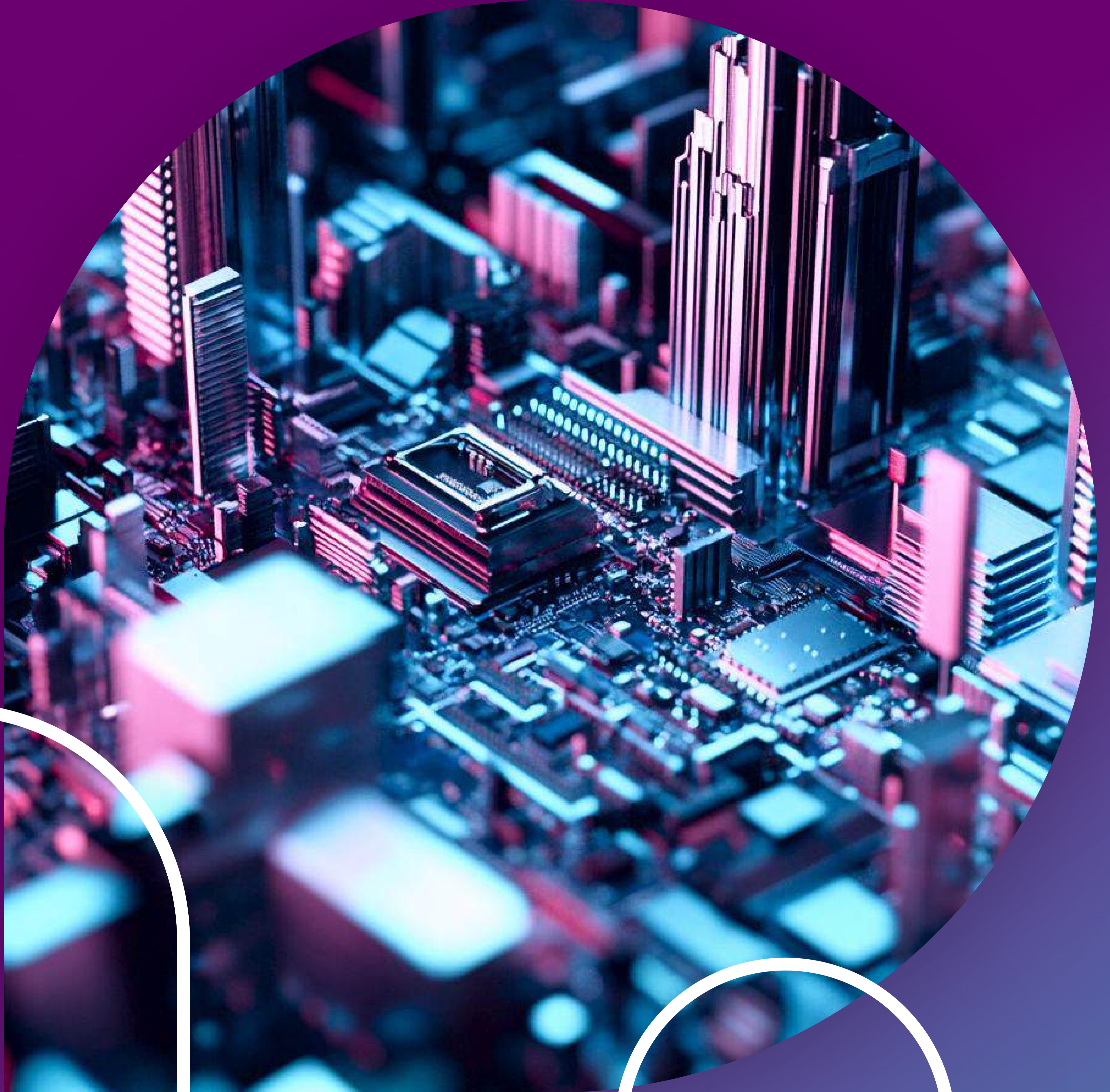


OOQI
Open Quantum
Institute



gesda



Progress Report (2nd Edition)

Open Quantum Institute

Geneva • March • 2025



Geneva, 10 Oct 2024, OQI
Advisory Committee
Credit: Marc Bader

Introduction

Quantum technologies encompass a diverse range of applications, from sensing to computing. Computing, while the least mature, has the highest disruptive potential.

As **UNESCO** launched the International Year of Quantum Science and Technology (IYQ) on 4 February 2025, the Open Quantum Institute (OQI), hosted by **CERN**, born at **GESDA** and supported by **UBS**, amplifies its efforts of co-shaping the future of quantum computing and its impact. UNESCO and OQI have joined forces to fostering multilateral cooperation, raising public awareness, and driving collective action toward ensuring that advancements in quantum technologies remain inclusive, secure, and beneficial to humanity.

In 2025, OQI continues to deliver on its pipeline, with over 30 engagement events during the year to inspire a future where humanity and technology advance together for the common good. OQI advances steadily thanks to the invaluable guidance and support of its **multi-stakeholder Advisory Committee**.

OQI pilot phase

On 5 March 2024, CERN took the baton from GESDA to host the Open Quantum Institute with support of UBS. Since then, OQI has further established the institute, nurtured the growing community and has advanced the use case pipeline as well as the activities of its Educational Consortium.

Between June 2024 and March 2025, OQI has tracked over 10,000 visits on its website from 120 countries. OQI has secured 3,676 followers on LinkedIn and welcomed 300 users to its community platform. The geographical distribution of our community is being worked on by the OQI Coordination Team. To date, 27 new institutions joined OQI as members, with more in the signature pipeline. Full visibility on partners and members is provided at <https://oqi.cern/>. The global OQI community supports keeping the momentum and advancing OQI's mission, structured by its four A's.

A1 Accelerating applications for humanity

We are exploring how quantum computing can accelerate the achievements of the United Nations' Sustainable Development Goals (SDGs) and beyond. We are combining forces of researchers, developers and entrepreneurs from academia and private sector, as well as from the United Nations, and some prominent NGOs to achieve the broadest possible societal impacts from the full potential of quantum computing.



