



quantum  
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White paper

# Accelerating Quantum in Belgium

A Belgian Quantum Ecosystem  
at the Heart of Europe

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## A brief introduction to quantum technology

Quantum technology is a collection of emerging technologies that aim to leverage the laws of quantum physics to improve critical information technology disciplines. This revolutionary field promises to enhance the energy-efficiency of computing methods to surpass that of today's traditional computing systems, and to tackle complex challenges that are currently unsolvable or cannot be solved in a reasonable amount of time. Quantum technology is poised to profoundly influence numerous sectors and industries, as highlighted in the first Quantum Circle white paper (3).

The long-term success of quantum technology will heavily depend on the achievement of more cost-effective or superior results and the sustained demand for quantum-based solutions, supported by a continuous advancement of quantum technologies that goes beyond the capabilities of individual organisations and requires a holistic ecosystem of its own.

There are multiple subdomains in quantum technology. Quantum computing, which is currently the best known, aims to perform complex calculations at speeds unattainable by classical computers. Other domains include quantum communication and quantum sensing, which utilises the sensitivity of quantum systems to external disturbances to measure physical quantities with unprecedented precision and accuracy.

Quantum-based applications will revolutionise diverse industries worldwide, including pharma, chemistry, healthcare and life sciences, energy, automotive, finance, insurance, mobility, defence, aerospace and telecom.

As nations around the world race to harness the potential of quantum technology, Belgium is making strides to position itself as a relevant player in this emerging domain. This paper aims to provide an overview of the current landscape of quantum activities and actors in Belgium, highlighting initiatives, accompanied by recommendations on how to tackle challenges and seize opportunities.



## The international quantum race is on

Globally, countries are recognising the strategic importance of quantum technology and are investing heavily to secure a leading position in this emerging field (1). China's staggering \$15 billion investment underscores its ambition to become a quantum superpower. The United States, with its National Quantum Initiative and \$3.8 billion investment, is also striving for leadership in quantum information science. The UK's recent 10-year National Quantum Strategy plan reflects a similar dedication to advancing within this new paradigm; the country is positioned as the third largest investor, with a \$4.3 billion commitment (2). Germany, with a \$5.2 billion commitment, has laid out its National Quantum Strategy, which focuses on bridging the gap between academic research and commercial applications. The original 2018 plan was updated in 2023 (4). France launched an ambitious four-year Quantum National Strategy dotted of \$2 billion back in 2021.

In the rest of Europe, Nordic countries and the Netherlands are actively investing in quantum research and development and formulating long-term strategies and fostering the development of industrial pilot projects. The European Commission and its Member States launched several quantum initiatives and programmes such as the Quantum Technology Flagship programme, the Chips for Europe initiative, the Digital Decade Policy Programme along with generous investments via the Horizon Europe and the Digital Programmes, aimed at supporting quantum research and innovating sectorial deployment with support of the Euro-HPC and the Chips Joint Undertakings. One of the focus points is the development of autonomous and resilient European quantum supply chains across Europe, where quantum computers, simulators and sensors are interconnected across a pan-European computing continuum grounded in a quantum communication network (9, 10).

The United Nations has designated 2025 as the International Year of Quantum Science and Technology (11). They aim to use this initiative to increase awareness about quantum technology among individuals, groups, schools, institutions and governments. In 2025, the World AI Action Summit will gather governments, businesses and researchers from across the globe to discuss Sustainable AI and its key drivers, one being quantum technologies.

With global and European powers investing heavily in quantum technology, Belgium together with its vivid quantum ecosystem, should also reflect on the necessary actions to claim its strategic position in this high-stakes race.





## The emerging quantum landscape in Belgium

Belgium is home to several initiatives aimed at fostering the development of quantum technology. The Belgium Quantum Communication Infrastructure consortium (BeQCII) exemplifies this effort, bringing together a range of expertise to pioneer quantum communication networks (8).

Recently, it was announced that the Flemish Supercomputer Center (VSC) will operate a new quantum computer utilising semiconductor spin qubit, within a consortium led by the Netherlands and supported by France. This initiative will contribute to the growing network of quantum computers under construction across Europe, which also includes the UHasselt's partnership in the LUMI-Q project. Both the VSC and the Wallonia-based Cenaero are actively advocating for the integration of quantum systems alongside traditional high-performance computers.

