



International Network  
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Science Advice

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# **INGSA-GESDA Simulation Game**

## ***QUANTUM WORLD BUILD***

### ***Governance of Revolutionary Technology***

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## **1. Background and Scene Setting**

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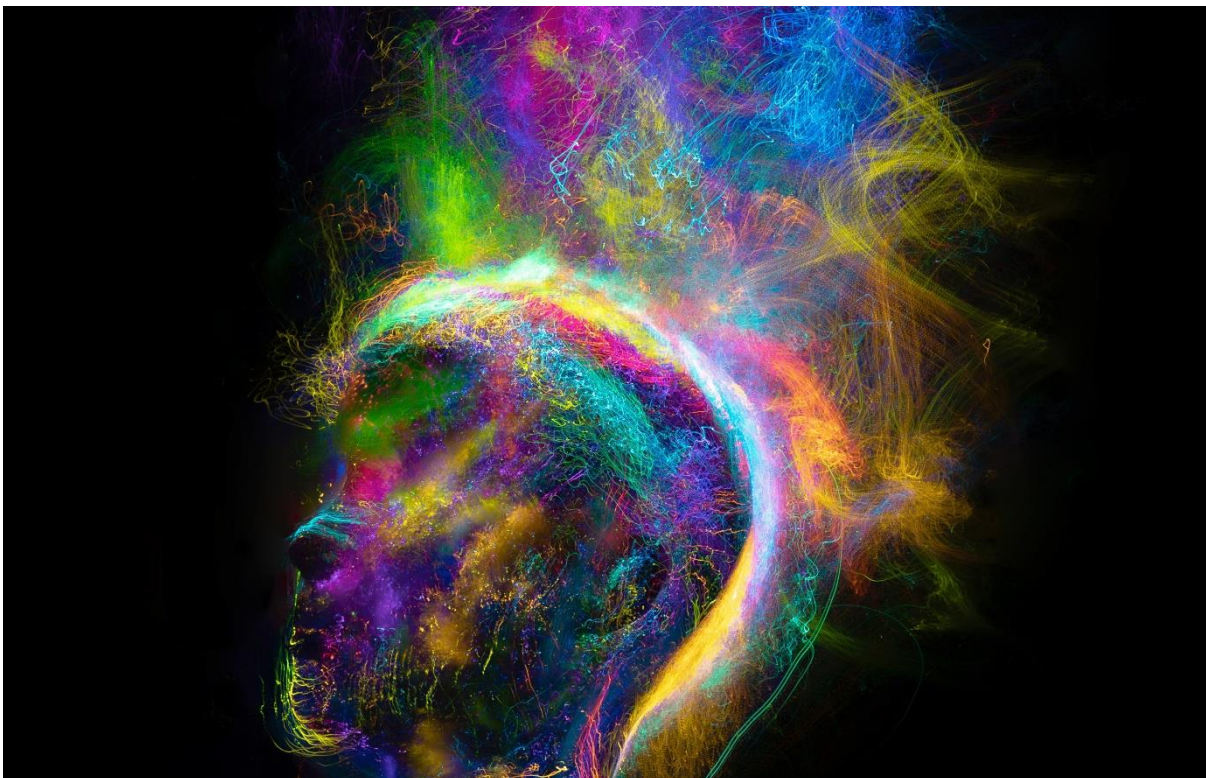
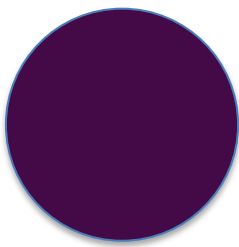
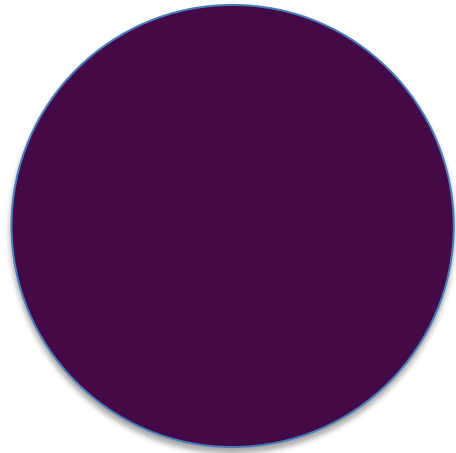