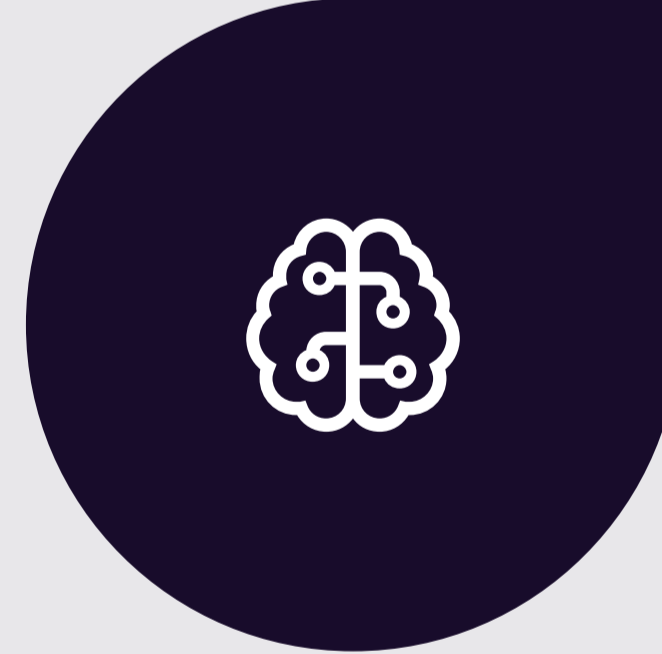
A2 Access for all

We are providing global, inclusive and equitable access to a pool of public and private quantum computers and simulators via the cloud.



A3 Advancing capacity building

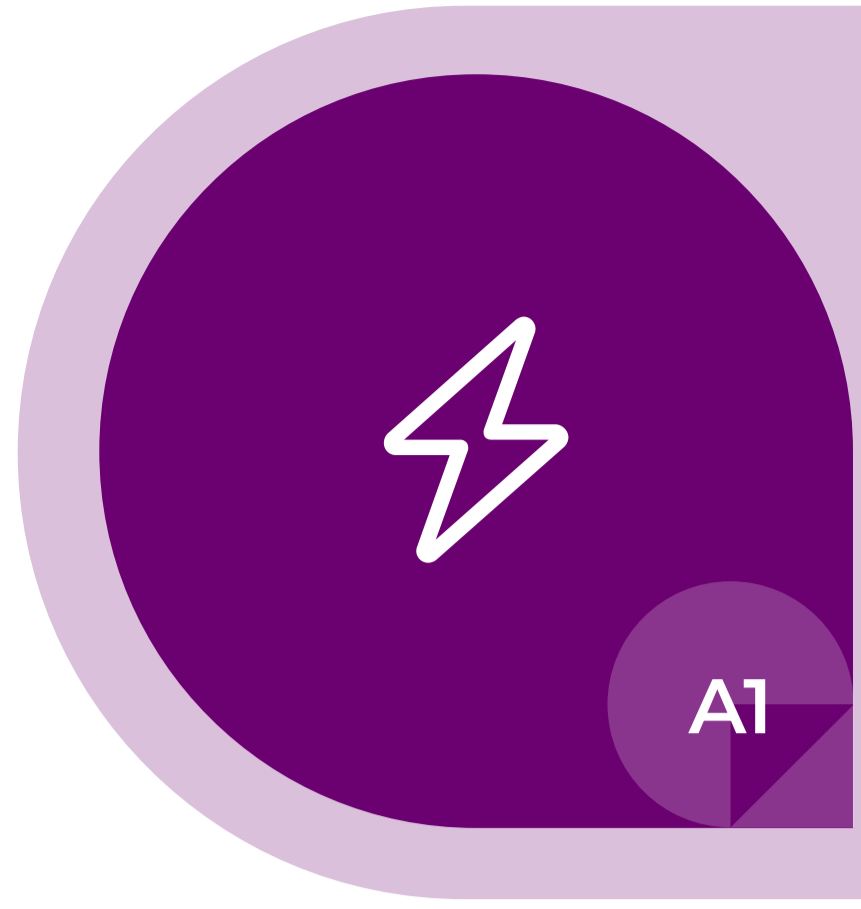
We are developing educational tools to enable everyone around the world to contribute to the development of quantum computing and to make the most of the technology.



A4 Activating multilateral governance for the SDGs

We are offering a neutral forum to help shape the multilateral governance of quantum computing for the SDGs





