

# IQM Position on the Call for Evidence on the evaluation and revision of the Chips Act

[IQM Quantum Computers](#) (IQM) is Europe's quantum computing leader, specialized in superconducting quantum computers. IQM provides both on-premises full-stack quantum computers and a cloud platform to access its computers. Customers include leading high-performance computing centers, research labs, universities and enterprises. The company has over 300 employees with headquarters in Finland and present in France, Germany, Italy, Japan, Poland, Spain, Singapore, South Korea and the U.S.

IQM has shipped more systems than any other vendor and has already raised \$320 million in Series B funding, marking the largest Series B round in the quantum industry to date. As the company pursues its ambitious [roadmap](#) to achieve quantum advantage in the 2030s, the focus now shifts to scaling production and driving major technical breakthroughs. The company plans to establish Europe's first industrial-scale quantum processor production facility in the upcoming future.

## Current Status: An overview of the existing landscape

The European Union is at the forefront of quantum computing research, but its quantum chip production capabilities are limited. Only a few operators, including IQM, have their own production capacity. [IQM's 2022 opening of Europe's first and largest private quantum chip fabrication facility in Finland](#), backed by a €35 million boost from the EIB, is a significant step forward. This facility is expected to have the capacity to produce 100,000 qubits by 2030. In line with the European Union's objectives, which include achieving 100 logical qubits, IQM's plan could potentially meet this goal with the first industrial-scale manufacturing facility. As the company continues to work towards EU goals, it anticipates that in the 2030's, it will be capable of producing systems in the 1000 logical qubit range, thereby reaching quantum advantage. To achieve this milestone, IQM expects to require an investment on the scale of €1 billion to further develop and expand the facility.

The EU can learn from its experience with classical semiconductors, where outsourcing production led to a loss of capabilities. The quantum sector presents an opportunity for Europe to establish itself as a leader and avoid repeating past mistakes. While academic research has been ongoing for decades, commercialization is still in its infancy, and no company has yet fully scaled up production to mature levels. The current focus on building quantum pilot lines for research and development is essential, but it must be accompanied by a clear plan for industrialization at the EU level.

Quantum chip fabrication being a novel area of technology, the race is on to ramp it up to mature production level. Quantum, including R&D grade low volume and low integration level chip fabrication, has been a topic of academic research for decades. While the pilot lines which are being built will make the bar lower for start-ups to test their technology, the roadmap of established quantum companies requires production sites. The emergence of quantum chip fabrication presents a global opportunity for regions to establish themselves as production for quantum technology. Europe can capitalize on this trend by creating an attractive environment for quantum companies to set up production sites.

## Guiding Principles and Funding: Establishing a clear plan and securing resources for manufacturing

To achieve the EU's goal of acquiring systems that can deliver 100 error-corrected qubits by 2030, comprehensive support for chip fabrication is necessary. This plan should focus on establishing a scalable public-private manufacturing infrastructure, with dedicated funding instruments for European startups, scale-ups and SMEs developing quantum chips. A key challenge in quantum chip manufacturing is the transition from laboratory to commercial production. The production of superconducting quantum processors uses traditional semiconductor manufacturing techniques, but with unique materials and structures rendering conventional semiconductor fabrication lines incompliant. To accelerate the transition from laboratory to commercial production, it's essential to have a dedicated set of production tools readily available for start-ups and scale-ups.

The Chips Act introduced a series of mechanisms to bolster semiconductor innovation and manufacturing in Europe, notably through Pillar 2. However, Pillar 2 was not designed with the unique requirements of quantum manufacturing in mind, which limits its effectiveness in this emerging domain. While Pillar 2 has laid a foundation for innovation, quantum manufacturing demands a more targeted and faster approach.

## Lessons from Similar Industries: Drawing parallels between quantum technology and semiconductor development

On the one hand, the requirements for quantum processor manufacturing differ substantially from those of traditional semiconductor production. Quantum chips have specific needs that are not met by the cutting-edge technology nodes used in modern semiconductor manufacturing.

On the other hand, pilot-scale facilities focused on quantum technologies available today and under development for near-future will not meet the scaling objectives needed for the error correction and will serve a more limited purpose in R&D.

The problems and scope of quantum manufacturing are distinct, and even top-of-the-line traditional foundries are not suitable for this purpose. The use of dedicated materials and structures in quantum manufacturing requires tailored processes and introduces a significant risk of contamination, making it unfeasible to utilize traditional foundries. The distinction has significant implications for the design of equipment and process flows, as the investment priorities for quantum manufacturing are substantially different from that of more conventional semiconductor manufacturing. Many semiconductor methodologies for deposition, lithography and etching are still relevant, but the dedicated features in quantum chip manufacturing calls for specialized production lines. Furthermore, scaled-up quantum chips have dedicated needs for quality control including the need of high-volume cryogenic characterization. This creates a challenge for companies transitioning from semiconductor production to quantum chip fabrication, as they must invest in new equipment, processes, and quality control techniques. As quantum technology advances, different modalities are progressing at different speeds. To create an effective industrialization plan, it's essential to consider these variations and develop a roadmap that takes them into account. Companies must be prepared to adapt and evolve their manufacturing to keep pace with the latest developments in quantum technology.