Scientific research in Belgium has received a significant boost with 27 quantum technology projects funded by the Fonds Wetenschappelijk Onderzoek (FWO) and the Fonds de la Recherche Scientifique (FNRS). Belgium's renowned microelectronics centre imec, plays a pivotal role in advancing quantum research and applications. Every university and many colleges and research centres currently have ongoing projects, ranging from quantum computing to communication, cryptographic security and sensing or photonics.

Belgium is home to promising startups that are developing groundbreaking technology. Notably, iQrypto (6) is working on Quantum Random Number Generators and microchips leveraging quantum technology, while Blackhills Quantum (5) provides advanced quantum and AI-powered cybersecurity solutions. However, the startup space in Belgium is relatively limited compared to the Netherlands, where 23 startups were registered in 2023 alone (7).

Worldwide leaders in quantum computing and post-quantum cryptography are also already active in Belgium. IBM, for example, is promoting fact-based information, and providing education, workshops and quantum device access via the cloud. European vendors such as Pasqal, are also well-aware of the dynamism of the Belgium quantum ecosystem and its pivotal role being at the heart of Europe.

The Quantum Circle community, a collaborative network of stakeholders in quantum computing, communication and sensing, strives to catalyse research and development, as well as the creation and adoption of sustainable quantum-driven applications and services in support of all stakeholders, to the benefits of the economy and society.



## Survey delivers in-depth market perspectives

In September 2024, the Quantum Circle launched a survey to gain a comprehensive understanding of the perception of quantum technology in Belgium. Below, we present a selection of the most intriguing results. A full report will be published on the [quantumcircle.eu](https://quantumcircle.eu) website.

In the survey, approximately 60% of respondents indicated that their organisations are at least exploring the potential applications of quantum technology, with quantum computing generating the highest interest. This aligns with the trends in the international quantum technology landscape.

A second key insight concerns challenges; most respondents identified a lack of expertise as the biggest hurdle, closely followed by technological immaturity. Financial aspects, such as uncertain return on investment and high costs, were also significant concerns, ranking third and fourth, respectively.

Seventy-five percent of participants estimated a 10-year timeline for the practical benefits from quantum technology to become visible. Among the various technologies, quantum-enhanced cybersecurity stands out as the most urgent to explore.

Based on these results and the successful progress made in other countries, this white paper will now focus on a first set of recommendations to help Belgium thrive in the quantum technology space.

## Recommendations for all ecosystem actors

When considering quantum technology, it is essential to address all value stack components, including hardware, software and integration services. Generally, Belgium lacks the history, infrastructure and workforce necessary to excel in developing quantum computer hardware. However, imec stands out as an exception, possessing the history and expertise to further advance within the chip industry.

On the software side, Belgium will thrive most by focusing on the development and integration of quantum applications for artificial intelligence, drug development, financial modelling, traffic optimisation, weather forecasting or energy transition.

Belgium also has a strong track record in cryptography research and the development of advanced algorithms and has a rich pool of experts with the



requisite knowledge. Notably, the Advanced Encryption Standard or AES, used daily on a global level, originated at KU Leuven. It will be crucial to bring these experts together to foster collaboration and innovation in the quantum security domain.

### **Governments: a coordinated and focused effort**

To amplify Belgium's presence in the quantum arena, it is essential to foster networks and partnerships between both local and international stakeholders. Quantum technology's unforeseen applications may necessitate collective action to address potential negative impacts, making international collaboration and engagement crucial. Such initiatives can also accelerate cross-border research and the development of emerging opportunities.

Given Belgian's governmental structure for research and innovation governance, establishing close alignment on strategy and investment scenarios between the federal and regional levels will be important, while taking advantage of Belgium's geographical location – home to many European institutions, agencies and bodies – to foster a constant and deep dialogue at European levels.