Accelerating applications for humanity

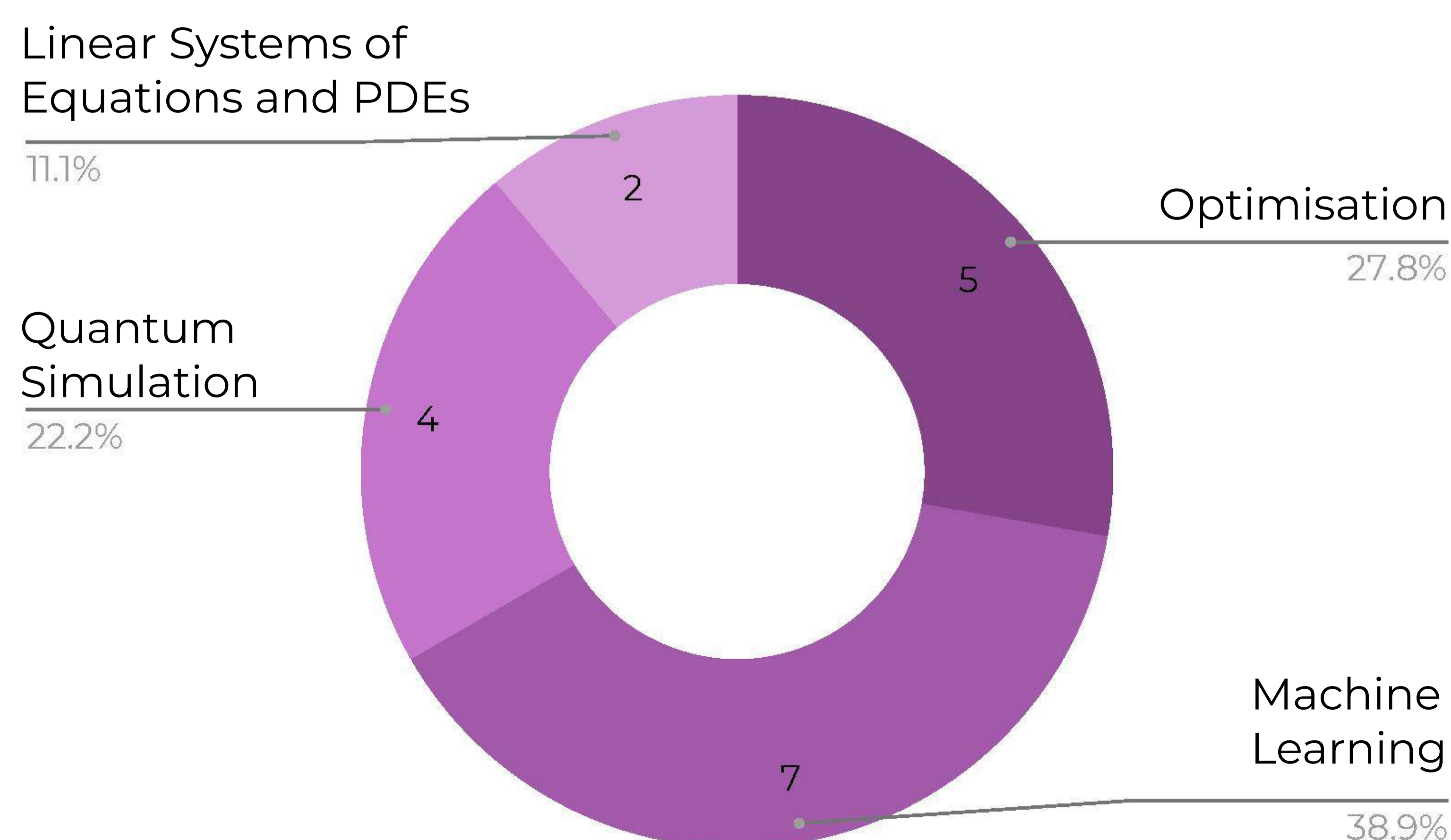
Open Quantum Institute

The pipeline of use cases for OQI pilot phase is fully consolidated: One use case (water leak detection) from the incubation phase is currently being implemented on simulator. Eight use cases, generated through a call for proposals issued in May-June 2024, are building their full proposal which will be evaluated by the external scientific and impact expert panels in May 2025. Nine additional use cases are being nurtured and further calibrated.

