The future won't wait: Why companies need to prepare for quantum computing now

By Yeama Bangali

"*When and how can industrial companies successfully use quantum computing?*" This is the big question many businesses are struggling with today. Worldwide, quantum researchers are working on answers, and expectations are high: quantum computing is associated with the hope of solving problems that are currently impossible or extremely costly to tackle with classical methods. However, simply waiting for breakthrough hardware developments can be risky for companies. Quantum computing has the potential to enter industry in a disruptive way – and those who are not prepared risk falling behind. This is why it is crucial to start working now on the right software designs and application scenarios for the future. For companies that want to remain competitive, actively exploring how to approach the topic strategically within their own organization can be a critical success factor.

Experiencing technology before it is rolled out

For many potential users in industry, quantum computing as a key technology seems exciting and fascinating at first – but for everyday business problems it still feels like science fiction: bold visions of a technological future that will begin "someday". At the same time, in recent years there have been promising advances on both the hardware side and in software and algorithms, suggesting that the time window until broader adoption is steadily shrinking. A few years ago, only computations with a handful of qubits were feasible; today, calculations on systems with hundreds of qubits are already possible, at least in experimental and early commercial settings. In fields such as materials science and quantum chemistry, the potential is particularly striking, because conventional computers quickly reach their limits here. Quantum computing could, for example, enable the development of new drugs or materials much more efficiently in the future.

How close this seemingly abstract quantum future already is, and which advantages and new business opportunities it can realistically open up for German companies, cannot be conveyed by strategies and studies alone. Equally important is concrete, hands-on experience – especially for the practitioners and decision-makers in companies today. Demonstrators can provide a low-threshold entry point to quantum computing and give users practical insights and strategic awareness of potential applications in their own organizations. With our Quantum Lab at Fraunhofer IAO, we aim to make the fundamentals of quantum computing tangible through engaging

experiments and demonstrations, thereby explaining quantum mechanical principles in an accessible way.

A VR demonstrator as a door-opener

Our latest development in the lab is a VR demonstrator that takes users into a fictional quantum world and makes the impacts and challenges of quantum computing tangible using selected application scenarios. Even without in-depth technical prior knowledge, users encounter visualizations and animations that make the topic easier to grasp and convey compact, target-group-oriented information. With this immersive introduction to the complex field of quantum computing, we aim to build a bridge between theory and practice. How can economically relevant questions be addressed end-to-end with innovative quantum algorithms? To tackle this central question and to demonstrate practical quantum advantages on different hardware platforms, we founded flaQship, the new Fraunhofer Lab for Applied Quantum Computing in Stuttgart–Heilbronn, where Fraunhofer IAO, Fraunhofer IPA and the IAT of the University of Stuttgart pool their expertise. Our VR demonstrator can serve as a door-opener for companies that want to start engaging seriously with quantum computing.

Together with my colleagues Niclas Schillo and Dr. Anne-Sophie Tombeil, we developed a storyboard for the VR demonstrator that is both scientifically accurate and carefully tailored to our target audience. Our colleagues from the eXtended Environment team then translated this concept into a technical and visual VR experience. This allowed us to make the potential impacts of quantum computing in sectors such as medicine, finance and energy tangible for users in an intuitive and vivid way.

Positive feedback: insights from Quantum Effects 2025

We presented the VR demonstrator for the first time at Quantum Effects 2025, where it was very well received. A recurring piece of feedback from users was that the direct and personal address by a "qubit character" was perceived as particularly positive. This character was seen as a charming eye-catcher that immediately creates a personal connection to the topic. Another Fraunhofer institute was so enthusiastic about this low-threshold form of knowledge transfer that it expressed interest in using a similar VR demonstrator for its own communication activities.

These first experiences showed us that it really pays off to explore new paths and use VR as a communication tool for a low-barrier entry into quantum computing. With this initial impulse to bring companies closer to the potential of the technology, we are addressing a crucial point: we create anchor points for conversations about how quantum computing could be embedded in a company's structure and strategy – and perhaps trigger an inner shift to start engaging with this future-oriented topic today. Recent surveys of companies in Germany indicate that many firms see the potential of quantum technologies but hesitate to invest because they lack clear information on market-ready applications and are uncertain about the economic benefits. In precisely

this space, transparent, well-designed science communication can provide orientation and help prepare investment decisions.

Technological innovation needs innovative communication

Developments in quantum computing are promising, but waiting passively for revolutionary hardware leaps could be risky for companies. It is already important today to identify potential use cases, build internal competencies and experiment with pilot projects to secure an advantage once the technology matures further. Those who join the race too late will have to develop use cases, skills and partnerships under much greater time pressure. Effective communication tailored to practitioners in companies plays a key role here.

Our VR demonstrator has shown that innovative approaches to knowledge transfer can not only provide a low-threshold entry into quantum computing but also spark conversations about how and where the topic could be anchored within an organization. Current surveys on quantum technologies suggest that understandable information on use cases, challenges and benefits is a key factor for companies to move from abstract interest to concrete investments. This is exactly where transparent, well-crafted science communication can make a real difference. The positive feedback from users at Quantum Effects illustrates the potential of such interactive formats. We are excited to see where the journey in quantum computing will lead – and what role science communication can play in turning quantum computing into real-world applications. If you would like to start your own journey into the quantum future of your company in a realistic and practical way, you are warmly invited to book a tour of our Quantum Lab and explore together with us where your concrete needs and potentials lie, and which next steps are necessary. Further information on tours and registration can be found in the reading links.

Reading links:

Quantum Lab:
https://www.iao.fraunhofer.de/en/labs-equipment/QuantumLab.html

flaQship Quantum Computing Training Program:
https://www.digital.iao.fraunhofer.de/en/competences/quantum-computing/quantum-computing-training-program.html

INQUBATOR: Quantum Computing Consulting and Testing Center for Industry
https://www.iao.fraunhofer.de/en/press-and-media/latest-news/quantum-computing-consulting-and-testing-center-for-industry.html

Market surveys by BSI and KPMG in Germany on cryptography and quantum computing: BSI - Presse - Gemeinsame Umfrage von BSI und KPMG in Deutschland zu „Kryptografie und Quantencomputing"(German)

Business survey conducted by Bitkom
Quantentechnologien: Unternehmen sehen Deutschland weltweit vorne | Presseinformation | Bitkom e. V. (German)