

# GESDA Solution Idea

The Open Quantum Institute

Geneva, October 2022

## The Open Quantum Institute

Quantum computing could have a transformative impact on our society and planet. GESDA wants to ensure everyone has a part to play in this journey, and that this disruptive technology is directed towards humanity's most pressing challenges.

That is the impetus behind our proposal for a new international governance solution, The Open Quantum Institute (OQI). It is designed to broaden access to quantum computing and spur the development of new quantum applications that can tackle the grand societal and planetary challenges we face in the coming decades. The OQI aims to catalyze new connections between researchers, technology developers, UN stakeholders, diplomats and policymakers from across the globe and ensure they have the necessary resources to undertake ambitious R&D collaborations that apply quantum computing to real world problems.

### **Why we must act**

Quantum computers will provide unprecedented computational speed-ups on problems at the heart of critical sectors like materials science, chemistry, energy, and logistics. If directed towards the right issues, quantum computing could enable scientific and technological breakthroughs that could transform the lives of millions.

So far, however, quantum computing development has been concentrated in a handful of nations and large multinational corporations. This increases the risk that the most socially beneficial use cases will be de-prioritized in favor of applications that confer commercial or geostrategic advantages. Little work has been done to investigate how quantum computing could help tackle the UN's Sustainable Development Goals (SDGs). Some commercially lucrative applications of the technology overlap with the SDGs – such as new techniques to develop drugs or design longer lasting batteries – but there are many other potential applications that have been neglected due to the lack of an obvious business case.

In addition, too few people have access to quantum computers today, which limits our ability to identify new applications and anticipate how the technology could impact the world in the future. This is particularly true for researchers and developers in the global south who are often most directly involved in finding solutions to the SDGs. Developed countries are also [putting in place national quantum strategies](#) that often feature a strong focus on quantum sovereignty. The development of quantum technology is still nascent and requires global participation to unlock its full capacity, and there is a risk that national quantum sovereignty measures will create gaps in the supply chain and limit access to enabling technologies for many nations.

### **GESDA's solution idea**

The idea of an Open Quantum Institute (OQI) is to tackle these issues head-on by providing global, inclusive and equitable access to quantum computing and to accelerate the achievement of the UN Sustainable Development Goals (SDGs).

The OQI would do this by brokering new working relationships between researchers and developers, quantum computing providers, intergovernmental organizations and national policymakers, and by educating key stakeholders about the transformative capabilities this technology will enable in the next 10 to 25 years. The OQI's aim would be to become the center of expertise for quantum solutions to the SDGs, by developing use cases with field experts and managing a repository of what is being done globally on SDGs. It would also provide researchers and developers from around the world with access to existing quantum computers via the cloud to work on these use cases.

The QQI brings together groups with different backgrounds and priorities, so developing governance structures that enable effective and sustainable collaboration is a priority. Being based in Geneva, allows the OQI to be tightly integrated with the operational hub of the multilateral ecosystem and to become a forum for collaboration that can help bypass geopolitical divisions. By leveraging GESDA's strong relationships with both the diplomatic and scientific communities the OQI would be the first truly international quantum computing initiative, bringing together a diverse and inclusive coalition committed to ensuring quantum computing has an open future.

The idea of the OQI is to deliver concrete solutions to global challenges by acting as honest broker between key stakeholders and helping translate ideas into action. To demonstrate and kickstart this process, train potential future users and test the market, GESDA has teamed up with XPRIZE to launch the "Quantum for SDGs" contest, which will distribute a multi-million non-dilutive grant to teams that come up with new ways to apply quantum computing to challenges at the heart of the SDGs

## The Making of the OQI

The OQI is the result of a rigorous process GESDA calls the Anticipatory Situation Room methodology, which is designed to anticipate and react to future scientific developments that could have significant global impact. It involves GESDA working as both a Think Tank to conceptualize challenges, and a Do Tank to design solutions to them.

In the Think Tank phase, GESDA held discussions with its diplomatic and scientific forums who identified quantum computing as a field that will have a transformative effect on people, society, and the planet in the coming decades. The process also highlighted global, inclusive and equitable access to quantum computers, and the development of applications that can help the SDGs, as the two most pressing issues for the field.