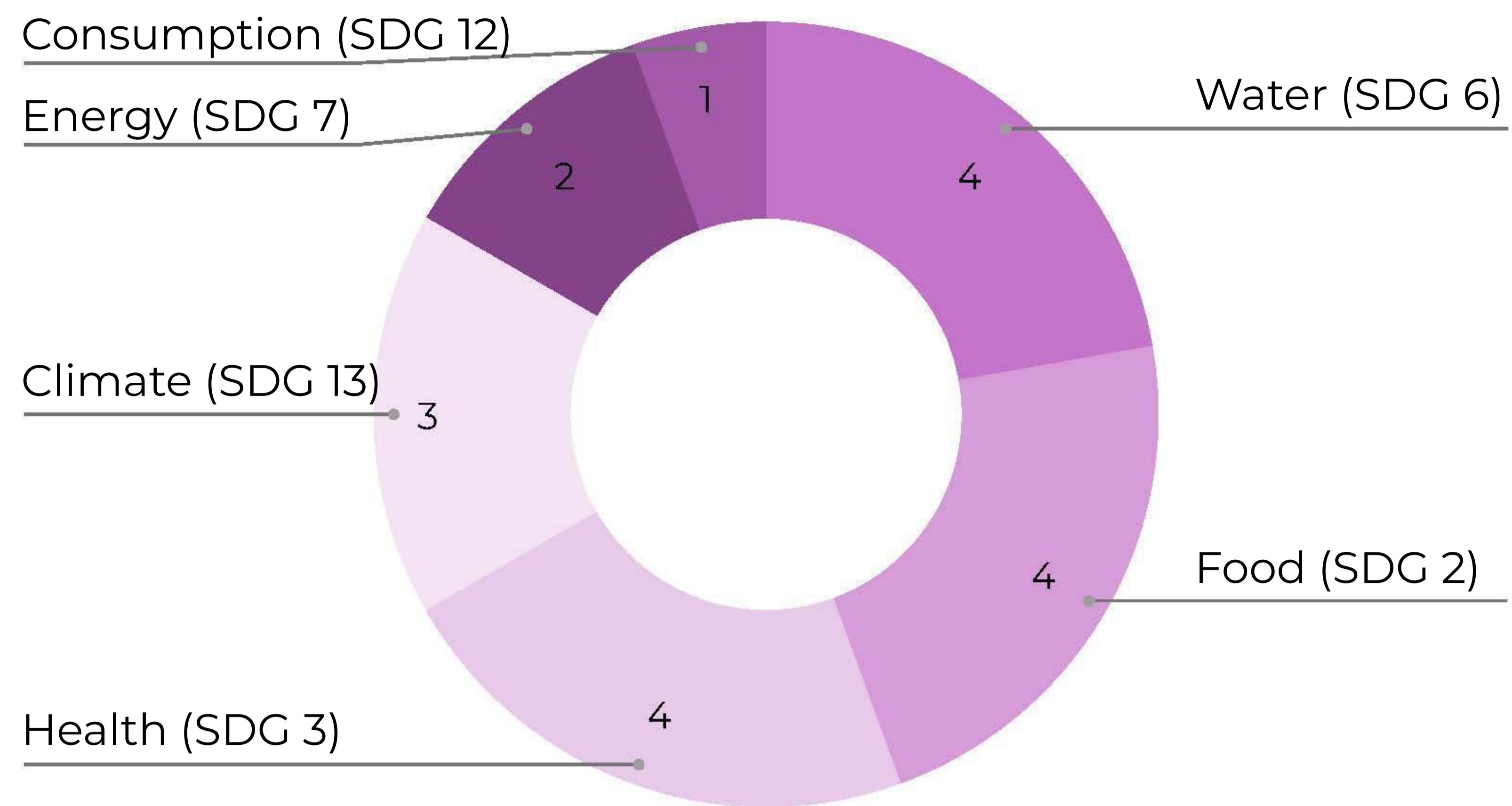
AI Key achievements

- **18 use case teams** are currently supported by OQI, exploring the relevance of quantum computing for SDG 2, 3, 6, 7, 12 and 13.
- **Examples of use cases include**
 - = Quantum computing solution to improve wheat, corn and soy yield by targeted gene editing.
 - = Quantum simulation and quantum machine learning solution to accelerate the antibacterial discovery and lower resistance.
 - = Quantum optimisation solution for water waste management in urban water distribution network.
 - = Quantum machine learning solution of catalytic materials for carbon capture.
- **UN organizations**, such as UN Habitat, UNFCCC, WHO, WFP, UNDRR, FAO, IARC have validated the use cases.
- Like-minded organizations supporting OQI are collaborating to extend the repository of use cases on OQI website, such as **XPRIZE Quantum Applications Competition** and **The Quantum Insider**. Additional organizations are being approached to feature their work and further inspire greater participation in this ambitious endeavor to impact humanity.

Quantum approaches to SDG application

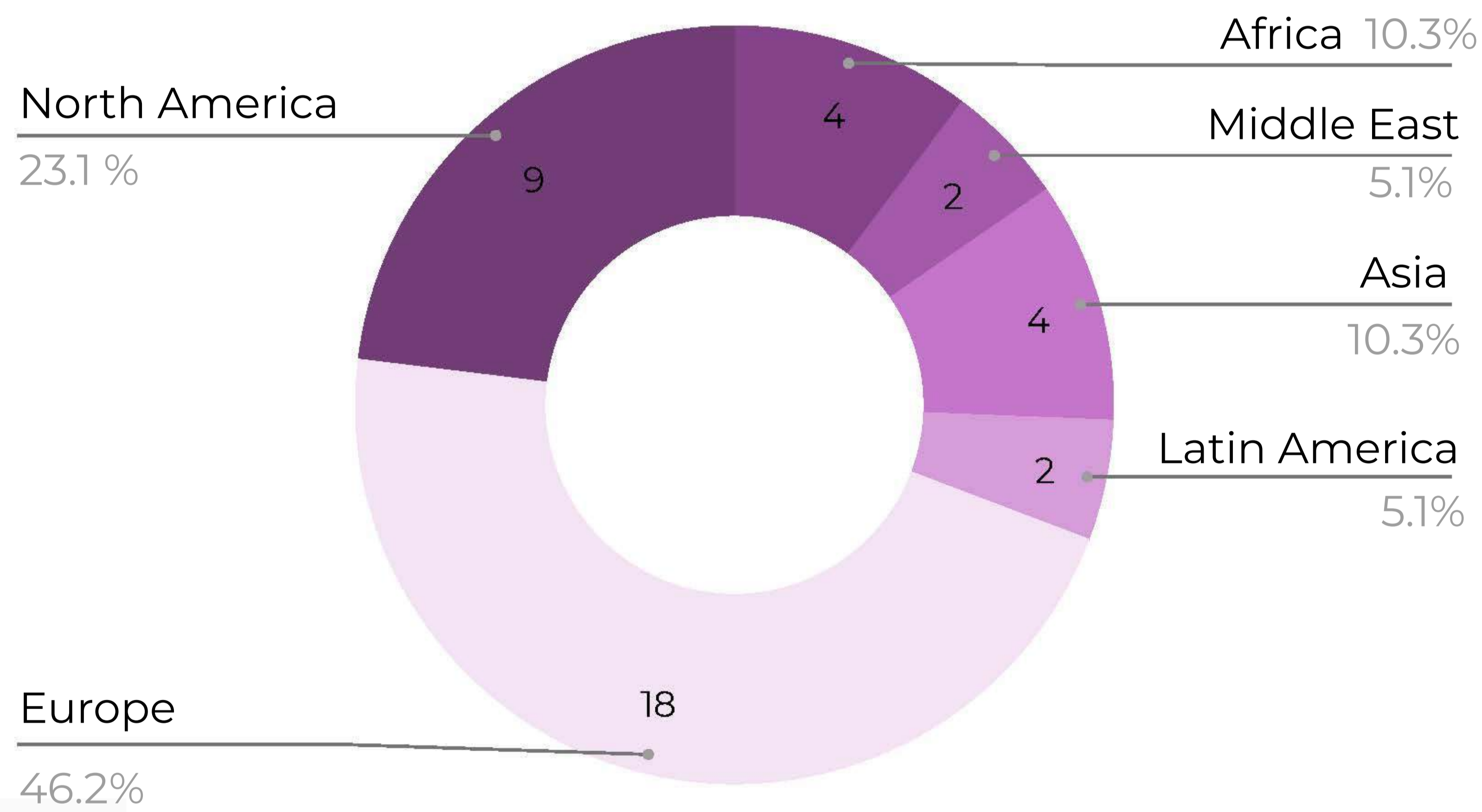


SDG relevance of quantum computing applications



- Expert participation include: Africa (Morocco, Ghana, South Africa), Middle East (Israel, Lebanon), Asia (India, Japan, Malaysia), Latin America (Brazil, Uruguay), North America (USA, Canada), Europe (Italy, Finland, France, Germany, Poland, Portugal, UK, Spain, Switzerland, Belgium, Denmark)

Global participation to OQI use case development





Geneva, 9 Oct 2024, OQI Technical Workshop on AI
Credit: Marc Bader



Geneva, 9 Oct 2024, Catherine Lefebvre, Senior Advisor at GESDA for OQI,
Credit: Marc Bader

The pipeline to explore use cases is on track. Below is the portfolio of active use cases supported by OQI.