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About the Geneva Science and Diplomacy Anticipator Foundation (GESDA): An independent non-profit foundation under Swiss law and a private-public partnership with the Swiss and Geneva authorities, GESDA was created in 2019 to strengthen the impact and innovation capacity of the international community through science and diplomacy anticipation. For more information, please visit the Foundation's website: [www.gesda.global](http://www.gesda.global)

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# QUANTUM WORLD BUILD

## *Governance of Revolutionary Technology*


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### Aims of the workshop

#### To explore such issues as:

- What decisions on governing principles could different parties make that will direct the use of quantum computing towards more beneficial use cases? We will map the stakeholders, their relative influence and their likely interests at the time, to better understand the possibilities for early intervention that could lead to better outcomes in the future.
- What does it mean to own a technology and its outputs, and are there (or should there be) imperatives to limit or share technologies that could better the world?
- What happens in the absence of technology regulation, and what would ideal regulation look like? How can we regulate before we know what the technology might do?
- What should be done, and by whom, to avoid negative futures and to enable positive futures?
- What is the interplay between national and international systems, and how might solutions be fostered and develop between the two?

#### To provide a stronger appreciation for:

- The potential of quantum computing and its applications
  - The nature of technology development and ownership of intellectual property
  - The power imbalances that can be created by limited ownership of disruptive technologies
  - The implications of scientific developments on geopolitical relationships and vice versa
  - The value of multi-level technology governance
  - The importance of science diplomacy and science communication for trust building
  - The value of anticipating scientific developments
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## 1. Background and Scene Setting

### Setting the Scene

The year is 2032. 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.

An intellectual property crisis is currently unfolding. Researchers at Bria National University (BNU) have used their quantum computer to identify a novel material for efficiently capturing greenhouse gas emissions, which can be produced cheaply and at scale. The material was discovered by simulating the interactions of molecules at scale to test their effects, given theoretically infinite candidate molecules, identifying molecules with high affinity to target molecules like CO<sub>2</sub> and CH<sub>4</sub>, and then arranging them in a lattice to form a greenhouse gas capture material.

As the impacts of climate change are being felt more keenly now than ever before, the BNU research has generated significant interest globally as there is significant potential to use this material to reduce the impact of greenhouse gases in the atmosphere faster than natural capture by oceans and forests. A provisional patent has been filed to protect the commercial opportunities for the material.

The researchers at BNU then decided to commercialise their findings by licensing it to a local company – Medormar Corporation – who promised to implement the novel material for the betterment of society. However, Medormar is charging an extremely high markup on the cost of production, with pricing that is out of reach for many governments and corporations. This has led to calls for other nation states with quantum computing capabilities to replicate the original research and reverse engineer the material. It is argued that if this can be done in jurisdictions where the patent does not apply, then there is no legal recourse for Medormar and the material can be made widely available at low cost for global public benefit.

These arguments, initially made by small NGOs and activists, have gained popularity as the climate crisis worsens. Now the World Meteorological Organisation (WMO) has issued a statement that there is a moral imperative for such carbon-mitigating technology to be shared as a Global Public Good. The WMO Secretary-General has stated: "The door is open; the solutions to our current climate crisis are available. We must act now - collaboratively and cooperatively - for the benefit of all of humanity. If we cannot work together, then we must take the necessary actions to secure humanity's future."

The Minister for Internal Affairs in Lauze, a neighbouring country of Bria that also has strong quantum computing capabilities, has asked the Director of the Patent and Trademarks Office to investigate the potential for a "public benefit" exemption to patent rights. This could pave the way for a patent granted in Lauze to be used by certain types of entities (e.g. charities and NGOs) without requiring a licensing agreement with the patent holder.

The prospective competition that these proposals will likely create has become an issue of great concern for the government of Bria, not only because Medormar – which has benefited from public investment - stood to capture the global market, but also because access to the novel material could be used as leverage by Bria in international trade negotiations.

