

# SUPERCOMPUTER AND ITS CRITICAL ASSESSMENT FOR INDIA

## PART 1: SUPERCOMPUTER AND REAL-TIME APPLICATIONS

### Introduction

A supercomputer is a type of computer that has the architecture, resources and components to achieve massive computing power. It consists of tens of thousands of processors that are able to perform billions and trillions of calculations or computations per second.

### PART 1(A): SUPERCOMPUTERS HAVE A WIDE VARIETY OF APPLICATIONS

1. Expedite research in Disease outbreak: It can process massive numbers of calculations related to bioinformatics, epidemiology, and molecular modeling, which help to study the structure and origin of the novel coronavirus. Tianhe-1 supercomputer in China has been using Supercomputer to diagnose COVID-19 patients
2. Automobile crash and safety modeling: supercomputer simulations enable deeper analysis of passive safety systems. With simulations, engineers can analyze the vehicle's performance, changing the values of the boundary conditions. In hours they can understand if the changes have produced a different performance or not.
3. Humanitarian assistance to forecast refugee movement: High Power Computing simulation at large scale can accurately predict the massive refugee movement coming from conflict areas of the world. Such simulations has helped to estimate how border closures affected the movement of refugees into neighbouring countries, such as Ethiopia or Uganda
4. Improve Agriculture Income: Performing numerical simulations of plant growth help seed companies achieve superior varieties instead of doing field trials which are more expensive and harmful for the environment. Other uses include: plague control, pesticides design and pesticides effects and the use of climate data to manage water and agricultural resources. Overall, it will double Farmers income.
5. Weather forecasting: supercomputers will enable more accurate warnings of severe weather, while also improving the models that predict the longer-term impact of climate change on the planet.

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6. Financial Market Place Supercomputer plays vital role in the real financial success in the emerging online currency world such as bit coin and stock market
7. Oil and Gas exploration: It helps to detect and accelerate deeper geological insights; also provide the required tools to help midstream pipeline operators to increase operational efficiency and improve cost, which improves predictive maintenance of pumps in the oilfield and in retail gas stations.

### PART 2 : CRITICAL ASSESSMENT FOR SUPERCOMPUTERS USAGE IN INDIA.

Unlike China and United States (Global Computing Power), India is not typically considered to be a pioneer or among the leaders when it comes to adopting newer technologies. From its 2007 number of 13, China has now grown to 220 supercomputers. That has enabled it to envision and enforce an AI-enabled future, whereas India has merely 3 such supercomputers in Top 500 list of Super Computer. According to the top 500 list of supercomputers these are PARAM Siddhi-AI, Pratyush, and Mihir. Only PARAM Siddhi-AI ranks in the top 100 list, and the rest of the two are in the top 200 list.

### PART 2(A): RATIONALE BEHIND LOW PERFORMANCE IN SUPERCOMPUTING IN INDIA:

1. Lack of suitable Policies to attract talented pool all over the world as well as retain the indigenously available talented pool. This outward going Brain drain has impact R&D for many years.
2. Inadequate Funding: Unlike Asian Countries China, Japan, South Korea, Singapore which invest hugely in burgeoning Supercomputer sector, Indian investment and funding capacity in high performance capacity is low due to limited funding opportunity. Economic Survey in 2019 mentioned, only 10% of total budget allocated under National SuperComputing Mission (NSM) is released by 2018.
3. Persistent Import Dependence of Supercomputer component: Although, India made effort in supercomputer assembly line, the components are yet imported from other part of the Country like United States, EU etc. India had already suffered from import ban on supercomputers from US due to arms embargo in late 1980.
4. Mutiprocessing difficulty: The machines in India work on principle of Parallel Processing a type of multiprocessing where the work is not just divided into chunks between different processors, but that parts of the same mathematical problem are solved simultaneously by a number of processors, unlike IBM super computers which uses Sequencing processing. Consequently, market for Parallel processing is small. Demand has been further dampened by United States competitors who have

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reportedly been 'dumping' computers at below-market prices.

5. Lack capacity to solve complex scientific problems which have real-life implications. There has been dismal participation of academic and Industries to encourage new innovations.
6. Huge Demand for Water Coolent: Cooling system within SuperComputers require huge gallons of water per minute that can cause water stress in already water depleted hotspots. This has restricted the expansion of Supertechnology in limited sectors and limited regions of India.

### PART 3: ASSESSMENT OF INDIA'S CURRENT SUPERCOMPUTER MISSION

To address structural challenges in High Performance Supercomputing, India has launched National Supercomputing Mission, in 2015 to enhance the research capacities and capabilities in the country by connecting them to form a Supercomputing grid, with National Knowledge Network as the backbone.

- The Mission is being jointly steered by the Department of Science and Technology (DST) and the Ministry of Electronics and Information Technology (MeitY)
- It is being implemented by the Centre for Development of Advanced Computing (C-DAC), Pune, and the Indian Institute of Science (IISc)

### PART 3 (A) : SIGNIFICANCE OF NATIONAL SUPERCOMPUTING MISSION

1. It will provide significant qualitative and quantitative improvement in R&D and higher education in the disciplines of Science & Technology.
2. The mission envisages manufacturing of supercomputing systems in India contributing to Make in India and generating employment. This will help reduce the import dependence and also contribute to export as well under Assemble in India for the World.
3. The mission will bring India into the select league of advanced countries such as the US, Japan, China and the European Union (EU) which share top supercomputing machines in the world. This will also provide security to our Critical Information Infrastructure(CII).
4. Supercomputing facilities will enable India to build capabilities in areas such as life saving drugs, and Health care. This will radically eliminate dependence of the country upon other Developed country for medical drugs, diagnostic, etc.
5. It will enable more accurate weather forecast as well as real time tracking of natural phenomenon, timely warning of cyclones etc. This will prevent most vulnerable



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hotspot i.e South Asia from Natural Hazards as estimated in recent IPCC 6th Report.

6. It would be an enabler for the Digital India vision of the Government by making available huge data storage space and linking systems together. Under Digital India Mission, it will also improve capacity of Inclusive Governance at grassroots level.

### **PART 3(B) : WAY FORWARD IN SUPERCOMPUTER SECTOR IN INDIA**

A country like India can no longer afford to ignore supercomputers; it needs the capacity to solve complex scientific problems which have real-life implications. It needs its workforce to have the skills to participate and lead in new innovations across various academic and industrial sectors. It needs to fulfil its goal of becoming a trillion-dollar digital economy and among the best places in the world to set up a digital business. To do all of this we need the appropriate infrastructure – digital as well as physical.

### **CONCLUSION: INDIA'S PURSUIT OF EXCELLENCE.**

Without Supercomputers, India risks being surpassed on the global stage by other nations and will consequently miss the huge benefits that come from having this vitally important technology. Simultaneously, the endeavour to build truly 'Made-in-India' supercomputers puts India in the race to expand computing power and solve more complex problems in daily life.