are created by cooling Rubidium atoms down to near absolute zero temperatures using lasers. Lasers are then used to arrange the atoms, hold them in place, run computations on them, and read out the results.

Atom-based approaches have the advantage in common that all atoms of a given element are always identical and have the same properties, and are easily available. Neutral atom approaches, although cryogenic, have the advantage that the space that must be maintained at very low temperature is extremely small, making the system overall smaller and less dependent on cryogenic infrastructure. Both categories of systems tend to offer low error rates.

On the other hand, both trapped-ion and neutral atom approaches need to sequence the pulses from multiple lasers in multiple qubits – this is computationally complex and, as one of our interviewees ironically pointed out, a problem that might itself benefit from quantum computing - and the clock frequency is usually lower.

Photon-based qubits

Photonic qubits (sometimes called "flying qubits") are made using a photon emitter to generate photons sent along various patterns via either on-chip waveguides or a high-end telecom-grade optical fiber. These patterns include beam splitters to create superposition and entanglement; the quantum state of the resulting photonic qubit is measured on a photon detector. Silicon photonics is a well-understood technology and a manufacturing process already used in scale, a major advantage, and the optical devices are relatively robust, offering lower error rates. The field is considerably less well developed than either superconducting or atom-based options, and reconfiguring the photonic system for different problems can be a challenge.

Interviewees see the modalities as complementary

Our interviewees sometimes expressed a preference between modalities but mostly wanted to express that they are more likely to complement each other, with different fundamental quantum computing approaches offering different benefits. This again underlines the importance of the problem setup, prototyping, and better software support for portability between systems.

> At this point you should keep all the options open. We don't know where there might be roadblocks to scaling up in any of these. The proof of the pudding is in the eating. Some of them may be complementary. In the short term, higher clock frequencies will be an advantage although for really big questions it may not matter much if it takes 10 minutes or a day. All else being equal, the superconducting system will win there, but the data and the problem are still important. General purpose QPUs are still under development; the different technologies are suited to different problems"
>
> **– Johansson**

> For me, the superconducting qubits are the most promising for now. But I also see benefits coming from the photonics and the major benefit comes from the fact that there are very low power devices, so within 10s of kilowatts one can get one day over 1000 qubits"
>
> **– Sterzel**

> Each has potential for different apps...Trapped-ion is inspired by closeness to the physical phenomenon, but however elegant these are, they may be subject to a bottleneck as they scale up; errors will become a significant bottleneck and demand a lot of redundancy. [It will be] fascinating to know how they scale; I won't be convinced until they're running millions of qubits"
>
> **– Almasque**

> We're intentionally preparing for a multi-modal quantum future. The field is evolving rapidly, and we want systems that can coexist and interoperate."
>
> **– Horibe**

Central concerns for many interviewees were design for manufacturing and scalability. Several of them mentioned that quantum computing systems would need to connect many more qubits together as they scaled up, and that this would imply connecting them via a chip packaging process rather than with cabling. This implies that any technology that can be integrated with the existing CMOS lithography and advanced packaging infrastructure has an important advantage.

> " I still worry that there is not enough. We still do not have the technology to build the quantum chips… in volume… Research in this direction is essential. And we have to really rely on this because right now, you know. Trying to connect qubits via cables, it's not the way to go. If there is no breakthrough – if we don't learn how to make quantum chips with good quality qubits in volume – we won't have quantum advantage….I was quite surprised that IQM was trying to build such a processor already. Not trying to connect qubits with cables but to make a single processor"
>
> **– Sterzel**

> " Realistically, I am agnostic. Superconducting lets you evaluate circuits much faster but it has quirks. Scaling up is a really interesting question – some things might not scale up but will serve a purpose. Spin qubits might not be uniform across the whole chip but could have really simple manufacturing; on the other hands, diamond artefacts have great thermal stability because they're diamonds but for the same reason won't scale well, but they could go in a rack server."
>
> **– Elahi**

Everyone agreed on the necessity to improve not just the qubit count, but the so-called quantum volume – the product of the qubit count and the longest circuit possible before the system loses coherence - and the error rate, sometimes termed fidelity. Fewer errors mean that fewer physical qubits are needed to reach a given goal in terms of error-corrected logical qubits. This puts an even greater focus on the first of our two themes: hardware industrialization. Several interviewees described existing quantum computers currently as research devices.

> " We need not so much qubits as quantum volume; qubits * depth of circuit. This can only be done when the qubits are more stable and less noisy. Currently there are about seven options and no clear winner, we're going with superconducting in a star topology from IQM. The other approaches have their own downsides."
>
> **– Jansik**

