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International Quantum Year, 2025: Opportunities for Science Diplomacy

Anupama Vijayakumar
Consultant, RIS

Quantum science and technology have been increasingly featured in the global policy discourse as a tool to address various societal challenges and achieve sustainable development goals. In this context, governments around the world are looking to craft policy measures intended to leverage the potential of this emerging field to evolve solutions pertaining to health, food security, water and climate resilience. In recent times, quantum tech has further become a central concern for science diplomacy and science and technology cooperation among leading players. The growing global interest in the field has recently culminated in the United Nations Educational Scientific and Cultural Organization (UNESCO) designating 2025 as the International Year of Quantum Science and Technology (IYQ). The IQY was officially inaugurated at an event held at the UNESCO headquarters, Paris during 4-5 February, 2025.

The UN has historically followed a practice of designating weeks, years or decades to create awareness and draw policy attention to certain important topics or events. Such proposals are often put forth by member-states and actualised through resolutions adopted by the UN General Assembly (UNGA). The IYQ was adopted vide UNGA resolution A/RES/78/287 passed on 7 June 2024. The resolution emphasises quantum science and tech as "vital to economic advancement" while recognizing how its potential applications could help address concerns related to food, water and health along with supporting "sustainable cities, communities and communications". It further underlines the need to scale up and mobilise means for boosting innovation in the field, particularly in developing countries. In this regard, it calls for 2025 to be earmarked for three purposes: first, to observe activities intended toward increasing public awareness on the applications of quantum tech. Secondly, to foster international collaboration and scientific cooperation among institutions, researchers and innovators and thirdly to focus on the application of quantum science and technology for sustainable development.

2025 holds particular significance from the point of view of the history of quantum sciences. The year marks the 100th anniversary of German scientist Werner Heisenberg publishing his theory reinterpreting quantum mechanics in the *Umdeutung paper*. The paper published in September 1925 is widely regarded in the scientific community as having reinterpreted the theories of quantum mechanics and is widely regarded as the modern day origin of the field, which studies the nature of matter at microscopic scales. Phenomena that occur from interactions at the microscopic levels can help boost existing technologies. For instance, the application of quantum computing and encryption is ushering in a new revolution in the larger field of information and communication technologies. The superior processing ability of quantum computers has particular significance for the prospects of powering rapid advances in the realm of artificial intelligence (AI). Quantum encryption on the other hand has been noted to render communications hack proof thereby bolstering cybersecurity. Ultra-precise measurements enabled by quantum metrology can further help improve the accuracy of Position, Navigation and Timing systems such as GPS and facilitate the availability of better internet services.

Despite paving the way forward for applications that create both benefits and risks for society, the field of quantum sciences and technology is often perceived as being highly complex. The IYQ herein marks an important step towards building public awareness on the same. It also lays the groundwork for creating a discourse that supports the responsible development and use of quantum applications, while ensuring that the governance mechanisms focus on equitable distribution of benefits. The IYQ also presents opportunities for interdisciplinary research and would help attract investments that would generate economic and social benefits for humanity.

The IYQ lays the groundwork for creating a discourse that supports the responsible development and use of quantum applications, while ensuring that the governance mechanisms focus on equitable distribution of benefits. The IYQ presents major opportunities for science diplomacy.

Through building awareness and simplifying what is perceived as a complex field of science, it offers an opportunity for advocates of science diplomacy to look beyond academia and engage the public as stakeholders. Major entities including industry leaders, universities, and research institutions have already partnered with UNESCO to pursue quantum applications for the benefit of the society. Science diplomacy to further the goals outlined under IYQ can further look to highlight areas including quantum literacy. Harnessing such opportunities for science diplomacy can potentially pave the way forward for ethical development, responsible use and upholding sustainability towards ensuring that quantum applications work to benefit and uplift humanity.

ADVANCES IN S&T

Filipino Researchers Identify Taal Ash as New Radiation Shield

The Problem: Radiation shielding is vital for areas using ionizing radiation to diagnose illnesses, detect structural flaws, or sterilize food. Conventional protective materials like concrete and lead can be expensive, and their production may harm the environment.

Taal Ash: In 2020, Taal Volcano erupted to release ash that blanketed parts of the country. Through comprehensive testing, researchers at Ateneo de Manila University and National University- Mall of Asia Campus revealed a unique application for the large volumes of Taal volcanic ash (TVA) that blanketed parts of the Philippines. The TVA-based geopolymer mortar contains iron-rich minerals that help reduce radiation penetration. High-electron and denser material, such as TVA, has stronger efficiency in blocking hazardous X-rays and gamma rays

Future Prospects: TVA can act as a barrier against ionizing radiation, potentially providing more sustainable shielding in industries and medical facilities. Volcanic ash-based construction materials could offer a lightweight, eco-friendly alternative.

World's 1st hybrid Quantum Supercomputer in Japan

Quantum Centric Supercomputing: IBM defines quantum-centric supercomputing as an approach that combines quantum computing with traditional high-performance computing to create a computing system that will be capable of solving highly complex real-world problems". The hybrid combination has the potential to mitigate errors and control noise, a problem that otherwise affects quantum computers.

Reimei Quantum Supercomputer: Developed at the Riken Institute, Tokyo, the hybrid platform combines the Reimei, a 20-qubit quantum computer with Fugaku, which is the world's sixth fastest supercomputer. Reimei uses "trapped-ion qubits". The technique allows scientists to control the quantum state of ions in an electromagnetic field, which can act as qubits which store information.

Future Prospects: The method employed in Reimei has significant applications for error and noise reduction in qubits. Similar hybrid platforms can effectively serve as "a stopgap until quantum computers grow large and reliable enough".