## Investment Requirements: Assessing the necessary resources for growth

Another crucial difference between the two industries is the volume of wafers processed. While a significant volume boost over today's pilot-scale quantum chip fabrication is needed, the massive scale of the semiconductor industry with wafer volumes 100 to 1000 times larger than those in quantum manufacturing is not needed. This disparity in scale means that the equipment

and process design considerations for quantum manufacturing are unique and cannot be simply extrapolated from the semiconductor industry. In practice, therefore, the investment is misdirected if the specific needs and volumes of the quantum sector are not considered.

Establishing a quantum foundry from scratch poses significant challenges, both in terms of cost and timeline. A more viable option could be repurposing an existing IC factory with declining volumes, which would not only allow for the preservation of jobs but also enable the recruitment of new talent. This approach could help leverage existing infrastructure and expertise, while also facilitating a more efficient and cost-effective transition to quantum manufacturing.

Unlike some other industries, ultra-high levels of automation may not be feasible for quantum chip manufacturing in the near term. However, some degree of automation will still be necessary to ensure efficiency and precision in the production process. As the industry continues to evolve, it's likely that automation will play an increasingly important role, but for now, a balanced approach that combines human expertise with targeted automation may be the most effective way to drive progress in quantum manufacturing.

### Collaborative Manufacturing Approach: Implementing a shared production model with common tools

Establishing a greenfield quantum foundry is a complex and costly endeavour, requiring significant investments in equipment and infrastructure. While the wafer volumes required for quantum manufacturing are relatively small compared to traditional semiconductor production, they still pose a substantial challenge. However, it's essential to consider the development timeframe for such a venture. With the new Multi-annual Financial Framework (MFF) set to begin in 2028, it's crucial to initiate investments as soon as possible to ensure timely development and deployment of quantum foundries. In this context, repurposing an existing foundry could be a viable and realistic option within the given timeframe, allowing for the refinement of processes and production of viable products.

In the long term, establishing large-scale foundries will be crucial for achieving efficient economies of scale and high utilization rates, ultimately driving the commercial production of quantum chips. To address this, a foundry-style approach can be effective, where production tools are shared among multiple start-ups in a dedicated clean-room facility. This can help accelerate the production of superconducting quantum processors, while minimizing contamination risks and optimizing usage rates.

### 2026 Strategic Plan and Alignment with Chips Act 2.0: Outlining a coordinated roadmap for the future

The Quantum Chips Industrialization Roadmap, to be delivered in 2026, should prioritize specific funding and scale-up support for European quantum chip developers. As quantum computing technologies become more mature and scalable, explicit funding and settlement programs for innovative chip factories that specialize in quantum chips will be required to support private quantum chip lines. The Quantum Chips Industrialization Roadmap should be closely coordinated with the forthcoming Chips Act 2.0, to ensure that both instruments support the growth of European quantum chip companies.

### Intellectual Property and Production Guidelines: Defining rules for innovation and scaling up production

The quantum sector faces unique challenges due to its market composition, which is dominated by small and medium-sized enterprises (SMEs) in the early stages of production. Additionally, the rapid evolution of processes in this field poses significant challenges. Clear IP ownership

is essential for both startups and foundries, as it often serves as a prerequisite for securing investment and driving growth. In an industry where processes and designs are constantly evolving and converging, it is vital to establish unambiguous IP ownership at all stages of development. This means that startups should have a clear pathway to maintain control over their proprietary technologies, and the distribution of process and design IP should be well-defined. By providing clarity on IP ownership, companies can confidently transfer validated processes to private foundries as the market matures, enabling them to scale production while focusing on their core business activities, whereas foundries can ensure a stable and reliable supply chain.

### Packaging and Integration: Identifying areas where Europe can take the lead

Already today, quantum processing units (QPUs) are typically built with 3D-integrated solutions including multi-chip stacks and dedicated 3D-integration solutions, and for example in superconducting QPUs it is foreseen that the scaling is largely enabled by suitable backend fabrication and integration solutions. Scaling towards further-generation QPUs will require developing new techniques and scaling the backend processing techniques to the next level. One potential opportunity for Europe lies in developing methods, tools, and capacities towards this end.

As European industry seeks to develop and establish itself in the quantum sector, it can pioneer new solutions and innovate new ways of developing methodology, tools and capacity to enable this. The need for advanced packaging technologies, such as 3D flip-chip solutions, is not unique to quantum computing, and other electronics manufacturers may also be interested in these technologies: the quantum technology needs new state-of-the-art packaging technologies to be able to precisely test, package, and assemble the final quantum processors. This back-end technology to be developed can also be used in other areas in advanced electronics or in MEMS, or in another words, it is not only limited to quantum technology.

This creates a potential market opportunity for European companies to develop and supply these solutions. Furthermore, the complexity of packaging solutions for quantum systems could play to Europe's advantage, as the region has the chance to establish itself as a leader in this area. While we have made significant progress in developing qubits, the development of packaging technology will ultimately determine which regions and companies can successfully create large-scale quantum systems that meet the required material and quality standards.

### Mitigating Supply Chain Risks and Bottlenecks: Addressing potential dependencies

The development of quantum technology relies on a range of critical materials, including niobium, tantalum, aluminum, and titanium for superconducting qubits. However, the supply chain for these materials is often limited and vulnerable to geopolitical disruptions. For example, exotic compounds like lithium niobate are typically produced in Japan, while helium-3, essential for dilution refrigerators, is primarily sourced from tritium decay in nuclear weapons programs and rare natural deposits. [A supply chain analysis by Nato](#) found that over 90% of high-purity material processing occurs outside of allied territories, leaving superconducting qubit fabrication vulnerable to external dependencies.