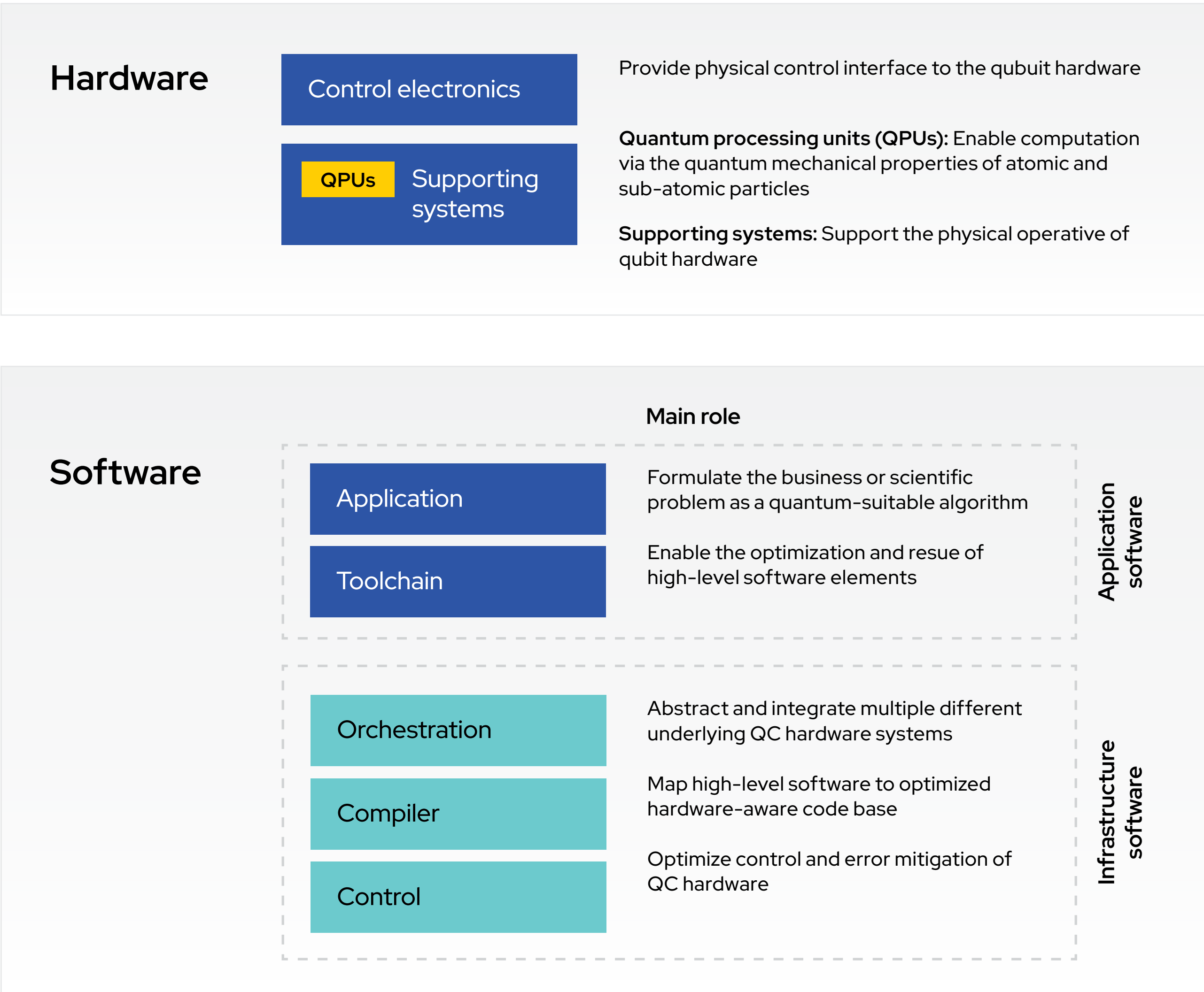
The Quantum Stack: Software, Middleware, & Tools

A practical quantum computing system consists of a technology stack.

The hardware layer includes the qubit source and its infrastructure, such as cryostats, the control and readout technology, such as microwave or laser emitters, and the classical computing system that supports it. Running on the classical computer, we will find the software element of the stack.

This needs to support the development of quantum algorithms, their compilation or transpilation into the quantum circuit format the quantum computer uses, and low-level drivers for the control of the qubits and the eventual readout of their state.

Figure 11: The quantum computing technology stack



Source: *Omdia*

As earlier, we can analogize these to the typical technology stack found in AI deployments.. Control and readout are the low-level assembly language, even below CUDA; the compiler and associated tools are more like the CUDA SDK; algorithm development is at the level of the high-level frameworks such as TensorFlow, Pytorch, or Jax, if not the MLOps platform. It is telling that although the two fields have developed roughly in parallel, the AI software stack is much stronger. None of our interviewees were remotely satisfied with the software tools and several complained bitterly.

> " There are two major obstacles: the quantum chips – they're not reliable. It does work but then it doesn't. The technology is not mature enough to provide repeatable results. The other is software: there's a lack of good libraries. Each version of [a common quantum computing SDK] is incompatible with the previous one, you have to adjust everything to make it work. And then there's the third one – classical supercomputers have software you can treat as a black box. You just change the parameters to work with different problems. In quantum computing you have to write all your code from scratch."
>
> **– Sterzel**

An important lesson from the AI space is that there are dozens of AI hardware startups, and even giant companies, working on AI accelerator chips of various kinds. These have often shown great ingenuity in processor design but have struggled to make an impact against NVIDIA because their software support is often an afterthought to the hardware. Even a company the size of AMD had to make a major effort to improve the software tools for its GPUs before it could make an impact in AI. One reason why this is so important is that the software support is the gatekeeper for those who can work with quantum computers; some of our interviewees observed that it was necessary to make quantum computing accessible to people other than quantum computing researchers.

> " The other issue is the skill set. We don't have enough people... Adoption will be a struggle; like AI in 2006"
>
> **– Almasque**

A crucial issue for the whole field is error correction. The current generation of so-called NISQ (Noisy Intermediate-Scale Quantum) machines, being analog systems, are affected by environmental noise and therefore need to apply a forward error correction algorithm to provide reliable results. As Shannon's law tells us, error correction in the presence of noise requires redundancy, and the amount of redundancy required increases rapidly with the amount of noise.

Achieving successful error correction, and hence a so-called FTQC or fault-tolerant quantum computer, requires both more qubits and less noise. Improvements to both the error correction algorithm and the software infrastructure can also help. As such, a future quantum computing platform will need to use pulse-level access to the hardware to apply error correction without needing to escalate up the stack and consequently act faster than software running at the algorithm level.

The most common current SDK is Qiskit, which takes the form of a transpiler, a circuit library, low-level tools, and an AI-powered assistant. Although this is widely used, the current version has been criticized for breaking compatibility with the previous version, and in general terms, for a lack of fine-grained modularity. Although some of the major functions can be used independently, some users want to break it down into smaller building blocks, while others would like a higher layer of abstraction.

One attempt at that is Qrisp, a high-level domain-specific programming language which aims to skip the circuit design phase entirely, letting users write program code with functions, variables, and object orientation and leave quantum circuits to the compiler. This means that Qrisp programs can be considerably briefer and more readable. Qrisp supports outputting compiled circuits for multiple different quantum computers, including superconducting systems such as IBM Quantum, IQM, and Rigetti but also Quantinuum's trapped-ion machine. It also features a powerful simulator tool for testing programs with quantum circuits up to 100 qubits before deploying to the quantum computer.

Integrating Quantum Computing into HPC Workflows

Omdia defines high performance computing (HPC) as the use of computer clusters that use a single master node to assign computing tasks to worker nodes in the cluster to compute advanced problems.

These HPC clusters must be used to process a core functional problem, such as scientific, engineering, and AI-based applications, rather than an ancillary or administrative function. They usually have a closely integrated architecture using proprietary networking such as Infiniband rather than the typical enterprise data center with OEM PC-architecture servers and a leaf-spine Ethernet network, and are most commonly found in research & education settings.