SDG (main)	Topics	Short description
 <p>2 ZERO HUNGER</p>	Sustainable food production	<p>Improving sustainability of global food systems by making them more resilient to climate change through a quantum optimisation solution to produce more nutritious food locally in less land.</p> <p>École Polytechnique Fédérale de Lausanne (EPFL), Globale Alliance for Improved Nutrition (GAIN), National Institute for Theoretical and Computational Science (NITheCS)</p>
	Food security	<p>Quantum computing optimisation of the food supply chain, in particular in the route planning of food delivery in underserved regions impacted by climate change or other crises.</p> <p>Quantum AI Foundation, Yale University, Hassan II University of Casablanca, University of Mumbai, Indian Institute of Technology, Technical University of Delft, QWorld, World Food Program (WFP)</p>
	Coated fertilizer design	<p>Quantum simulation to maximize the nutrient release from coated fertilizers depending on soil acidity for sustainable agriculture.</p> <p>Mohammed VI Polytechnic University (Morocco), Université du Littoral Côte d'Opale (France)</p>
	Plant genomics	<p>Quantum computing solution to improve wheat, corn and soy yield by targeted gene editing.</p> <p>Inari, QuEra, Venturus, Eversoles Associates, Food and Agricultural Organisation of the United Nations (FAO)</p>
 <p>3 GOOD HEALTH AND WELL-BEING</p>	Drug metabolism	<p>Quantum simulation of in vivo metabolic oxidation of drug compounds used to treat diseases such as Alzheimer's disease.</p> <p>Algorithmiq (Finland, UK)</p>
	Women's health	<p>Quantum simulation of the molecular interaction of the biological targets and drugs involved in the treatment of endometriosis, perimenopause, and menopause.</p> <p>Universal Quantum (UK, Germany)</p>
	Predicting gastrointestinal cancer (G-quAI)	<p>Quantum machine learning solution to improve accuracy of gastrointestinal cancer diagnosis and speed up medical treatment and prevention.</p> <p>University of Coimbra, Centre for Social Studies, International Agency for Research on Cancer (IARC), World Health Organization (WHO)</p>
	Accelerating novel antimicrobial discovery	<p>Quantum simulation and quantum machine learning solution to accelerate the antimicrobial discovery and lower resistance.</p> <p>Global Antibiotic Research & Development Partnership (GARDP), qBraid, McMaster University, Università degli Studi di Cagliari, World Health Organization (WHO)</p>

SDG (main)	Topics	Short description
<p>6 CLEAN WATER AND SANITATION</p> 	<p>Water Leak Detection</p>	<p>Quantum machine learning solution to optimally position sensors and detect water leaks in urban water systems.</p> <p>Reply, QClavis.io, UN Habitat, Pasqal</p>
	<p>Eliminating “Forever chemicals” from Water Sources (PFAS)</p>	<p>Quantum simulation of the decomposition of “forever chemicals” (Poly-fluoroalkyl substances (PFAS)) for more efficient removal in water, limiting physiological and environmental harm.</p> <p>Sandbox AQ, Quantum South, UN Habitat</p>
	<p>Molecular Docking to Clean Up Pollution</p>	<p>Quantum simulation and quantum machine learning solution to accurately model the chemical process of molecular docking involved in removing organic pollutants in water.</p> <p>Quandela, QunaSys, World Health Organization (WHO)</p>
	<p>Water resource management</p>	<p>Quantum fluid dynamics solution to model integrated hydrological cycle and assess impact of climate change.</p> <p>American University of Beirut (Lebanon), Massachusetts Institute of Technology (USA)</p>
<p>7 AFFORDABLE AND CLEAN ENERGY</p> 	<p>Smart-grid management</p>	<p>Quantum optimisation solution to improve the management of large energy grids and efficiently distribute energy.</p> <p>Classiq (Israel), Wolfram (USA)</p>
	<p>Layout of turbines in a wind farm</p>	<p>Quantum optimisation solution to efficiently layout of turbines in a wind farm and maximise the power produced.</p> <p>University of Plymouth (UK), G. Narayanamma Institute of Technology and Sciences (India)</p>
<p>12 RESPONSIBLE CONSUMPTION AND PRODUCTION</p> 	<p>Illegal mining</p>	<p>Quantum machine learning solution for monitoring illegal mining through satellite imagery and promoting environmental conservation, particularly in Ghana.</p> <p>University of Energy and Natural Resources (Ghana), University of Education Winneba (Ghana)</p>
<p>13 CLIMATE ACTION</p> 	<p>Weather and climate forecasting</p>	<p>Quantum fluid dynamics solution to improve the reliability of weather and climate forecasts.</p> <p>Planqc (Germany)</p>
	<p>Catalytic carbon capture</p>	<p>Quantum machine learning solution to improve efficiency of catalysts involved in the chemical process of carbon capture.</p> <p>QCentroid (Spain, Finland)</p>
	<p>Flood risk assessment</p>	<p>Quantum machine learning solution to provide better accuracy in flood prediction and improve prevention mechanisms in regions at risk, in particular Malaysia.</p> <p>Universiti Teknologi Petronas, Malaysia Quantum Information Initiative, QuaTi</p>

A1 What's next

- Ongoing collaboration with the quantum experts on the OQI Advisory Committee to further develop the **OQI Use Case Guidelines** – a methodology for building use cases with a strong emphasis on rigor in selecting and applying quantum algorithms, as well as on impact measurement. These guidelines serve to enhance the quality of use cases and will be converted into an educational tool (A3) for broader distribution, supporting the global community participation in use case development.
- The **scientific and impact expert panels** – with OQI Advisory Committee members and external experts – will perform the evaluation of the use case proposals in May 2025 to select those for implementation on simulator and quantum processors.
- **Ongoing support** – with project management, technical and financial support – to the use case teams all around the world.



