

India's Rising Supercomputing Ecosystem

Mains: *PIB Analysis*

India's **National Supercomputing Mission (NSM)** has expanded the country's High-Performance Computing (HPC) ecosystem. As of September 2026, **40 supercomputers with a combined capacity of 68 PF** have been deployed, with a target of **50 systems exceeding 123 PF**.

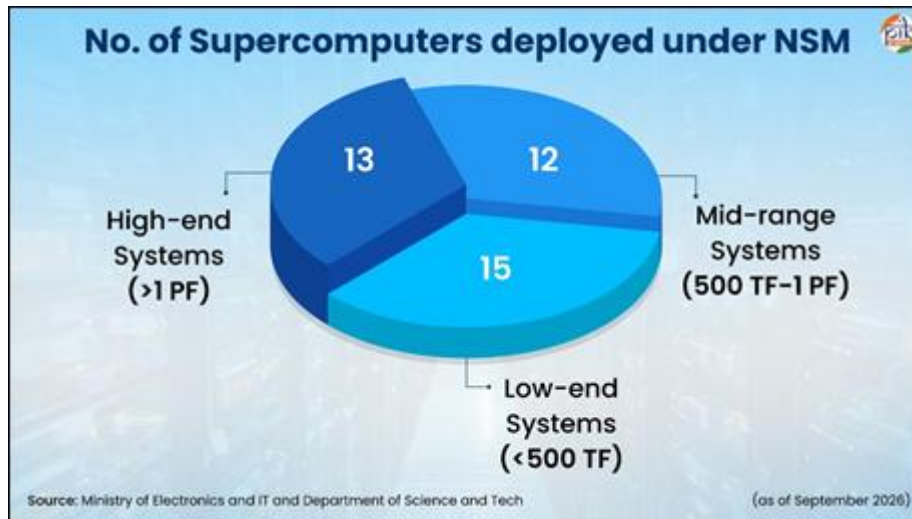
What is Supercomputing?

Supercomputers use **parallel processing**, where multiple processors work simultaneously to perform complex calculations. Their performance is measured in **FLOPS (Floating Point Operations Per Second)**; 1 PF equals one quadrillion operations per second.



Evolution and National Supercomputing Mission

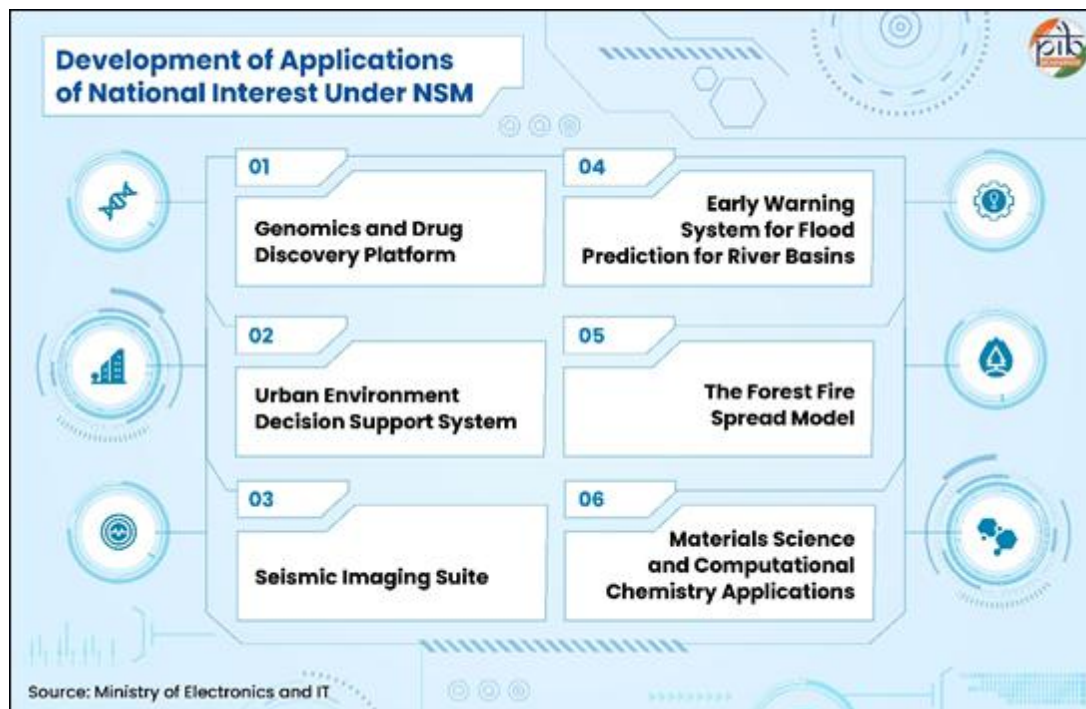
- India's indigenous journey began with **PARAM 8000 in 1991**, developed by C-DAC.
- **NSM was launched in 2015** with an outlay of about **₹4,500 crore**, jointly steered by DST and MeitY.
- C-DAC, Pune and IISc, Bengaluru implement the Mission.
- It follows a **"Build" approach** covering assembly, manufacturing, and design/manufacturing support.
- India has developed indigenous **servers, interconnects, cooling systems and HPC software**, reducing dependence on imported technologies.



Current Status and Indigenous Capabilities

- **40 supercomputers** → **68 PF** capacity as of September 2026.
- **13 high-end systems** have capacity above 1 PF.
- The **PARAM Rudra** series uses indigenously designed Rudra servers and software.
- Around **6,000 Rudra servers** have been deployed, with 1,500 more under manufacturing.
- Indigenous **100/200 Gbps interconnect technology**, cooling systems and **PARAM Shavak** have strengthened the domestic HPC ecosystem.
- The **National Knowledge Network (NKN)** connects supercomputing facilities and facilitates resource sharing and collaboration.

Applications for National Development



Supercomputing supports:

- **Healthcare:** genomics, drug discovery and disease modelling.

- **Agriculture:** crop-yield prediction and data-driven farming.
- **Climate and disasters:** weather forecasting, flood prediction and forest-fire modelling.
- **Environment:** air-pollution modelling and climate simulations.
- **Energy:** seismic imaging for oil and gas exploration.
- **Science:** astrophysics, materials science, computational chemistry and engineering.

For instance, the **Mahanadi flood-warning system** can provide forecasts up to two days in advance.

Significance for India

1. **Scientific advancement:** Accelerates complex simulations and research.
2. **Strategic autonomy:** Builds indigenous hardware and software capabilities.
3. **AI readiness:** Provides the computational foundation for AI and big-data applications.
4. **Disaster resilience:** Improves early-warning and climate modelling.
5. **Human capital:** NSM infrastructure has supported **16,000+ researchers across 400+ institutions**.
6. **Aatmanirbhar Bharat:** Strengthens domestic HPC manufacturing and innovation.

Challenges

- High capital and energy requirements.
- Need for advanced semiconductor and component capabilities.
- Shortage of specialised HPC and AI talent.
- Need for greater industry-academia collaboration and wider accessibility.
- Growing demand for **energy-efficient and sustainable computing**.

Way Forward

India should focus on **exascale computing, energy-efficient systems, indigenous semiconductor capabilities and AI-HPC integration**. Greater participation of startups, industry, academia and research institutions can convert computing capacity into practical solutions.

Conclusion: India's transition from **PARAM 8000 to PARAM Rudra** reflects a shift from acquiring computing power to building a **self-reliant supercomputing ecosystem**, supporting the objectives of **Aatmanirbhar Bharat and Viksit Bharat 2047**.