The emerging field of HPC+QC integration

Integration between HPC and quantum computing is a major priority in both fields. Many of the problems that are suited to quantum computing are also HPC problems, and if we recall the data in Figure 1 with its focus on life sciences, chemicals & materials, and aerospace, many of the same people are likely to be users for both. For the foreseeable future, quantum computers are likely to remain complex devices that need a lot of specialist support and infrastructure, which means that an HPC-like access model is going to be appropriate with users submitting jobs to a quantum computing service center that runs them on a scheduled rather than interactive basis. Essentially all our interviewees emphasized that projects using quantum computing very often also use HPC, further underlining the need for integration.

Interviewees from HPC centers usually asserted that they had a general mission to keep up with the cutting edge of computing technology, as well as the main one of supporting academic or sometimes private sector research users. As such, the motivation for HPC+QC integration is both a technology-push and a demand-pull one. Apart from generally preparing for a future, HPC centers we interviewed try to:

- Research quantum computing themselves
- Develop HPC+QC integration, especially job schedulers
- Support a local ecosystem of quantum computing users, researchers, and vendors
- Provide quantum computing access to their users
- Provide capabilities that require both HPC and quantum computing
- Address use case identification and problem setup by conducting outreach and offering advice

A good example of an application of HPC-QC integration is RIKEN's work on quantum chemistry, where Mitsuhisa Sato's group has been developing new algorithms such as sample-based quantum diagonalization and exploring quantum machine learning as an approach to molecular simulation.

> "Looking ahead, we aim to explore quantum machine learning for chemistry, rather than relying solely on optimization approaches like quantum annealing.... Quantum chemistry at the molecular level may be one of the first areas where we see real applications of quantum information processing."
>
> **– Sato**

Sato's team has been working with the Fugaku supercomputer on the classical side and IBM's quantum cloud service. Starting in February this year, they have added a 20-qubit trapped-ion machine to the collaboration, and they expect to add a 156-qubit superconducting system very soon, as well as GPU computing.

Checking in on progress: our interviewees on HPC-QC integration

Nearly all the interviewees have direct experience of HPC-QC integration. A key technical issue they often brought up was job scheduling – as Mikael Johansson said, HPC is relatively abundant while quantum computers are scarce, and as a result, efficient scheduling is a must to avoid leaving the quantum machine idle.

> "HPC resources are abundant but quantum computers are scarce, so you want to have something running whenever the quantum computer is up and working. It's a very different problem, with a lot of moving parts. Scheduling is also dependent on the user base and the kinds of problems they have; if they're doing the same things it's easy. You can't block the quantum computer for too long on any one project."
>
> **– Johansson**

> "We don't yet have tight integration between the quantum and HPC, you cannot treat the quantum accelerator as a chip next to the HPC if you want to avoid any loss of the resources while the HPC waits for the quantum. There is no satisfactory solution right now."
>
> **– Sterzel**

On the other hand, as Mitsuhisa Sato points out, even if HPC resources are abundant by comparison with quantum computing, they are scarce compared with general-purpose cloud or data center computing, so scheduling cannot afford to leave the HPC waiting either.

> " The quantum computer is very expensive, and its classical counterpart is simply a server. It's much cheaper and it can be stopped anytime. But in the case of HPC, if you want to combine a supercomputer and a quantum computer, the supercomputer is also an expensive resource. To make the best use of both these resources, we need a more sophisticated scheduler."
>
> **– Sato**

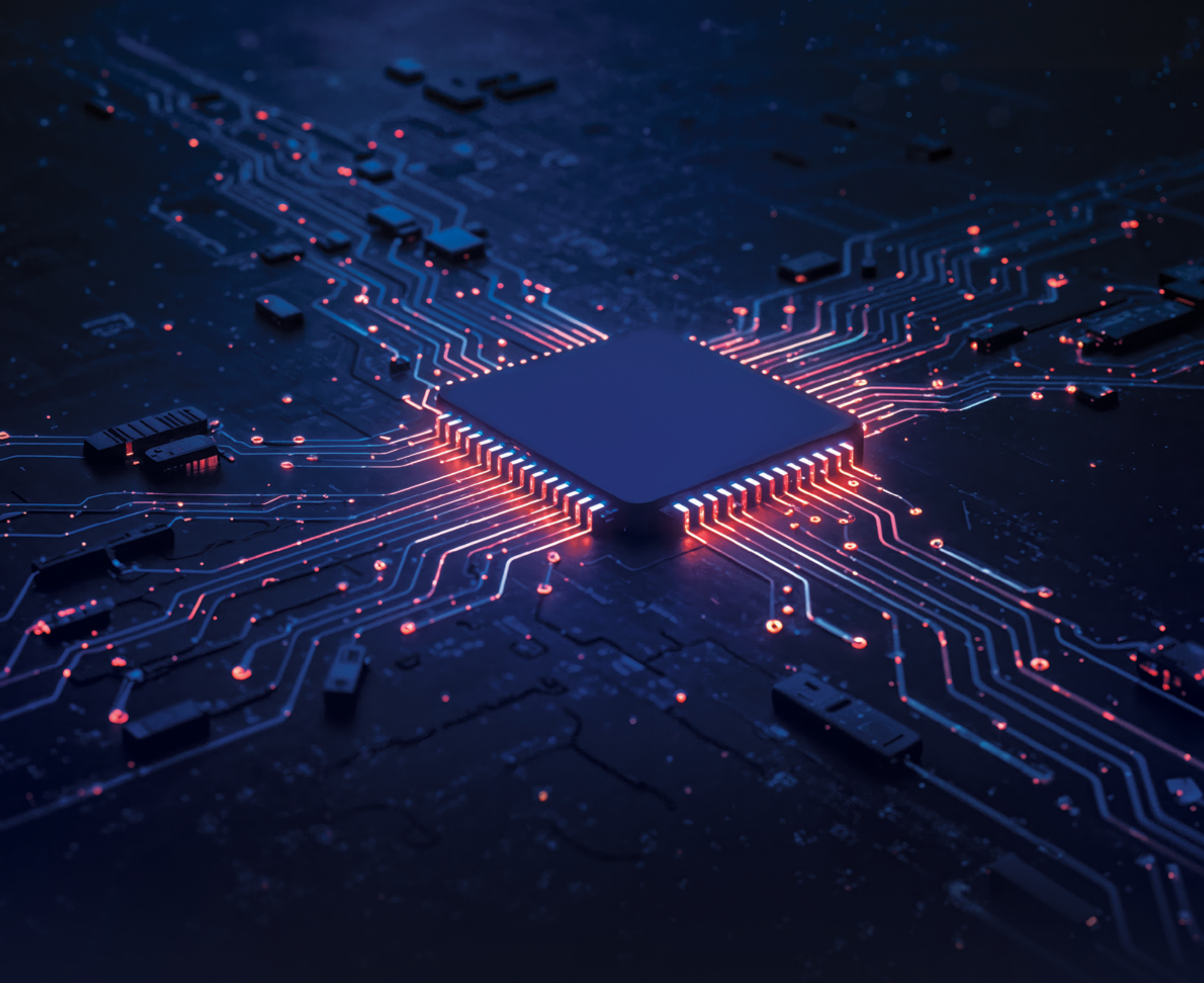
In general, the mismatch between processing speeds in the two domains is a problem, and so is the fact that HPC uptime greatly exceeds that of the quantum computers. Quantum computing jobs therefore have to happen dynamically and opportunistically when the quantum computer is functioning. Also, there is a mismatch in terms of scale – HPC projects tend to work with large data sets but current quantum computers are quite small. Network latency was also identified as an issue:

> " There are problems we all know – error correction, more qubits – but from the HPC side we have specific problems such as the actual connection between the HPC and the quantum computers – they were not built to be integrated with HPCs. You can just use Ethernet but the latency is not good. In the other direction the quantum computer doesn't know how to access data from the HPC and can't see the job queue. Computing power in the quantum computer is very small – in HPC we work with big problems and big data but quantum computing is not ready for this yet."
>
> **– Marzella**

At an institutional level, interviewees appreciated the EuroHPC Joint Undertaking, and the work at Leibniz Supercomputing Centre (LRZ) Germany and at CSC and VTT Finland are model examples for others.

> " There are several approaches around the world but without self-promoting, I think we've done very well in Finland. We've had the 5-qubit machine open for researchers for 2.5 years, gaining experience. Our infrastructure does work well but it's also based on international collaboration with other Nordic countries. There's a good basis to expand in the EuroHPC framework."
>
> **– Johansson**

IQM



Interactions Between Quantum Computing and AI

AI for Quantum Computing

The intersection between quantum computing and AI is an increasingly important and promising field of research. One question Omdia tried to shed light on is whether quantum computing is helping AI or vice versa. As it turns out, AI is increasingly important as a bridge from the classical to the quantum computing world, acting as a transpiler to generate quantum computing circuits from classical code and helping users with the problem setup. Issues we diagnosed earlier in this report.

> "[An example of AI supporting quantum computing is] Building big reasoning models to generate circuits from code – it's already almost fit for purpose. A big problem is working out what to try – you need an expert just to do that – but a big model might be able to do that"
>
> **– Elahi**

AI is also helping to work with quantum computing circuits once designed, automating the "circuit knitting" and "circuit snipping" processes. The latter is especially important as the way forward involves scaling up the numbers of qubits and consequently, operating on multiple quantum devices in parallel. Parallel programming is hard enough on classical; parallel quantum computing will be genuinely tough without the help of AI. It is especially important to optimize for shorter circuits as QCs tend to be limited by how long they can maintain quantum coherence; shorter running times increase the chance of a successful run.

> "If we don't find shortcuts, the optimization problems will blow up as the qubit count goes up into the thousands… snipping circuits into smaller pieces is important for parallel quantum computing once we get multiple devices… it's also more useful to have a shorter algorithm that's tractable and more error-free than one that's mathematically optimal."
>
> **– Johansson**

AI is also proving useful for operational applications, such as optimizing the sequence of laser or microwave pulses for analog systems such as trapped-ion or cold-atom quantum computers or estimating hyperparameters:

> " AI is a powerful instrument for quantum computing researchers; another application is with the analog QCs, deciding which pulses to use inside the quantum computer. Both analogue and quantum mechanical; AI is helpful in understanding how it will behave under certain pulses. Some researchers are starting to explore this approach. Also, optimization problems such as finding the right hyperparameters for the quantum computing problem. AIs are really good at finding the relationship between the data, the quantum computer, and the hyperparameters."
>
> **– Marzella**

AI here is helping to address the biggest issue all of our interviewees have raised: software tools and support. Essentially all quantum computing code has to be written from scratch, and nearly none is portable between different quantum machines. Being able to rely more on software libraries, on cross-compilation, and on generated code would be a major boost to higher adoption. AI-for-QC could also help with materials, operations optimization, and signal processing for control and readout, but the major issue is software, specifically development and middleware. The interviews turned up cases of AI helping with all of the following:

- Agent code development
- Circuit development
- Transpilation and compilation
- Control and readout

Quantum Computing for AI

Quantum computing can also help with AI, although the relationship seems asymmetric – quantum machine learning (QML) is a subject of research while AI in quantum computing development is already a reality. Both quantum annealers and full gate-based quantum computers have been proposed as accelerators for AI training, optimizing the weights in AI neural networks, and gate-based quantum computers have also been proposed for inference.

A major problem is simply that both fundamental AI methods and the GPUs that support them are improving at a rapid pace, so QML is faced with a moving target, as Mikael Johansson says.

> "GPUs are super-efficient now, there's a lot to catch up with. In principle, it does work, but the crossover point where it's more efficient than using a classical supercomputer is still unclear"
>
> **– Johansson**

There are a lot of possible options. As well as setting up AI training as an optimization problem for an annealer. Some researchers have been using quantum-inspired algorithms running on classical hardware, applying quantum latent spaces in generative adversarial networks, or using quantum-reservoir computing. However, there is a fundamental contradiction – QML, like essentially all machine learning methodologies, relies on large training data sets, and quantum computing's strong suit is computationally-complex problems with limited data.