In response, the Bria government has placed significant export controls on quantum computing-related products and services to limit the opportunity for others to replicate the material. As it happens, Bria is not only a leader in quantum computing, it is also the world's largest producer of helium, which in its liquid form is critical for cooling quantum computing systems. So, by preventing the export of helium, Bria has effectively reduced supply to protect its 'sovereign innovation niche.' This has sent the global price of helium skyrocketing, which in turn has significantly increased the cost of operating a quantum computer.

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QCS, a globally recognised consultancy firm in Bria, had been helping others build quantum computers overseas, but was forced to suspend their work when the Bria Minister for Foreign Affairs and Trade designated quantum computing technology (including related services) as a “restricted good”. This has angered the government of Solte, a small nation who had commissioned QCS to help them build a small quantum computer to support climate change modelling and identify which parts of the country need further investment in infrastructure resilience. In addition, overseas researchers who were part of collaborations with Bria National University now have also been blocked from participating in any research that uses the university’s quantum computing facility.

The consequences of the Bria government’s actions to preserve its economic position are swift. The shortage has led to a global setback in the development and application of quantum computing systems, and with it, major constraints and delays in realising promising technological innovations to fight climate change. The topic has been discussed in multilateral forums like the United Nations, although there has been no consensus reached. Without a swift resolution to the deadlock, uptake of the novel material remains limited, and its impact on climate change is negligible.

**How did we get here, to a (hypothetical) place where the potential of quantum computing has led to a significant power imbalance that works against the public interest?**

**Let’s rewind...**

We go back ten years to 2022, in a world where quantum supremacy<sup>1</sup> has recently been achieved and research-intensive states are investing increasingly in the technology. Recognising the significant need for co-ordination and guidance in the ongoing development of this technology, the World Economic Forum (WEF) has recently released a set of Quantum Computing Governance Principles (attached). The first core value identified is the Common Good: “the transformative capabilities of quantum computing and its applications are harnessed to ensure they will be used to benefit humanity.”

Based on this, the Department of Physics at Bria National University is hosting an International Symposium on Quantum Computing for the Common Good, with a range of academics, industry leaders, NGOs, and policymakers represented. The aim of the symposium is to identify practical changes in policy, regulation, and strategy between the various stakeholders to uphold the use of quantum computing to further the Common Good. While the participants hold a variety of perspectives, the meeting has been convened under a spirit of collaboration to find shared pathways forward. The Head of Department of Physics at BNU hopes that the symposium will foster international co-operation on the development quantum computing technology, and to establish common ground on how to share the benefits globally.

-End Scene-

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<sup>1</sup> Quantum Supremacy is defined as having realised the first quantum computer to solve a computing task that could not be solved by a conventional silicon-based computer in a feasible amount of time.

# Supplementary Information: Country Profiles

### *Bria*

Bria is a large and wealthy nation that is the political and economic leader in its region. It is led by a centre-right government that emphasises economic growth, prosperity, and free-market ideals. The economic prosperity of the last few decades has largely been due to its strong investment in industry innovation, and subsequently using its international influence to protect its technological supremacy. This has made the government popular with citizens, but on occasion has created tension with Bria's neighbours, who tend to see it as unwilling to compromise in diplomatic negotiations and willing to use its economic power to get what it wants.

Bria's early investment in quantum computing has made it a world leader in the field and the Government had announced additional investment of \$500 million into the technology over the next 10 years. There is some tension with neighbouring Solte with a dispute over a relatively small region that has significant hydropower capacity. While this is mostly being handled diplomatically, there have been a few military skirmishes over the last 20 years.

Natural Resources: coal, copper, lead, molybdenum, helium, phosphates, rare earth elements, gold, iron, silver, tungsten, zinc, petroleum, natural gas, timber, arable land

Population: 128,000,000 (census last conducted in 2019) Population Distribution: large urban clusters throughout the country (with over 80% of the population in these cities), particularly on the Western edge of the country bordering Lauze and Solte; mountainous areas in the centre of the country with deserts in the northeast.

Government type: Constitutional federal republic with bicameral legislative branch

### *Lauze*

Lauze is a wealthy, mid-sized country that is known for its high living standards and level of education. The capital of Lauze is the financial powerhouse of the region, but historically the country has invested in its generous public services and less in research and development.