In the Do Tank phase, GESDA set up a task force made up of leaders from science and diplomacy to evaluate potential solutions and design an initiative that could drive progress in these areas. The result was the OQI. This solution idea has been presented at the GESDA Summit 2022 to open it up for broader feedback via a global survey with GESDA's communities.

**After a formal evaluation, decision will be made whether to kick-off the final incubation phase for the OQI in 2023.**

Provided decision is made to incubate the OQI, this final stage of the Do Tank phase ensures the proposal is feasible and sustainable in practice. The task force will hand over this development to a coalition of experts and partners who will oversee its incubation. The OQI has already assembled a strong group of supporters - including quantum computing providers, research entities, UN organizations and governments – who will be instrumental to making the OQI a reality.



# Frequently Asked Questions

## 1. Who is behind the OQI initiative?

The OQI is being developed by GESDA, an independent public-private foundation initiated by the Swiss and Geneva governments in 2019 and supported by a consortium of private philanthropic foundations. The organization was established to act as a bridge builder between the scientific and diplomatic communities and its mission is to anticipate future scientific breakthroughs, accelerate their global impact and make multilateralism more effective. To do this GESDA leverages a network of leading scientists, diplomats and policymakers to both map emerging technology and science and develop practical initiatives that can help fulfill its mission.

The task force responsible for designing the OQI is co-chaired by [Matthias Troyer](#), a former professor at ETH Zurich who leads Microsoft's quantum computing program, and [Anousheh Ansari](#), CEO of XPRIZE Foundation, a non-profit that organizes competitions to develop socially beneficial technology. The OQI already has strong support. Among the academic supporters are CERN, the Swiss Federal Institutes of Technology ETHZ and EPFL, the University of Geneva, University of Calgary in Canada, University of Copenhagen in Denmark, Quantum Delta NL in the Netherlands, Forschungszentrum Jülich in Germany, Raman Research Institute in India, and the National Institute for Theoretical and Computational Sciences (NITheCS) and University of KwaZulu-Natal (UKZN) in South Africa. Compagnia di San Paolo Foundation, one of Europe's largest philanthropic foundations of banking origin, also endorses the project. Initial supporting industry partners include Microsoft, AQT, AWS, IBM, IQM Quantum Computers, PASQAL, Oxford Quantum Circuits and Strangeworks.

## 2. What makes the OQI unique?

While there are already several initiatives attempting to direct quantum technologies towards socially beneficial applications, the OQI idea has several distinguishing features. It has a broad remit to find solutions to all of the SDGs rather than focusing on a specific issue such as climate change. It is also open to anyone, no matter where in the world they come from.

It works with world-class quantum experts from academia and industry to provide a realistic picture of what quantum computing will make possible on the 5-, 10- and 25-year timescales. It engages directly with domain experts at the UN and other intergovernmental organizations to anticipate their future needs and potential challenges. And it consults with policymakers and diplomats to raise awareness of the impact quantum computing could have, ensure global participation in governance efforts and make sure the benefits of quantum computing are shared equitably.

The OQI is unique because it is demand-driven and extremely well-connected. Being based in Geneva, Switzerland would also provide a forum where countries with diverse geopolitical positions can exchange constructively. This would ensure that it can deliver concrete solutions co-designed and implemented alongside major intergovernmental organizations, academic experts and leading industry players.

## 3. Who is the OQI for?

The idea of the OQI is to act as a bridge between four key communities – researchers and developers, quantum computing providers, intergovernmental organizations involved in the SDGs, and national policymakers and diplomats. Participation in the OQI network would bring benefits for each of these communities but would also require them to contribute as well. Beyond acting as a forum that can facilitate better relations between these groups, the OQI would also develop an educational toolkit to build awareness of quantum computing and ensure global participation in the initiative.

## 4. What will the OQI's core activities be?

The idea of the OQI is to provide global, inclusive and equitable access to state-of-the-art quantum computing capabilities. This would be achieved by developing partnerships with quantum computing providers who can provide OQI with access to their quantum computers. Educational resources and training courses would be made available to ensure that those without a background in quantum computing can participate and also to boost awareness of how quantum computing can help tackle the SDGs.