> "As with a lot of AI techniques, QML is empirical and highly dependent on parameters and data. We'll need thousands of qubits to try it out on anything, but small-scale data sets, although quantum reinforcement learning, might be useful earlier"
>
> **– Johansson**

Richard Sutton's classic "Bitter Lesson" paper argued that relatively simple methods taking advantage of more powerful classical computers and more training examples tended to beat more sophistication in modelling; if we are now in a regime where training data is the limiting factor, more computing power might not help much. However, the point about quantum computing working well on "big compute, small data" might cut both ways:

> "Another interesting frontier we explored in some thesis projects involves tackling problems with limited data. While traditional AI typically requires large datasets to perform well, we found that by leveraging QPUs we could train models on much smaller datasets or refine results without the need for a fine-tuning phase. Our preliminary studies suggest that quantum computing holds significant promise, particularly in scenarios where data scarcity prevents AI from achieving optimal performance."
>
> **– Marzella**

A possible angle for QML progress is energy. GPUs are notoriously power-hungry, both in training runs and for inference serving, with flagship devices drawing well over a kilowatt each and leadership CPUs over 300W. Quantum devices scale well in terms of power, as both Elahi and Marzella point out:

> "If you use GPUs you have a serious energy footprint. To scale up, you simply have to add more GPUs. This is unlike QPUs, where adding qubits comes at minimal energy cost while scaling up dramatically."
>
> **– Elahi**

> "Something is still missing in AI despite the huge GPU compute power. QPUs seem to be good for variational algorithms; if you have enough QPUs, you might be able to do better at parameter tuning although you'd have to cut up the problem right. QPUs might use much less power than GPUs in solving the parameters for AI models"
>
> **– Marzella**

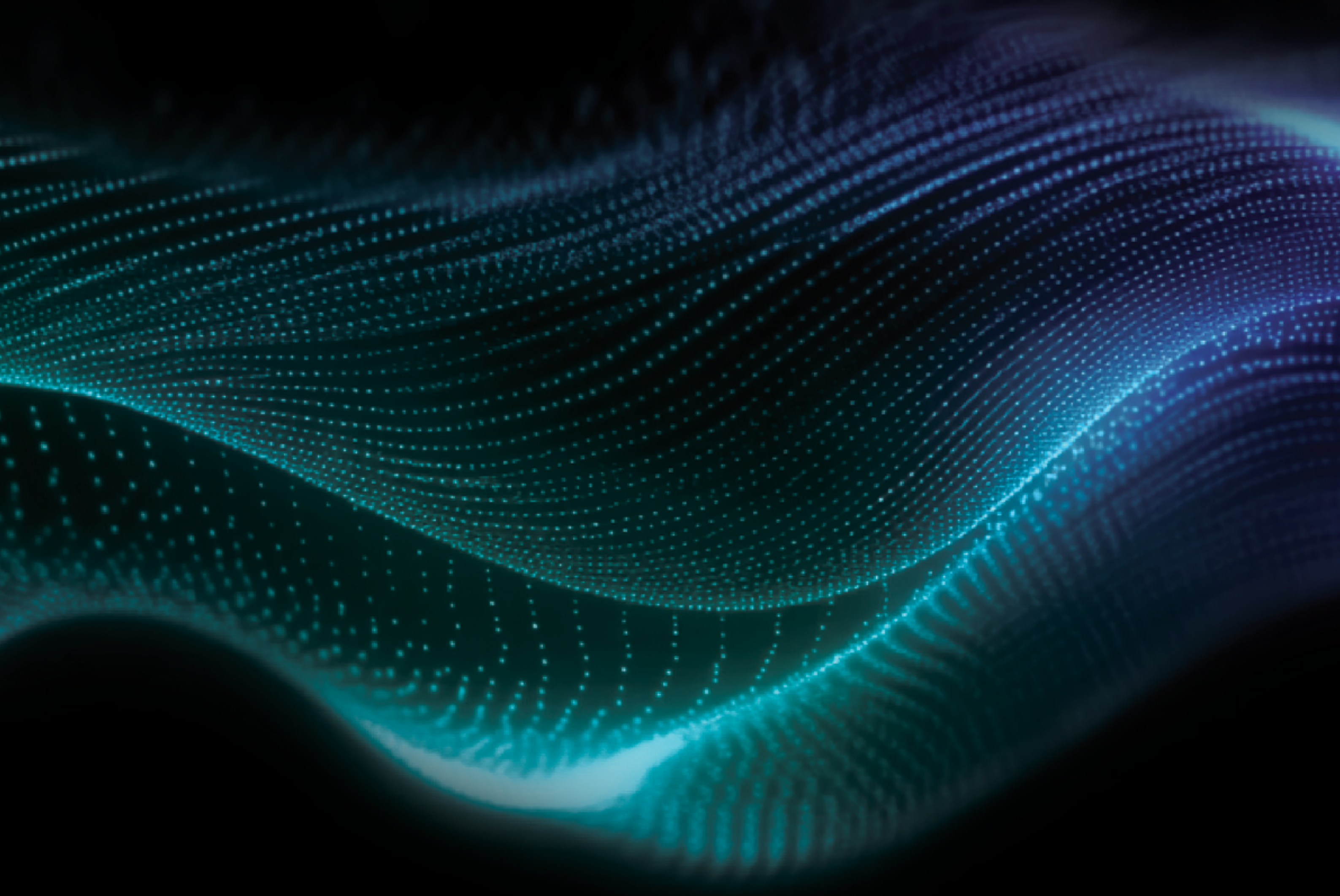
Even with the advent of fault-tolerant quantum computers, there will be limits to how much quantum computing can help AI – for a start, AI inference is I/O-bound rather than compute-bound, and even training is subject to a constant factor overhead from loading data into the quantum system. The best-known algorithm, HHL, provides a quadratic speedup to the process rather than an exponential one, and works best with data that remains in superposition, originating from a quantum process. As a result, it will be necessary to plan for the closest possible integration of quantum computing, classical HPC, and AI.

As Intel's former CEO, Pat Gelsinger envisaged that future data centers might contain roughly 50 per cent GPUs for AI and other highly parallel workloads, 25 per cent classic CPU-based hardware for general purpose computing, and 25 per cent quantum computing.

NVIDIA CEO Jensen Huang proposed something broadly similar at the recent GTC event, suggesting that quantum computing would eventually be seen as an accelerator like a GPU or FPGA. Quantum computing projects will always use significant classical computing power to set up the problem, load data, and analyze results, and they are likely to be integrated into applications running in the classical domain; we have also seen that they will increasingly make use of AI.

Why not make a virtue of necessity, then, and assume that HPC, quantum computing, and AI will go together?

An example application would be searching chemical space for candidate molecules that would meet a requirement. An AI model can generate candidates, while quantum computing can provide a fast, hopefully first-time-right simulation to evaluate them, and the HPC system could use the output to finetune the AI model and refine the output as it explores adjacent space to the intermediate results.



Public Policy and National Programs

Globally, governments have treated quantum computing as a strategic sector for both military/intelligence reasons and also for economic development reasons.

The main defence sector concerns are around cryptanalysis (using quantum computing to factor out and break older encryption systems), so-called post-quantum cryptography (developing encryption systems resistant to quantum computing), and quantum sensors for positioning, navigation, and timing. It is possible that the successor to GPS might be a quantum system. On the economic development side, the applications in question are essentially all the others, although there is overlap, the aerospace and defence sector being a large consumer of computationally demanding simulations.