Despite this, Lauze National University has developed the first quantum computer that can claim quantum supremacy. This is thanks to the clever work of their scientists in collaboration with Betude Corp, a start-up founded by quantum computing experts from around the world. Notably, Betude Corp does not include membership of scientists from Bria - while there is no specific exclusion on their joining the group, a general political mistrust seems to be at play here.

Lauze recently elected a centre-left government on a platform of further increasing investment in the country's social services to combat systemic issues like rising house prices, increasing inequality, and armed skirmishes with neighbouring nations. Science and technology investment is unlikely to increase with new government.

Natural Resources: coal, iron ore, natural gas, cobalt, cadmium, ferrosilicon, gallium, manganese, magnesium, aluminum, lead, zinc, rare earth elements, uranium, arable land

Population: 82,000,000 (census last conducted in 2021) Population Distribution: several large cities on the Eastern edge of the country bordering Bria and Solte, one large city on the Western edge bordering Wakke; vast desert areas where significant mining operations are conducted in the South of the country.

Government type: Constitutional monarchy with unicameral legislative branch

## 1. Background and Scene Setting

### Solte

Solte is a small nation with skilled researchers and engineers but not enough scale or funding to compete with Lauze and Bria in the race to develop quantum computing. Instead, Solte works collaboratively with others internationally, with the expectation that these partnerships will enable them to develop a quantum computing facility once the technology is sufficiently advanced.

The centre-right government of Solte has a strong history of political and financial investment into its science diplomacy, relying on science partnerships and sharing agreements to stay technologically relevant. The country also has a long history of social welfare innovation, with the highest tax-free income level in the world and a few trials of Universal Basic Income in particular regions. There is some tension with Bria, with a disputed territory on Solte's north-eastern border, which has significant hydropower capacity. No one has been able to develop or build power plants there due to the dispute, and while it has mostly been handled diplomatically, there have been small military actions in the region over the last 20 years.

Natural Resources: natural gas, iron ore, sand, coal, timber, hydropower, gold, limestone, fish

Population: 6,000,000 (census last conducted in 2018) Population Distribution: one major city in the Northern region, and a series of fishing villages/towns towards the South; vast forests are distributed throughout the country, although a lot of this has been cleared for farming in the past.

Government type: Federal republic with six states/regions represented in a unicameral legislature

### Wakke

Wakke is a small nation without any quantum capability. It is strongly affected by the impacts of global challenges like poverty, pollution, and climate change. The country has an agrarian and manufacturing economy and ultimately ends up being a critical provider of goods to its richer neighbours. It is also considered to be a labour-farm, with considerable migration of workers to countries with stronger economies.

Lauze provides significant amounts of foreign aid to Wakke and has requested that representatives of the country be invited to attend the symposium. However, the government of Wakke is conscious that it needs to set out its own path and doesn't want to be overly dependent on others. To that end, the government has been investing in education to grow its own people, including full scholarships for high-performing students to attend overseas universities as long as they return to Wakke and spend at least ten years contributing to local businesses.

Natural Resources: gold, timber, industrial diamonds, bauxite, rubber, silver, salt, limestone

Population: 32,000,000 (census last conducted in 2018) Population Distribution: the capital city is on the Eastern edge of the country, with a number of satellite cities nearby, with the rest of the population distributed between smaller towns and villages throughout the country; most forests have been cleared for farming and industrial hubs, although there has been a recent revival of tree planting activity in the West.

Government type: Unicameral parliament directly elected in single-seat constituencies

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## 1. Background and Scene Setting

### ABOUT INGSA

*INGSA provides a forum for policy makers, practitioners, academies, and academics to share experience, build capacity and develop theoretical and practical approaches to the use of scientific evidence in informing policy at all levels of government.*

Anyone with an interest in sharing professional experience, building capacity and developing theoretical and practical approaches to government science advice is welcome to join INGSA.

By signing up to the INGSA Network you will receive updates about our news and events and learn of opportunities to get involved in collaborative projects.

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This simulation was developed under the auspices of the Geneva Coalition on Anticipatory Science and Diplomacy, initiated in 2021 by the Geneva Science and Diplomacy Anticipator (GESDA) encompassing 14 Swiss and global institutions to empower the current and next generation of leaders with a multilingual mindset in science and diplomacy.

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