A2

Access for All

Open Quantum Institute

OQI continues to foster partnerships with industry to provide open inclusive access to a pool of quantum computers and simulators via the cloud.

A2 Key achievements

- Steady progress being made with incubation partners in signing formal **OQI Partnership agreements**, the latest with **Microsoft**.
- Beyond incubation partners **Pasqal** and **qBraid**, now **QuEra** has become a member with additional industry providers including **Quandela**, **Universal Quantum** and **Planqc** actively engaging in the use case development.
- Pooling is much more than just hardware. In addition with access to tools, libraries, educational material, and documentation, several software providers are also actively engaged in the use case development.
- Within the A3 educational activities, quantum computers are also needed for students to run **Hackathon pre-training exercises**, for which OQI is partnering with qBraid.

A2 What's next

- Continued **consultations with industry providers** to perform a selection of use cases that best fit the different quantum computing devices, as well as to provide expertise throughout the development of the use cases. The target for the implementation of selected relevant use cases is Q3 2025.

A3



Advancing capacity building

Open Quantum Institute

OQI has already started to amplify its capacity building activities, strengthening regional efforts in 5 continents, in line with IYQ 2025. OQI targets young researchers and developers (graduate level) from quantum-underserved geographies, policy makers and diplomats.

A3 Key achievements

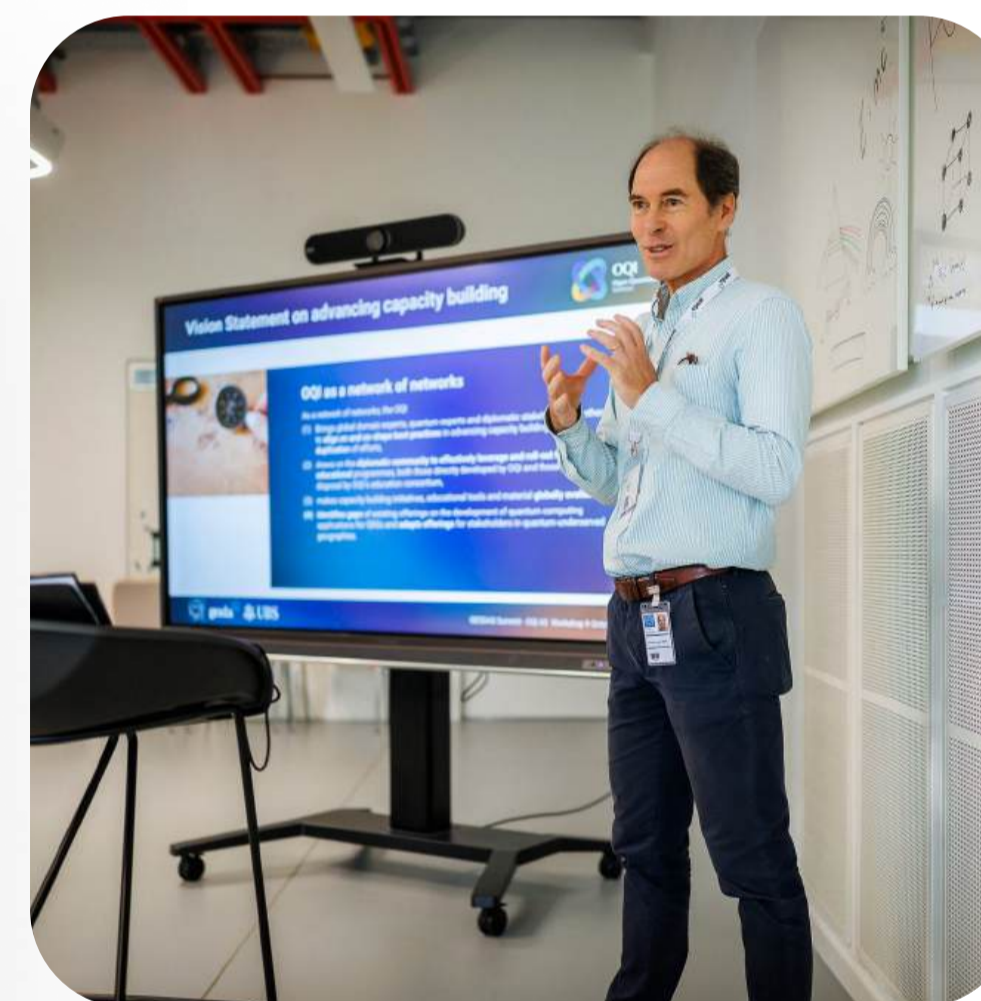
- **OQI Educational Consortium has become operational:** its members have agreed on and are contributing to the execution of a globally engaging roadmap throughout 2025, with first commitments for specific activities confirmed.
- **55+ institutions contributing**, with 17 official member institutions, and 80 experts involved.
- **Educational products of OQI are aligned and relayed as part of IYQ.** The global community has started to deploy those products and a selection of institutions are supported by OQI in their execution of “quantum-for-all” supportive activities, including OQI’s “hackathon in a box”. Products and activities are presented on OQI’s [education webpage](#).
- **Five OQI supported Quantum Diplomacy Games** in 2025: three were played in Q1 2025 (Germany, Switzerland, US) with at least two more planned in Latin-America and South East Asia during Q3 and Q4 2025.

Educational Consortium

OQI’s educational consortium brings together domain experts, quantum experts and diplomatic stakeholders to align on and co-shape best practices in advancing capacity building, avoiding duplication of efforts and making capacity building initiatives, educational tools and material globally available.

The Consortium has agreed on three overall objectives for OQI’s remaining pilot phase:

- co-shape and implement seamlessly **best practices**,
- enable **future quantum ecosystems** that are regionally and culturally relevant, responsive to the unique needs of diverse communities, while maintaining respect for sovereignty and local innovation, and
- ensure that the **quantum underserved geographies** have a voice in co-shaping **global quantum diplomacy**



Tim Smith, OQI Coordinator
Credit: Marc Bader



Marianne Schoerling, Senior Program Manager at GESDA for OQI
Credit: Marc Bader



Geneva, 09 Oct 2024,
OQI Educational Consortium
Workshop on A3
Credit: Marc Bader



OQI

Quantum Diplomacy Game

This simulation serious game, a role play on quantum diplomacy, was developed and tested by GESDA with its diplomatic community and advisors during the incubation of the OQI. The game's objective is to raise awareness of the geopolitical implications of quantum computing as an emerging technology.

