What is the ‘responsible quantum technologies’ movement? | Explained

A white paper published in June by the University of Oxford cautioned against our inflated expectations of quantum computers

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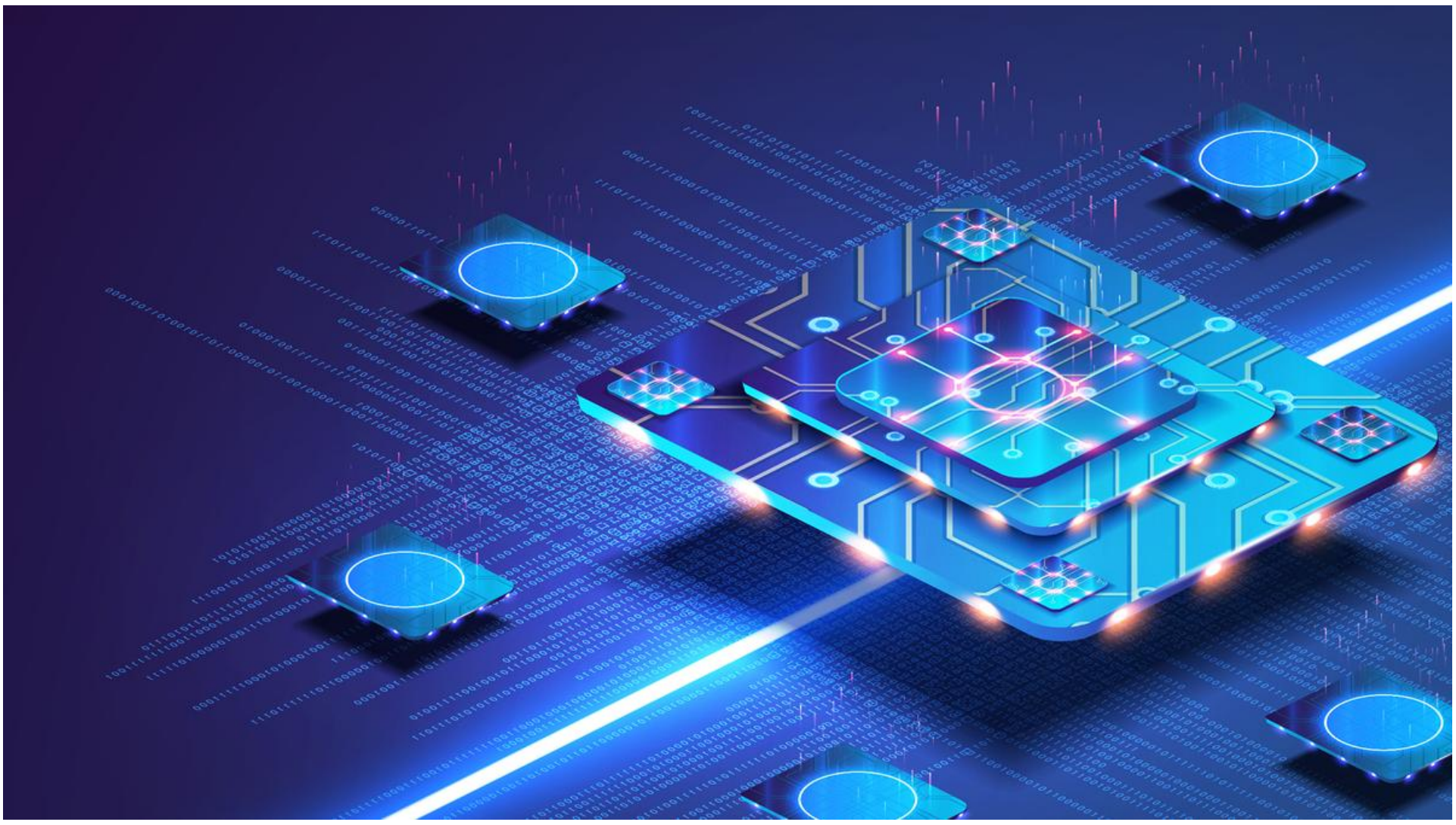

Researchers and some governments have been calling for practising responsible quantum technologies to harness the value of quantum S&T while engendering public trust. Representative illustration. | Photo Credit: Getty Images/iStockphoto

The United Nations recently said 2025 will be observed as the International Year of Quantum Science and Technology (IYQ). There are to be many events focusing on quantum science and technology (S&T), including to create awareness of its concepts and explore its benefits for humankind.