The OQI would also articulate use cases to leverage quantum computers in favor of the SDG and would produce toolkits that help researchers and developers work on these SDG-related applications. To accelerate R&D projects, the OQI would help link researchers and developers to industry experts, SDG experts and governments. It would also support researchers and developers in the mobilization of external funding streams.

## 5. What are the benefits of partnering with the OQI?

With the OQI, researchers and developers would gain access to a broad pool of state-of-the-art quantum computing resources that could otherwise be expensive or difficult to access, and quality educational resources to help them put the technology to best use. They would also be connected to a diverse network of experts with a wide range of specialisms and gain access to R&D exchange programs and information sharing on SDG-related use cases.

Quantum computing providers would get the opportunity to showcase their technology and gain visibility with end-users, policymakers and other industry players. The OQI would also give them access to a broad new user base, which is actively working with the OQI to develop new use cases for their technology. Companies would also have a place at the table in a forum that is likely to play a role in developing international best practices and governance standards for quantum computing.

Intergovernmental organizations would get the opportunity to encourage efforts of R&D towards use cases they see as critical to solving the SDGs. Any subsequent innovations can then be applied to their programs to accelerate progress towards meeting those goals. It would also provide these organizations with an opportunity to learn more about cutting-edge quantum technologies and how they are likely to impact their mission going forward.

National policy makers and diplomats would be able to take advantage of training and educational resources to gain insight into the latest developments in quantum computing. The OQI would also act as a global forum to discuss what needs to be done on a multi-lateral level to manage the development of quantum technologies.

## 6. What does the OQI need from partners?

Researchers and developers can contribute to the OQI by helping define SDG-related use cases and develop solutions, as well as educational material to help train others to use quantum computers. They can also help by mentoring other researchers and contributing to reports on the state of quantum computing and future trends.

Quantum computing providers can help primarily by providing access to their quantum computers and assisting with training programs to help researchers learn how to use the computational resources efficiently. They can also help with the development of SDG-related use cases, educational materials and reports.

Intergovernmental organizations can contribute by highlighting the challenges that need to be overcome to solve the SDGs and helping to broker new relationships between quantum experts and researchers and developers who are working on SDG-related challenges.

National policymakers can help by providing opportunities for their population to participate actively in the R&D and implementation activities. It can do so through direct funding for national R&D projects and by working with the OQI to develop best practices and governance standards that ensure an open future for quantum computing. This includes getting a head start on critical issues such as *responsible use of quantum computing*, while the technology is still in the development phase.

## 7. How will the OQI be sustainable?

Provided the feedback of our community and the ensuing formal evaluation of OQI are positive, GESDA will take responsibility for the initial incubation of the OQI to ensure it becomes a sustainable and independent institution. During this phase GESDA will set in place the structure and governance of the OQI; bring together key partners from both science and diplomacy who will be critical to

getting the project off the ground; and secure funding through membership fees, partnership contributions, and donations from sponsors and philanthropists.

### **8. Who will govern the OQI?**

Provided the feedback of our community and the ensuing formal evaluation of OQI are positive, GESDA will work with partners and funders to establish a governance team that ensures the OQI functions according to its core values. The current hypothesis is that the OQI's central authority will be the Management Board, which will be responsible for updating eligibility criteria for the selection of projects and participants, appointing the executives of the OQI, and setting equitable membership fees.

The current model as proposed by the Task Force also includes a Scientific Committee, which would be established to coordinate efforts of R&D activities around SDG-related use cases and ensure best practices for quantum computing R&D are followed. In parallel a Diplomacy Committee, would be responsible for ensuring continuous engagement with the diplomacy community and to help anticipate future needs for multilateral governance and policymaking. A Partners Committee would help coordinate activities being conducted in collaboration with partners and on-board new ones. And a Use cases Committee, would be responsible for the assessment, prioritization and management of SDG use cases.

### **9. When will the OQI be ready to operate?**

Provided the feedback of our community and the ensuing formal evaluation of OQI are positive, the OQI would be incubated by GESDA in 2023 & 2024 and then would start its operations in 2025.