In recent years, governments have usually employed industrial policy in a so-called "derisking" mode – using the government balance sheet to take on specific risks or to use specific policy to mitigate them. A good example would be the revival of semiconductor manufacturing in the United States, in which the federal government guaranteed substantial financial risks, but also coordinated investment across different industries and geographies to reduce supply-chain and workforce risks, and more generally, used its intervention to signal convincingly that there would be continuing demand for chips made in the US and that the effort was a priority for both federal and state governments and for both political parties. Omdia identified five areas of risk that public policy tries to reduce:

- Funding risk – e.g. that research will have to be prematurely abandoned due to liquidity constraints
- Research risk – e.g. that fundamental technical issues will arise that defy solution
- Ecosystem risk – e.g. that development will be held up either by upstream, supply chain problems or downstream, adoption and integration problems
- Workforce risk – e.g. that it will prove impossible to find necessary skills
- Infrastructure risk – e.g. that projects will need physical infrastructure that doesn't yet exist

Our interviewees were mostly concerned with workforce risk, funding, and the irreducible uncertainty of whether quantum computing will work in practice or if so, how long it will take. On workforce risk, interviewees noted that there was a lack of talent in industry, although in the research space this was less of a problem.

> For the moment, the talent pool is too small. There's plenty to do that's not being done because there's nobody to do it."
>
> **– Johansson**

On the point of finance, Ekaterina Almasque argued that European quantum computing companies were well served for very early-stage seed money but growth investment was much harder to come by and there was an institutional gap in the market.

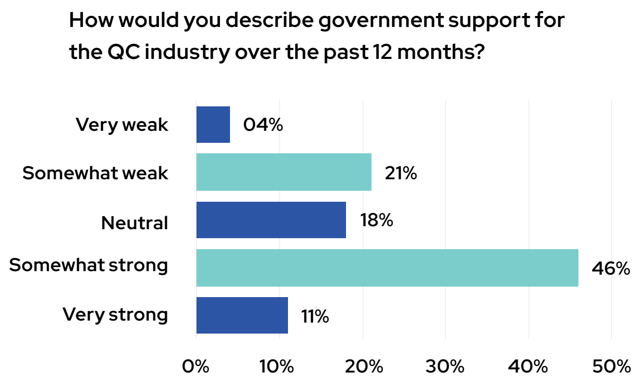
> In Europe, funding is relatively limited, and there aren't many institutions that are willing to make significant investments. In the U.S., there are far more options including large VC funds and private institutional investors. Seed funding isn't the issue, but when it comes to larger growth capital - like $300+ million rounds - there's a lack of institutions that could take the lead or even to write a large enough cheque. Geopolitical concerns also play a role, with many being very hesitant to accept funding from geographies such as China. The European Commission and countries like the Netherlands are trying to put programs together, but much more capital is needed, especially smart capital from private sources."
>
> **– Almasque**

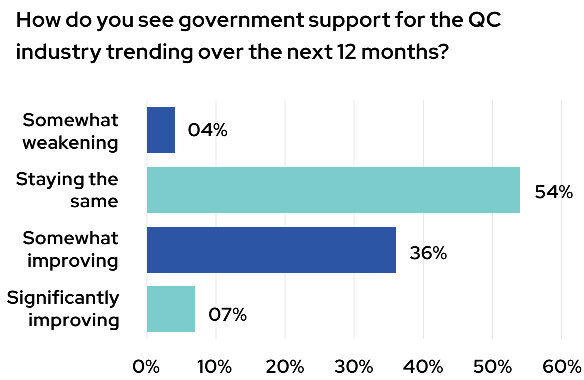
In the US perspective, Kirk M Bresikner, Chief Architecht, HPE Labs, emphasizes the importance of continuing to allocate sufficient funding to retain the country's technology competitive advantage that is has maintained for several decades.

> How do we continue to advocate for open academic research while also competing globally? That's what enabled the U.S. to lead for so long—we need to understand how to keep that advantage."
>
> **– Bresniker**

The concern on everyone's mind was that funding might run out before the kind of results were achieved that would decide whether quantum computing was a worthwhile investment. However, respondents to the quantitative Vendor Sentiment Survey felt that government support was strong or very strong and was likely to remain the same or improve, as shown in **Figure 12**.

Figure 12: Survey respondents were confident about government support for Quantum

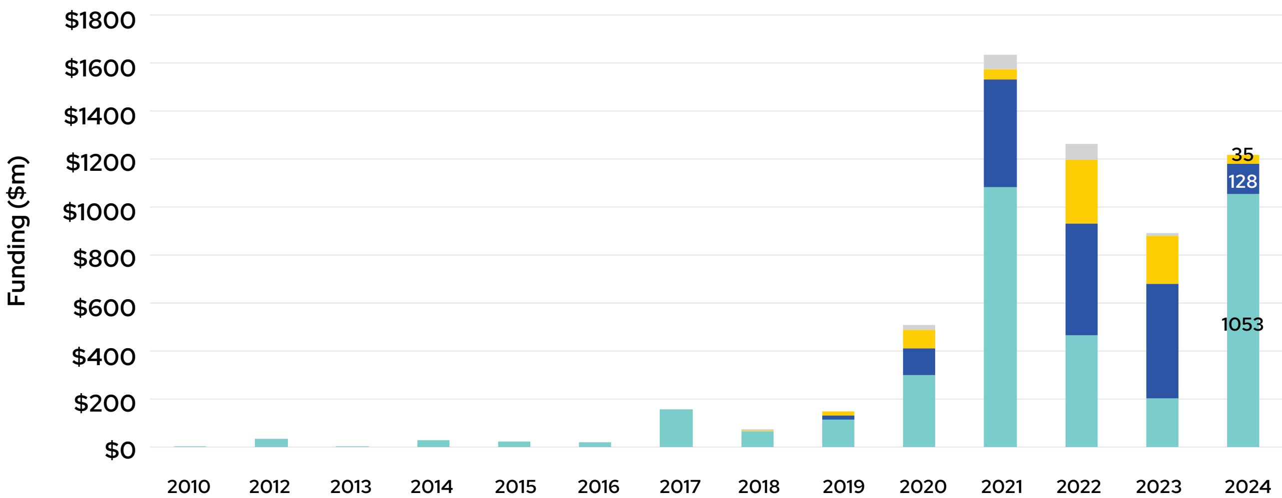




Source: *Omdia Quantum Computing Vendor Survey*

There is considerable geographic variation in public funding for quantum development. Since 2010, the Tracker has registered $5.9bn in investments where at least one government agency, sovereign wealth fund, policy bank, university, or research institution is listed as an investor. Out of this, $3.5bn was in North America, $1.6bn in Europe, and $636m in Asia & Oceania. European funding has, however, increased dramatically under the post-COVID NextGen EU agenda although this slowed down in 2024.