The applications of quantum mechanics constitute an emerging technology yet quantum S&T haven’t captured the public attention the way artificial intelligence (AI) or genome editing have. Nonetheless, quantum S&T applications in three domains — quantum computing, quantum sensors, and quantum communications — are in different stages of development worldwide.

What is responsible quantum S&T?

Quantum S&T are part of the ‘S&T plans’ of many governments and the subject of significant private sector investment. According to an estimate computed by consulting firm McKinsey last year, four sectors — automotives, chemicals, financial services, and life sciences — are expected to gain about $1.3 trillion in value by 2035 thanks to quantum S&T. Among investments by countries, China leads with $10 billion in 2022, followed by the European Union and the U.S. India’s contribution is currently $730 million (Rs 6,100 crore).

The value of quantum S&T is in transforming our abilities to transmit and make use of information across sectors. But they also carry the risk of misuse thanks to the technologies’ potential for dual use, like weakening digital security.

Researchers and some governments have thus been calling for practising responsible quantum technologies to harness the value of quantum S&T while engendering public trust. This is why, for example, the U.K.’s ‘National Quantum Strategy’ states, “We will ensure that regulatory frameworks drive responsible innovation and the delivery of benefits for the UK, as well as protecting and growing the economy and the UK’s quantum capabilities.”

What is quantum governance?

The World Economic Forum (WEF) was one of the first organisations to discuss quantum computing *governance*. Its ‘Quantum Governance’ framework for this is based on the principles of transparency, inclusiveness, accessibility, non-maleficence, equitability, accountability, and the common good. Members of the framework include those from national government agencies, academic institutions, and private sector leaders (including in India).

The WEF’s objective here is to accelerate the development of responsible quantum computing by building trust in the technology during its development to preempt and mitigate potential risks. The framework’s virtue is that it addresses responsible development up front rather than as an afterthought.

IBM, a major global player in quantum computing and a member of WEF’s initiative, has also said that its efforts to develop quantum S&T will focus on making a positive social impact and building a diverse and inclusive quantum community. According to the company, its contracts bar the use of its quantum products in potentially harmful applications and encourage the development of technologies that can protect organisations against the misuse of quantum computers.

Reality isn’t that simple of course. For example, a white paper published in the last week of June by Ernst & Young and the Responsible Technology Institute (RTI) of the University of Oxford cautioned against inflated expectations and overestimating our understanding of ethical issues. In particular, it called out the gaps between countries in terms of quantum S&T capacities and reasoned that lack of access to talent and technologies could widen the gaps further.

From another perspective, a group of academics from the U.S., Canada and Europe recently proposed another framework for responsible quantum technologies. Here, the group has suggested 10 principles to guide the applications of quantum S&T aim together with their RRI values. ‘RRI’ stands for ‘responsible research and information’, a concept and practice endorsed by the European Commission. Many institutions worldwide, including funding agencies, have adopted it; it emphasises ‘anticipation’, ‘reflection’, ‘diversity’, and ‘inclusion’ while foregrounding public engagement and ethical considerations.

What do countries want?

These frameworks and initiatives have emerged largely from among researchers and are united in their focus on and intention to maintain openness. National policies on the other hand have preferred frameworks that confer greater and stronger protections of intellectual property rights vis-à-vis quantum technologies.

For example, the U.S. National Quantum Strategy is clear “the ... government must work to safeguard relevant quantum research and development and intellectual property and to protect relevant enabling technologies and materials. Agencies responsible for either promoting or protecting quantum technologies should understand the security implications.”

Similarly, it may be naïve to expect the private sector — with its large investments and desire for patents and profits — will favour sharing and openness in the name of responsible quantum technologies. There may be exceptional circumstances but they won’t be the norm. This is why the Open Quantum Institute, initiated by the Geneva Science and Diplomacy Anticipator and hosted by CERN, is important: it has private sector support and can work on quantum technologies for all, at least to some extent.

What is the impact of policies?

Unfortunately, there aren’t many case studies yet on the impact of policy frameworks that have embedded responsible innovation in quantum S&T. One published by University of Oxford researchers in 2021 pointed to a need for a more granular understanding of ‘responsibilities’ on the U.K. government’s part.

But for these challenges, the fact remains that researchers, private entities, and governments have expressed interest in deliberating the responsible dimension of quantum S&T development. The pursuit of responsible quantum technologies can’t be dismissed as a gimmick.

This is heartening even if how, or whether, their engagement will translate to more meaningful policies and regulations is still unclear.

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