EAST-WEST CENTER

ASIA PACIFIC BULLETIN

Number 537 | October 28, 2020

EastWestCenter.org/APB

New Delhi's Quest for Quantum Technologies

By Vibhanshu Shekhar

India joined the 'global quantum race' in February 2020 when it launched the National Mission on Quantum Technologies & Application (NM-QTA) and declared that the country would invest $1.2 billion over the next five years in the development of quantum technologies. Though the allocated funding for the initiative is not at par with the depth and scale of investment in quantum technologies by the United States and China, it is more than the budget allocated by many of the advanced economies of Europe and Asia. Some Indian physicists even view the NM-QTA as an initiative that 'promises to catapult India into the midst of the second quantum revolution.'

Vibhanshu Shekhar, Adjunct Professorial Lecturer at American University, explains that: "The three principal areas in which India is likely to concentrate are quantum communications and quantum satellite, quantum computing, and quantum cryptography."

India is a late starter to the quantum race, which it began in earnest in 2018, when the government launched the Quantum Enabled Science and Technology program (QuEST) under the aegis of the Department of Science and Technology (DST). QuEST set an ambitious goal of building quantum computers and communications systems within ten years. However, the main success of the QuEST program came from the conceptualization of the NM-QTA that has become the nodal program on quantum-related research across multiple departments and agencies of the Indian government.

A somewhat specific iteration of the goals of the NM-QTA has come from the DST. The principal aim of the NM-QTA is to give a push to the 'next generation transformative technologies,' such as 'quantum computers and computing, quantum communication, quantum key distribution, encryption, crypt analysis and quantum sensing.' While the goal of the NM-QTA is comprehensive, the three principal areas in which India is likely to concentrate are quantum communications and quantum satellite, quantum computing, and quantum cryptography. While the ISRO (Indian Space Research Organization) is likely to lead the quantum communications and quantum satellite, DRDO (Defense Research and Development Organization) and MEIT (Ministry of Electronics and Information Technology) are probably going to lead quantum computing and quantum cryptography. Viewed in this context, the NM-QTA is a multi-pronged initiative with multiple agencies leading research on different aspects of quantum technologies.

India's Quantum debate builds on three key assumptions. First, quantum technologies are Janus-faced – they have both protective and disruptive capabilities. It is often argued that quantum encryption, at least in theory, cannot be decrypted, and any country or company with adequate quantum computing capability can break the encryptions prevalent in traditional computers. The disruptive nature of quantum computers is likely to pose a significant threat to India's traditional digital platforms. According to the official note of the DST, "It has become imperative both for government and industries to be prepared to develop these emerging and disruptive technologies in order to secure our communications, financial transactions, remain competitive, drive societal progress, generate employment, foster economic growth and to improve the overall quality of life."

The DST statement highlights the second important driver of India's quantum quest – the China-centric security dilemma. As India shuts down its doors to Chinese apps and technologies, one can safely assume that it will be a nightmarish scenario for Indian policymakers if Beijing has already developed a code-breaking quantum capability. Beijing plans to develop quantum computing capability by 2025. After its recent border skirmish with China in the Ladakh region, India has banned nearly 100 Chinese technology apps in two phases. Moreover, India has continued to resist the entry of Huawei's 5G technology and its coupling with the local telecom businesses. In this context, India's quantum initiative is also a catch-up game – reduce the widening gap with China in terms of explorations of quantum technologies.

Another underlying assumption that undergirds India's critical space and technology ambition is its quest for self-reliance and quantum autonomy. The Modi government's two initiatives – "Make in India," and "Atmanirbhar Bharat" (Self-Reliant India) attest to India's continuing focus on self-reliance. The NM-QTA is one of the nine priority programs of the Modi government. The Indian push for quantum autonomy may get more resolute with the sharpening edges in the Sino -U.S. quantum rivalry.

"Another underlying assumption that undergirds India's critical space and technology ambition is its quest for self-reliance and quantum autonomy"

The most important question facing India's quantum quest is - does India have what it takes to crack the puzzle and achieve its goal of building a 50-qubit quantum computer? While India has already taken the initiative and made a significant financial commitment to the quantum program, it faces formidable challenges in two areas – infrastructure and innovation. India's quantum initiative rests on limited infrastructure. One Indian expert remarked that the number of people working on quantum technology might range between 100 and 200 researchers. There are very few institutions in India, such as Raman Research Institute, working on applied aspects of quantum technologies. Similarly, the private sector's participation in quantum technology development is confined to a few companies, such as Q Nu Labs.

A viable solution to domestic limitations can come from potential international collaboration with India's technologically advanced strategic partners, such as France, Israel, Japan, Singapore, South Korea, and the United States. In this context, India-France engagement in the exploration of quantum technologies has gained some momentum since the two countries signed a Roadmap on Cybersecurity and Digital Technology in August 2019. Similarly, the need for India-U.S. collaboration in quantum technologies was underlined in various speeches at the India Ideas Summit 2020, including in the keynote address of Indian Prime Minister Narendra Modi. U.S. Senator Mark Warner suggested that the United States and India collaborate in quantum computing while working toward a bigger international coalition in the technology sector.

India has shown the intent, made the necessary financial commitment, and joined the race for quantum supremacy. However, India's position in the race is likely to depend on its ability to match its intent with infrastructure and innovation using both domestic resources and effective international collaboration.

Vibhanshu Shekhar is an Adjunct Professorial Lecturer at American University. He can be contacted at vibesjnu@gmail.com.

APB Series Founding Editor: Dr. Satu Limaye | APB Series Coordinator: Peter Valente