By increasing investment in academic programmes, Belgium can cultivate a pool of experts capable of navigating the international quantum stage. Additionally, European, federal and regional governments should support outreach and awareness campaigns to educate the public and industry leaders about the potential risks and benefits of quantum technology, fostering a supportive environment for quantum innovation. These efforts should also focus on attracting multidisciplinary profiles that are closer to the business, to identify relevant problems that quantum technologies might be able to address. When making these resources available, special attention should be paid to ensure an equitable access to quantum technology research, infrastructure and talent, as well as a sustainable use of resources.

Unlike its neighbours, Belgium currently lacks a national quantum strategy. Such a roadmap could significantly enhance the country's quantum capabilities and provide a framework for supporting quantum technology startups and organisations eager to explore quantum opportunities. This strategy must align with EU's strategies, which invests in research and innovation projects as part of the Horizon Europe and Digital Programmes as well as nationally via the National Digital Decade Roadmaps stemming from the European Digital Decade Policy Programme.



However, a national strategy alone will not be sufficient. The government should also encourage venture capital investment in startups by offering favourable tax incentives and co-investment schemes. This financial support is crucial for early-stage companies developing quantum technologies. Additionally, any administrative barriers that hinder funding for industrialisation or investments in startups should be eliminated.

Not only will startups and scaleups be important for Belgium's position within the quantum space, but sector industry leaders will also be crucial for establishing a sustainable ecosystem. Governments can raise awareness among these organisations of the current state of the technology and its potential.

### **Industries: sandboxes for multi-party innovation**

Today, quantum technology research is often concentrated within the headquarters of multinational corporations. While these entities often have a presence in Belgium, their quantum initiatives at this stage are rarely extended to the local ecosystem.

To stay abreast of the current state of quantum technology, organisations should appoint dedicated employees, like quantum champions or ambassadors, to increase awareness and monitor internal, legislative and industry-specific developments. This proactive approach will enable them to identify the risks and opportunities introduced by the field in a timely manner.

The first research into quantum technology applications within an organisation is more likely to result in improvements to classical systems, rather than direct advancements in quantum technology. As research and industrial technology leaders gain a better understanding of the environment, they can leverage new perspectives to enhance current processes. This makes it worthwhile to start investing now, even if the direct application of quantum technology may take longer to materialise.

When a promising opportunity arises, it is time to perform proof-of-concepts to gain hands-on experience and assess the impact of the implementation by identifying the challenges and added value. The focus should be on hybrid solutions, where the benefits of both classical and quantum systems can be utilised optimally.



## **Academics & research: knowledge to capitalise on**

The success of quantum technology in Belgium hinges on the availability of skilled experts. Accessible quantum-specific study programmes can broaden the pool of trained professionals, who should be nurtured by academia and then gain hands-on experience in research institutions. This will deepen their expertise and spur the development of new quantum technologies. Furthermore, forging partnerships and alliances between industry and quantum companies is essential for co-developing comprehensive quantum solutions, and can provide access to cutting-edge research, high-calibre talent, and potential markets.

Research centres can facilitate access to quantum computers without needing to own them. Quantum computers are expensive, and as the field evolves the hardware will likely be quickly outdated. These devices also require maintenance and in-house knowledge, which can be hard to obtain. Hiring cloud-based computing time is likely a more practical model. By tapping into services offered by global technology providers and local high-performance computing centres, researchers and startups can collaborate and experiment on algorithm development.

## **Conclusions and recommendations**

Belgium has the potential to become a significant player in the quantum technology landscape by leveraging its unique strengths and by accelerating collaboration between local and global experts. Government, academia, research institutions, industries, startups and technology providers must work together to create a supportive ecosystem that encourages innovation and addresses the challenges associated with quantum technology.

This requires investing in education and outreach, developing a national quantum strategy aligned with EU initiatives, and providing financial support to startups and established organisations alike. By doing so, Belgium can position itself at the forefront of quantum technology and reap the benefits of this revolutionary field, capitalizing on its geographical location at the heart of Europe.

The Quantum Circle community seeks to serve as facilitator between the various Belgian and European stakeholders located in Belgium. To make this happen, representatives of these different parties should join the conversation and actively contribute to the initiative. In the future, the Quantum Circle could drive the establishment of a Belgian-European Quantum Innovation Centre that brings together researchers, practitioners and end users, leveraging quantum computing, communication and sensing technologies.





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