Since Jan 2025, a new edition of the facilitator as well as participant guide is available on OQI's website.



OQI

Quantum for SDGs hackathons



OQI's "Hackathon in a Box" is a step-by-step guide to organize hackathons at the nexus of the application of quantum computing and the SDGs, available by September 2024 on OQI's website.

All host institutions of OQI supported hackathons, quantathons, benefit from a complementary training programme and have access to OQI global community of practice.



Washington, 5 Feb 2025, Quantum Diplomacy Game, Swiss Embassy in Washington D.C.
Credit: Swissnex



Munich, 29 Jan 2025, Quantum Diplomacy Game, International Quantum Forum
Credit: TUM Think Tank



The Quantum Diplomacy Game



Use the future to build the present: Think creatively about the world you want to help create

Quantum computing represents a complete change in the way computation has been practiced by humanity so far. For specific applications, this new emerging technology might, in principle, solve problems that are today intractable by conventional computers. How can we make sure they are used to benefit all in the best way? How to co-shape collectively the future governance of the technology?

Welcome to the Quantum Diplomacy Game, where you'll learn to navigate the rapidly shifting frontiers of science and technology—and shape tomorrow's diplomatic landscape. Developed by the **Geneva Science and Diplomacy Anticipator (GESDA) Foundation** and the **Open Quantum Institute (OQI)** this experience highlights how scientific breakthroughs expected at 5-, 10-, and 25-year horizons (<https://radar.gesda.global/>) can drive transformative changes in society, geopolitics, and the global economy. You will discover how anticipatory science diplomacy can help leaders in academia, policy, business, and civil society devise informed decisions today to ensure that tomorrow's technologies benefit all humanity.

How to play

The Quantum Diplomacy Game is a unique and interactive role-play that runs for 2 to 3 hours in person, facilitated by an experienced and trained facilitator. Participants are presented with a future scenario involving large-scale quantum computing issues on a global scale and then guided back to the present to engage in an exercise within a plenary, discussing what decisions could have been made from the perspective of each assigned character. The game participants take on the roles of scientists, policy makers, industry players, and stakeholders



The story

The year is 2035. Large-scale quantum computing has been achieved, but the costs of running these systems are still too high for general commercial use. Quantum computers are capable of processing orders of magnitude more data, more quickly than conventional computers, making them suited for complex, computationally-expensive tasks. Several nation states have quantum computer systems operated by research institutions, but the technology is still inaccessible for most.

Why this game matters

This serious game provides an experiential learning opportunity to see firsthand how emerging technologies like quantum computing are reshaping international collaboration. As you negotiate alliances and resolve crises, you will gain insights into the geopolitical, ethical, and normative factors influencing tomorrow's science-driven world.

The three pillars of Anticipatory Science Diplomacy

Science anticipation

Scientific innovation is accelerating, bringing opportunities to solve our most serious challenges—but also potential risks. By peering into the future of quantum technologies, you will experience how diplomatic strategies can be shaped before new science is deployed. In the game, you'll practice ways to harness the benefits of cutting-edge research while keeping potential ethical, social, and environmental implications in full view.

Honest brokering

Scientific advances open new pathways for society—but only if we can build trust, manage diverse viewpoints, and translate discoveries into real-world applications. In the game, you'll learn to facilitate discussions among stakeholders with different goals and agendas. Expect to test how effectively you can foster collaboration, promote transparency, and expand the range of possible solutions.

Multilateral action

No single nation can tackle global challenges alone. Through scientific cooperation and inclusive governance frameworks, we can bridge divides in a multi-polar world. During each round of the game, you will broker treaties, negotiate resource-sharing agreements, and design frameworks that ensure quantum breakthroughs remain equitable and accessible across borders—directly supporting the United Nations Sustainable Development Goals (SDGs).

A3 What's next

- In 2025, OQI will **roll out OQI educational activities globally on 5 continents** (impacting **quantum underserved geographies** through amplification of OQI's activities and piloting of new activities as key support of IYQST25).
- The **first foundational training** based on learnings and guidelines for use case development as curated by OQI A1 is being developed in collaboration with members of the Educational Consortium.
- Continued consultation within **Educational Consortium** to strengthen OQI's unique value propositions (UVPs) to serve as a best-practices collider, future quantum ecosystems builder, and quantum diplomacy advocate.
- Community building will be supported by a **new community platform**. By spring 2025, the A3 community will start onboarding, with a special focus on the quantum computing applications community, as well as researchers and developers (graduate level) from quantum-underserved geographies participating in OQI supported activities such as hackathons and the affiliated training programme.

A4



Activating multilateral governance for the SDGs

Open Quantum Institute

OQI continues to provide a neutral forum to help shape the future multilateral governance of quantum computing for the SDGs.

A4 Key achievements

- Deepening **engagement with the international organizations** in Geneva and further, following the Quantum Diplomacy Symposium organised by GESDA as part of its contribution to OQI A4.
 - International collaborations: **Innovations Dialogue on Quantum Technologies** co-organized with UNIDIR (Nov 2024).
 - **OQI contributions** or **joint research** for action-oriented governance in discussion with ITC-ILO, UNIDIR, ITU, UNICC, UNESCO, OECD, etc.
- Confirming the relevance of OQI for **science diplomacy leaders**, demand for 1-2-1 briefings as part of diplomatic visits in Geneva is growing considerably – averaging 6-8 in recent months.
 - Examples include Council of Europe, Mongolian Parliament, Lithuanian Ministry of Foreign Affairs, Lithuanian Academy of Science, Council for Innovation, Science and Technology of Chile, WIPO DG, etc.



