



India and Advanced Computing Technologies

This editorial is based on ["In an Era of Cyber Wars, India Needs A Fortified Computing Ecosystem"](#) which was published in Hindustan Times on 10/06/2022. It talks about India's initiatives on adoption of advanced technologies like supercomputers and quantum computing and the challenges associated.

For Prelims: National Supercomputing Mission (NSM), Quantum Computing, Information Technology Agreement, PARAM Ganga, PARAM Siddhi-AI, QuEST Programme, National Mission for Quantum Technologies and Applications (NM-QTA), Quantum Key Distribution (QKD) solution.

For Mains: Advanced Computing Technologies - India's Progress and Challenges, National Supercomputing Mission - Success and Challenges, Quantum Computing and India - Applications, Challenges, India's Initiatives.

The 21st century is earmarked as **Information Technology driven** and **India is at the Centre of global attraction** and considered as a **knowledge powerhouse**.

Advanced mechanisms have taken over the field of computing, with governments, along with private companies, embroiled in a high-stakes race to **increase indigenous computing power for economic and strategic purposes**.

With India's data generation at an all time high, there is a **need to improve computational capabilities** by using **advanced computing technologies**.

Advanced Computing Technologies - How much has India Progressed?

- **National Supercomputing Mission:** The [National Supercomputing Mission \(NSM\)](#), 2015, was the first step taken by the Government of India in this regard.
 - It is a jointly funded programme, by the **Department of Science and Technology (DST)** and the **Ministry of Electronics and Information Technology (MeitY)**.
 - The main objectives are to spearhead research in the **development of supercomputers** and build a **national supercomputing grid**.
 - As of May 2022, **India now has 15 supercomputers disclosed to the public**, with combined performance capability of 24 petaflops.
 - The NSM **recently deployed [PARAM Ganga](#)** - a High-Performance Computational (HPC) facility at IIT Roorkee.
 - **PARAM PORUL**, a **state-of-the art Supercomputer** at NIT Tiruchirappalli was also inaugurated under the mission.

- **PARAM Siddhi-AI** is the **fastest supercomputer in India** built under NSM.
- **Quantum Computing:** In 2018, the Department of Science & Technology unveiled a programme called **Quantum-Enabled Science & Technology (QuEST)** and committed to investing Rs. 80 crore over the next three years to **accelerate research**.
 - In the 2020 Budget speech, the Finance Minister of India announced the **National Mission for Quantum Technologies and Applications (NM-QTA)** with a total outlay of ₹8000 crore over five years for **strengthening the quantum industry** in the country.
 - In 2021, the government unveiled the **indigenously developed Quantum Key Distribution (QKD) solution**.
 - The **domestic private sector of India has also been involved** in the development of quantum computing hardware, software, and algorithms.

What are the Challenges Pertaining to Adopting these Technologies in India?

- **Slow Growth Rate:** Although there has been significant progress in the introduction of supercomputers in India, considering the distribution of the world's top 500 most powerful supercomputers, **India accounts for just 0.6% of the total**.
 - There is still a long way to go before India can develop an interconnected grid of supercomputers.
- **Slow Progress in Legislative Procedures:** Although the NM-QTA was announced in the 2020 Budget speech, the **mission has still not received any approval** and **no funds were allocated, disbursed or utilised** under NM-QTA during the FY 2020-21.
- **Limited Private Sector Involvement:** The Union Minister of Science & Technology has also claimed that for the NM-QTA, **no private sector partners had been identified yet** and no one from outside the government had been tapped for consultations for the national mission.
 - The government must recognise the leaps made by these companies.
- **Foreign Dependence:** The ability to build advanced computing facilities rests on raw materials.
 - It would be impossible to indigenously manufacture the whole system from scratch. This is where the **reliance on high-tech imports** kicks in.
 - Moreover, trade barriers — export control mechanisms and import restrictions — can **hamper access to the building blocks** of these systems.

What Areas Need to be Worked Upon?

- **Better Policy Making and Regulations:** The focus should be to develop an **overarching strategy for the next 10-15 years** where it must be **ensured that there is no misallocation of resources** and that the efforts put in are concentrated in key areas that provide both economic and strategic benefits.
 - The primary focus must be on **establishing Centres of Excellence** dedicated to such advanced computing technologies within academic institutions as well as government research institutes.
 - A majority of the Indian **government's outlay has to be pumped into such institutions**. This can pay dividends in two ways:
 - It will help **create crucial intellectual property (IP) infrastructure** that can be used for the country's benefit.
 - The focus on research and academia will also **improve the talent pool** and **strengthen the domestic technology workforce**.
- **Liberalisation in Tech-Trade:** Advanced processors for supercomputers and cryogenic cooling systems for quantum computers are a necessity. But indigenously developing them will take time.
 - **Cutting down on import tariffs**, along with **embracing multilateral trade agreements** such as the **Information Technology Agreement** must be the government's priority.
 - Moving towards a **liberalised technology trade policy** can help the country accelerate its computing programme.
- **Nationwide Computing Grid:** **China's national computing network**, which talks about a **geographical approach to building data centres** and computing clusters across the mainland, **can serve as a blueprint** to scale-up computing infrastructure.

- The concept of "**eastern data and western computing**" in China has been proposed, which involves setting up computing architecture in the less-developed western regions of the country to handle the data stored in centres in the tech-aligned east.
- A computing grid in India can follow a similar pattern; the government, which has so far focused on academic research institutions as hosts for computing systems, must disperse these facilities.
 - **Creating a better network will improve the functioning** of an advanced computing grid and **handle large-scale data processing with ease.**
- **Advancing Computing from Military Lens:** India must focus on its computing strategy, **keeping the national security angle in mind.**
 - It is necessary to **develop India's computing power from a military lens**; it will facilitate the advancement of the military and improve computing technology.
 - In the age of information warfare and cybersecurity threats from across the border, **increased computational capacity is a necessary risk-mitigation tool.**
 - **Advanced computing facilities at strategic environments** such as **naval bases, air command control centres, and border outposts** can help in the faster analysis and real-time data processing that contains critical military intelligence.

Drishti Mains Question

What are the challenges associated with the adoption of advanced technologies (introduction of supercomputers, quantum computing) in India. Discuss the steps that can be taken to speed-up the adoption.