Figure 13: Public funding for Quantum Computing by region, 2010-2024



Source: *Omdia*

EuroHPC

Most of our interviewees are participants in EuroHPC projects. This is the primary way in which the European Union is supporting quantum computing, funding national HPC centers to acquire quantum computers, making quantum computing services available to researchers, developing HPC-QC and multi-QC integration.

European institutional funding also reaches quantum computing through the Horizon programme for research, the European Innovation Council for startups, and the European Investment Bank for growth capital, as well as the member states' agencies. Its primary method of action is acquiring new HPC and quantum computing machines at major EU HPC centers; so far the organization is funding eight existing or planned quantum computers and nine supercomputers.

Interviewees noted that the EuroHPC projects were tending to run late and that issues such as user authentication and resource allocation had been disproportionately difficult.

ORNL QC User Program

The US Department of Energy's Oak Ridge National Laboratory houses the Department's Quantum Science Center, their leading research facility on quantum computing, quantum sensing, quantum materials, and quantum networks. It also provides researchers access to a wide variety of commercial quantum computers through its QC User Program. These include IBM Quantum, IQM, IonQ, and Quantinuum.

This approach is a bit different to the EU one, which grew out of an effort to improve classical HPC infrastructure; ORNL is the home of Frontier, the world's most powerful supercomputer, and understandably went down a different route. Among many other projects, ORNL is working with Quantum Brilliance to test integration of its diamond devices with the supercomputers and also with D-Wave to evaluate its prototype Advantage2 annealer.

RIKEN

The Japanese project at RIKEN, meanwhile, was explicitly called out by multiple interviewees as an example. RIKEN is working with Osaka University, Fujitsu, and Softbank to integrate the Fugaku ARM-architecture supercomputer with GPU resources and multiple quantum computers, including both superconducting devices from IBM and trapped-ion ones from Quantinuum. The RIKEN project has long-term support from NEDO, the Japanese government's leading industrial R&D agency, helping to signal that it is likely to be an enduring factor.

Conclusion

Taken together, our interviewees were optimistic. Increasingly, they are seeing real quantum computing projects happening on the machines they operate.

> "History proves that research always serves needs that weren't envisaged. Quantum inspired algorithms began as a research project and ended up in the classical space – e.g. our molecular docking project."
>
> **– Marzella**

Closer integration between HPC + Quantum Computing, and Quantum Computing + AI, is extremely important and is beginning to happen. The future quantum computing paradigm – indeed, the future scientific computing paradigm – is likely to be one in which quantum devices, GPUs, and other accelerators work together with classical HPC systems to address high value use cases such as simulation, combinatorial optimization, and quantum machine learning.

Hardware is steadily improving but there remains much to do, and it seems likely that several different quantum modalities will continue to coexist without a dramatic breakthrough. It may be the case that the modalities evolve into specialized options for different use cases and/or infrastructure contexts – there might well be a case for a lower-performance but more deployable option as well as the quantum equivalent of Frontier.

Software remains a major issue, with our interviewees having little good to say about the current state of quantum SDKs, APIs, or tools. Projects like Qrisp are a step forward as they offer an approach that is both decoupled from implementation on different quantum computers and closer to a familiar high-level programming language. The challenge for 2026 will be to tackle hardware industrialization and software platforms together.

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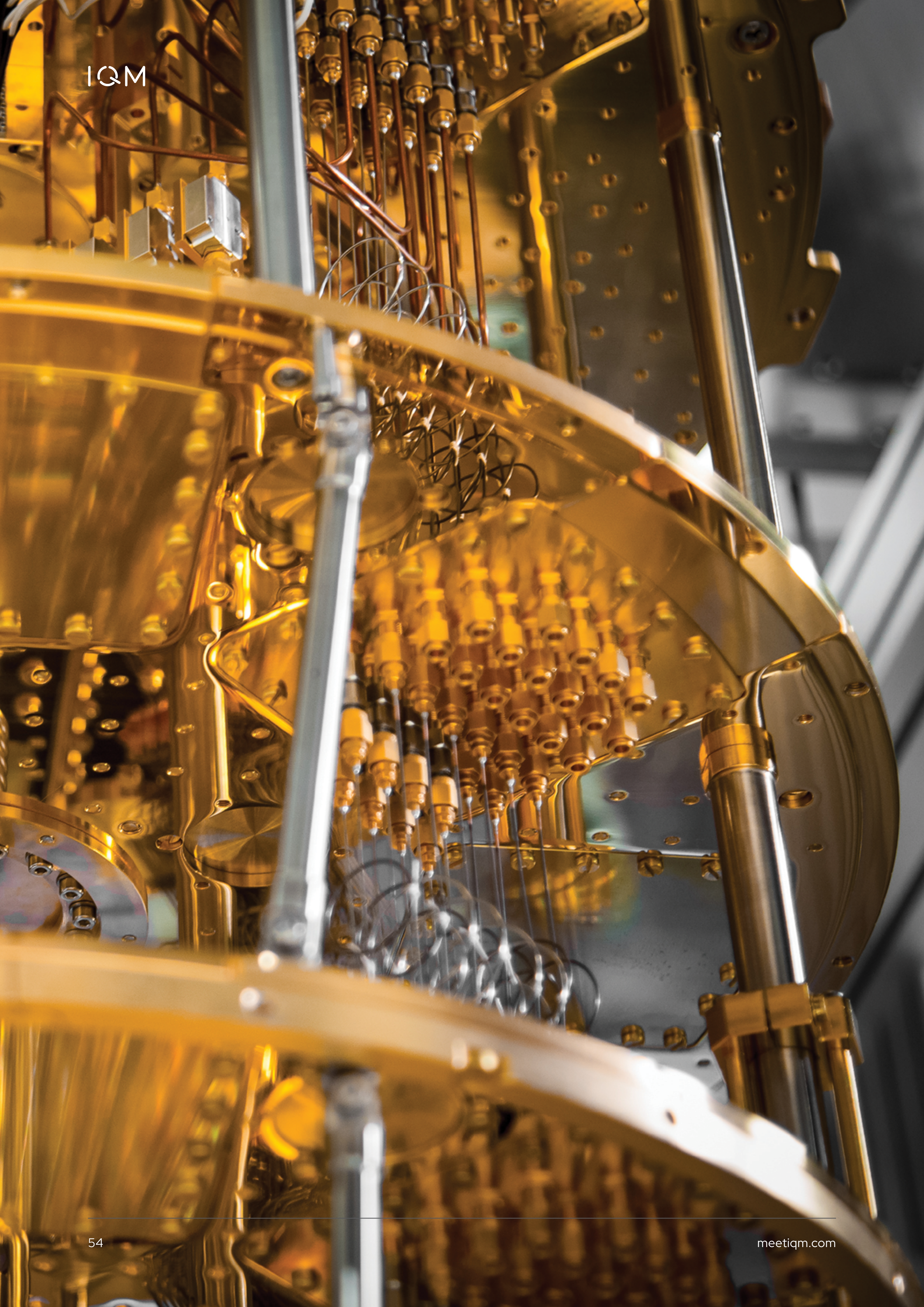
Interviewed Experts