Geneva, 22 Nov 2025, Innovations Dialogue 2024, UNIDIR/GESDA
Credit: UNIDIR



Paris, 4-5 Feb 2025, UNESCO Launch of International Year of Quantum Science and Technology
Credit: UNESCO/Marie ETCHEGOYEN



A4 What's next

— Further engagement with international organisations

— Quantum for Good Day at the AI for Good Global Summit with ITU (8 July 2025).

— Product in development: Quantum Diplomacy Series

— Deep dives/briefs in collaboration with UN IO's on the topics of safety and security and the future of work in the realm of quantum technologies, among others.

— Regional briefings to Permanent Representations in Geneva on Anticipatory Leadership and Quantum Diplomacy.

UNESCO and OQI joining forces in 2025

“Through the inauguration of the IYQ in Geneva on 21 Feb 2025 under the theme “Quantum Science and Technologies for All”, we, UNESCO and OQI, reaffirm our dedication to fostering multilateral cooperation, raising public awareness, and driving collective action toward ensuring that advancements in quantum technologies remain inclusive, secure, and beneficial to humanity.

We call upon all stakeholders to collaborate actively in realising the vast potential of quantum science to address global challenges while upholding ethical principles and fundamental human rights.

We encourage you to engage in the International Year of Quantum Science and Technology to inspire a future where humanity and technology advance together for the common good, creating a more just, sustainable, and innovative world.”



INTERNATIONAL YEAR OF Quantum Science and Technology



Geneva, 21 Feb 2025, Ambassadorial panel moderated by Lidia Brito, Assistant Director-General of Natural Sciences, UNESCO, with Permanent Missions of India, Italy, Saudi Arabia, Mexico, Kenya, Slovenia, and Vanuatu at the inauguration of the International Year of Quantum Science and Technology in Geneva, UNESCO/OQI
Credit: Marc Bader

Acknowledgment

The Open Quantum Institute (OQI) is an anticipatory, multi-stakeholder and multilateral instrument. We are anticipating the moment, when quantum computers will be ready at scale by reflecting now on their future impact on people, society and the planet. By acting now, we enable human agency and prepare the future multilateral governance. OQI would like to thank all **members of the Advisory Committee** for its strategic guidance:

Alain Labrique (Director of Digital Health and Innovation, WHO) // **Anousheh Ansari** (CEO, XPRIZE Foundation) // H.E. Mr. **Arindam Bagchi** (Ambassador, Permanent Mission of India to the United Nations Office) // **Barry Sanders** (Professor Scientific Director, Quantum City, University of Calgary) // H.E. Mr. **Bilal Ahmad** (Ambassador, Permanent Mission of Pakistan to the United Nations Office) // H.E. Ms. **Claudia Fuentes Julio** (Ambassador, Permanent Mission of Chile to the United Nations Office) // **Cornelius Hempel** (Group Head, ETH Zürich – PSI Quantum Computing Hub) // H.E. Ms. **Désirée Schweitzer** (Ambassador, Permanent Mission of Austria to the United Nations Office) // **Diederick Croese** (Director Centre for Quantum & Society, QDNL) // **Dominik Heinrich** (Director, Innovation Division, World Food Programme (WFP)) // **Elica Kyoseva** (Director of Quantum Algorithm Engineering, NVIDIA) // **Francesco Petruccione** (Professor, Stellenbosch University) // H.E. Ms. **Francisca Mendez** (Ambassador, Permanent Mission of Mexico to the United Nations Office) // **George Popescu** (Head of Quantum Computing Laboratory, University Politehnica of Bucharest) // H.E. Mr. **James Waweru** (Ambassador, Permanent Mission of Kenya to the United Nations Office) // **Joachim Mnich** (OQI Advisory Committee-Co-Chair, Director for Research and Computing, CERN) // **Massamba Thioye** (Project Executive UN Climate Change Global Innovation Hub, UN Framework Convention on Climate Change (UNFCCC)) // **Manfred Plank** (Group Head of Quantitative Risk Modelling, UBS) // **Marco Gilli** (President, Compagnia di San Paolo Foundation) // **Marieke Hood** (ad interim Co-Chair, OQI Advisory Committee, and Executive Director Impact, GESDA) // **Matthias Christandl** (Professor for Quantum Computing, University of Copenhagen) // **Matthias Troyer** (Technical Fellow and CVP, Microsoft Quantum) // **Mira Wolf-Bauwens** (Responsible Quantum Computing Lead, IBM Research Europe) // H.E. Mr. **Omar Zniber** (Ambassador, Permanent Mission of Morocco to the United Nations Office) // **Ozge Aydogan** (Director, Beyond Lab) // H.E. Mr. **Paul Bekkers** (Ambassador, Permanent Mission of Kingdom of the Netherlands to the United Nations Office) // **Philippe Chomaz** (Executive Scientific Director, Commissariat à l'énergie atomique et aux énergies alternatives (CEA)) // **Prince Osei** (Acting President, African Institute for Mathematical Sciences (AIMS)) // **Rosario Fazio** (Director of the Trieste Institute for Quantum Technologies (TQT), Abdus Salam International Centre for Theoretical Physics (ICTP)) // **Ryan Babbush** (Head of Quantum Algorithms, Google) // **Simon Plant** (Deputy Director for Innovation, UK, National Quantum Computing Centre) // H.E. Mr. **Tovar Da Silva Nunes** (Ambassador, Permanent Mission of Brazil to the United Nations Office) // **Urbasi Sinha** (Professor, Raman Research Institute) // H.E. Mr. **Vincenzo Grassi** (Ambassador, Permanent Mission of Italy to the United Nations Office) // **Vladimír Bužek** (Professor, Institute of Physics, Slovak Academy of Sciences).

OQI thanks the following former members of the OQI Advisory Committee for their invaluable contributions to shaping OQI and their guidance during the pilot phase of the institute:

Sandro Giuliani (former Co-Chair, OQI Advisory Committee and former CEO, GESDA) // **Christian Bluhm** (former Group Chief Risk Officer, UBS) // **Alberto Anfossi** (Secretary General, Fondazione Compagnia di San Paolo).