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**DAILY EDITORIAL
ANALYSIS**

TOPIC

FUTURE OF INDIA'S CHIP INDUSTRY

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Context

- NITI Aayog's Frontier Tech Hub recently released the report titled Future of India's Semiconductor Industry, highlighting both the opportunities and challenges in building a domestic semiconductor ecosystem in India.

Why Semiconductors Matter?

- Semiconductors are the **backbone of modern electronics**. They power smartphones and laptops; electric vehicles and telecom systems; AI infrastructure; defence and aerospace technologies.
- Today, India imports nearly all its semiconductor requirements, making the economy vulnerable to global disruptions.

Current Status of India's Semiconductor Ecosystem

- India currently **does not possess a fully operational semiconductor** fabrication plant. The first fab, expected in **Dholera, Gujarat**, may become operational by 2028.
- At present, around **10 semiconductor projects** are under various stages of development.
 - ◆ India still imports most chips used in domestic electronics manufacturing.
- The geopolitical tensions around Taiwan highlighted the risks associated with concentrated chip production.
- The NITI Aayog report warns that dependence on imported chips for defence systems can create serious national security vulnerabilities.

Major Challenges Before India

- **Long Gestation Period:** Semiconductor fabs are among the most complex industrial facilities in the world.
 - ◆ According to the report, a fab requires **4–5 years** before production begins.
 - ◆ Yield optimisation and reliability testing take additional time.
 - ◆ Thus, commercial viability emerges only after several years.
- **Massive Capital Requirements:** Chip manufacturing requires enormous investment. The report estimates that India may need **\$45–60 billion** in public expenditure over the next decade.
 - ◆ It raises concerns regarding fiscal sustainability; efficient allocation of subsidies; and investor confidence and 'bankability'.
 - ◆ It suggests targeted and commercially viable investments under the upcoming **India Semiconductor Mission (ISM) 2.0**.
- **Technological Dependence:** India lacks advanced lithography technology, high-purity semiconductor materials, and specialised manufacturing equipment.
 - ◆ Most of these technologies are controlled by a few countries and firms globally.
- **Skilled Workforce Gap:** Semiconductor manufacturing requires highly specialised engineers and technicians. Building such human capital involves long training cycles, advanced research institutions, and industry-academia collaboration.
 - ◆ The report stresses the need for sustained investments in R&D and talent development.

India's Semiconductor Mission

- India launched the **India Semiconductor Mission (ISM)** with an outlay of **₹76,000 crore** recognising the strategic importance of semiconductors.

Key Features of ISM

- **Fiscal Support for Fabrication Units:** The government offers up to **50% capital subsidy** for semiconductor fabrication plants (fabs).
 - ◆ Several State governments are also providing incentives such as land, electricity, and infrastructure support.
- **Incentives for Packaging and Testing:** India has promoted semiconductor packaging, assembly, and testing facilities.
 - ◆ These are less capital-intensive than fabrication and can integrate India into global supply chains more quickly.
- **Talent and Design Ecosystem:** The mission supports semiconductor design tools for students and universities; research and innovation in chip design.
 - ◆ It builds upon India's existing strength in semiconductor design services.

Strategic Shift Suggested by the Report

- **Focus on Mature and Strategic Nodes:** Report recommends focusing on mature semiconductor nodes; strategic and defence-oriented chips; and compound semiconductors instead of competing immediately in cutting-edge chips (3–7 nanometre nodes).
 - ◆ This approach is considered more practical and economically viable.
- **Packaging as a Core Strength:** The report identifies semiconductor packaging not as a secondary activity but as a 'core production pillar'.
 - ◆ Advantages for India include lower capital requirement, faster scalability, employment generation, and integration into global supply chains.
 - ◆ It aligns with India's comparative strengths in manufacturing and services.
- **Building Indigenous Research Capacity:** The report emphasises sovereign chip design capabilities, materials science research, and AI-driven semiconductor engineering.
 - ◆ India already has a strong presence in semiconductor design services. The challenge is to move from a 'services-led model' to creating indigenous intellectual property (IP).
- **Geopolitics and Trusted Partnerships:** The semiconductor sector is deeply linked to global geopolitics.
 - ◆ The report identifies the United States, Japan, European Union, and South Korea as trusted strategic partners for technology access, equipment servicing, and supply chain resilience.
 - ◆ It indirectly reflects concerns regarding China's growing influence in semiconductor manufacturing.
 - ◆ For India, semiconductor diplomacy is becoming an important component of strategic and economic policy.

Conclusion & Way Forward

- A successful semiconductor ecosystem can reduce import dependence, enhance national security, boost electronics manufacturing, generate high-skilled employment, and support India's digital economy ambitions.
 - ◆ It complements initiatives such as Make in India, Digital India, Atmanirbhar Bharat, and Production Linked Incentive (PLI) schemes.

- India appears to be adopting a calibrated approach focused on selective strengths such as packaging, mature nodes, and chip design rather than attempting to replicate the entire global semiconductor value chain overnight.

Source: TH

Daily Mains Practice Question

[Q] India's semiconductor ambitions are driven as much by strategic necessity as by economic aspirations. Comment.