Kirk M Bresniker	Chief Architect	HPE Labs
Anti Vasara	Former CEO	VTT
Mikael Johansson	Manager, Quantum Technologies	CSC
Marius Stertzel	EGI Executive Board Member	Cyfronet
Mitsuhisa Sato	Deputy Director	RIKEN
Ekaterina Almasque	Co-founder and Managing Partner	BlankPage Captial
Sara Marzella	Quantum Computing & HPC Specialist	CINECA
Manfred Rieck	Head of Quantum Tech	Deutsche Bahn
Pascal Jahan Elahi	Quantum Supercomputing Research Lead	Pawsey Supercomputing Research Centre
Branislav Jansik	Supercomputing Services Director	IT4Innovations, VSB Technical University of Ostrava
Masahiro Horibe	Deputy Director	National Institute of Advanced Industrial Science and Technology (AIST)



IQM

IQM is a global leader in superconducting quantum computers. IQM provides both on-premises full-stack quantum computers and a cloud platform to access its computers. IQM customers include the leading high-performance computing centres, research labs, universities and enterprises which have full access to IQM's software and hardware.

IQM has over 300 employees with headquarters in Finland and a global presence in France, Germany, Italy, Japan, Poland, Spain, Singapore, South Korea, and the United States.

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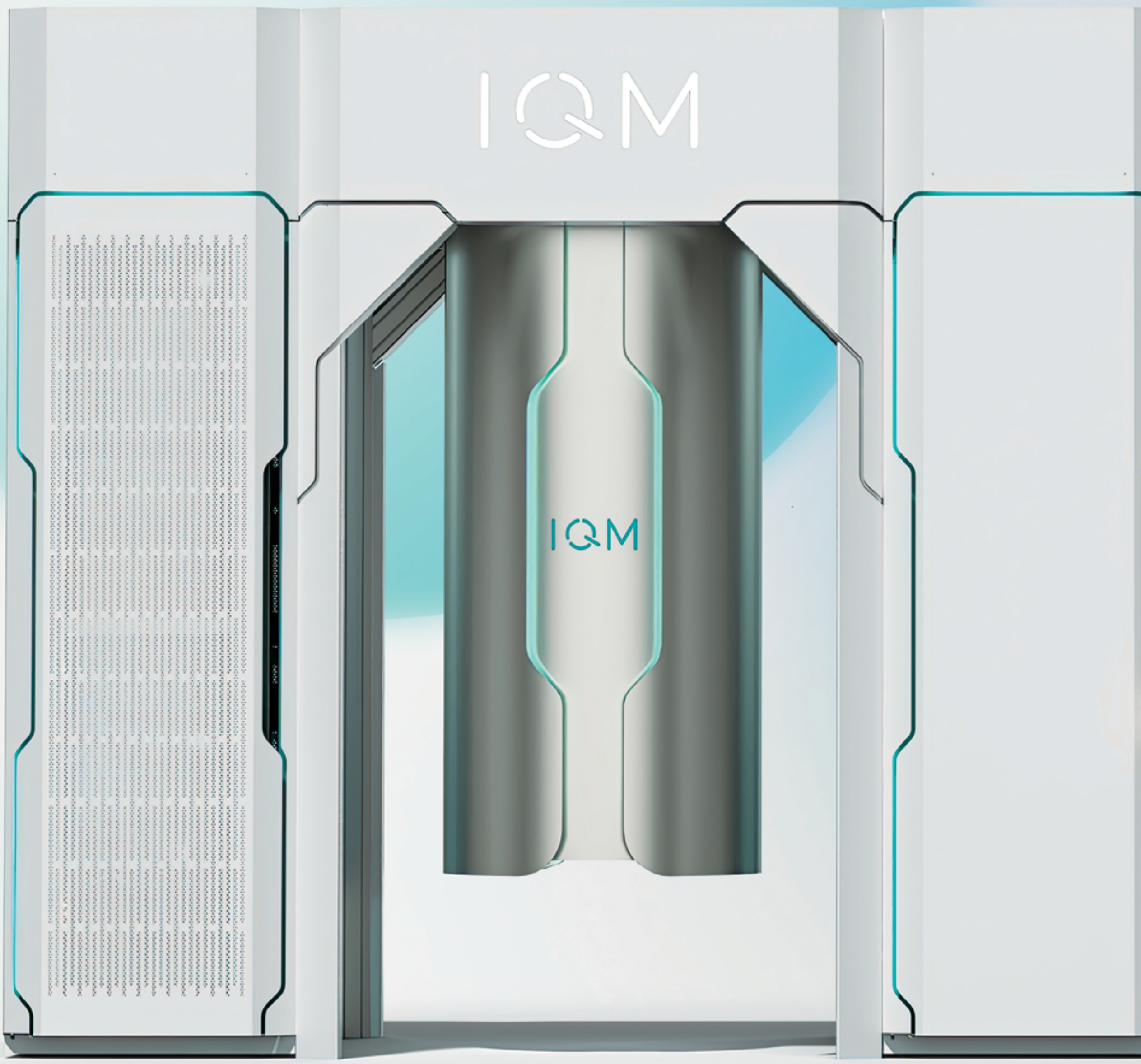

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