



Time: 10 min

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Chip off the blocks: On semiconductor fabrication in India

Syllabus: GS3/ Indian Economy & Related Issues, Growth & Development

In Context

- The Union government must be clearer on what it aims to achieve by continuing to spend crores of rupees on bringing more semiconductor fabrication capabilities to India.

About Semiconductors:

- **What are Semiconductors?**
 - Semiconductors are the thumbnail-sized building blocks of almost every modern electronic device from smartphones to connected devices in the Internet of Things (IoT).
 - They help give computational power to devices.
- **Components:**
 - The basic component of a semiconductor chip is a sliver of silicon, which is etched with billions of microscopic transistors and projected to specific minerals and gases, forming patterns to control the flow of current while following different computational instructions.
- **Semiconductor nodes and uses:**
 - The **most-advanced** semiconductor technology nodes available today are the **3 nanometre (nm) and the 5nm** ones.
 - Semiconductors having **higher nanometre value** are applied in **automobiles, consumer electronics** and so on.
 - Those with **lower values** are used in devices such as **smartphones and laptops**.
- **Semiconductor fabs:**
 - Semiconductor fabrication plant is a factory for semiconductor device fabrication.

Challenges

- **Underutilised funds:**

- Funds for production-linked incentives (PLI) for manufacturing semiconductors lie under-utilised by upwards of 80%.
- The government is still continuing to spend crores of rupees on bringing more semiconductor fabrication capabilities to India.
- **Unclear objectives:**
 - Experts are pointing out that the Union government must be far clearer on what it has achieved. The government must also be sure on what it aims to accomplish.
- **Reliance on imports:**
 - Some efforts here, such as the design-linked incentive scheme, show promise. But the bulk of the capital remains focused on the assembly and subsidising of large manufacturing plants, with much of the raw and even intermediate material still being imported.
- **Hesitation of private players:**
 - With the limited scope of what the PLI funds are incentivising, multinational chipmakers are staying away from making substantive commitments, despite incentives.
 - Private capital is also in a state of flux, with advancements in chips and emerging technologies such as artificial intelligence leaving policymakers guessing on how best to allocate resources to boost their technological position for the coming decade.
- **Challenges of chip manufacturing:**
 - Developing an ecosystem for chip manufacturing in a greenfield location is a major challenge.
 - Hundreds of chemicals and gases are required for chip fabrication, people need to be trained, and abundant clean water be made available. But above all is the art of chip-making.
 - Despite the best of equipment, poor quality and low yields can make fabs fail.
- **Need for an advanced technology:**
 - There are other issues, such as whether to set up a logic/processor, memory or analog fab.
 - Electronic equipment and its functionalities are characterised by their logic chips, which are therefore strategically important and generate the highest profit.
 - The most advanced set of technologies is needed to manufacture them.
- **China's monopoly in the sector:**
 - Elaborating on the opportunities for India currently, he said electronics and semiconductor products today was a \$1.5 trillion industry with China solely accounting for almost 75% of it and having enjoyed a monopoly in the sector for over two decades now.

Lessons India can learn from China

- India's strategy has been to set up a new logic fab. China, which acquired loss-making fabs and then set up its own logic fab, provides lesson.
- **Acquiring existing fabs has many advantages:** They are reasonably priced, have stabilised technology, a supply chain ecosystem, an established product line, and market.
 - They will enable India to build the fab ecosystem and train human resources.
 - Much lower subsidies would be required, and the funds saved could be used for advanced R&D in fab technologies which will help build state-of-the-art fab in next few years.
- **Another strategy could be setting up ATMPs:** Tessolve, now acquired by Tatas, had set up an ATMP in 2013-14. This ATMP is successfully packaging chips upto 7 nm feature size. China has over 100 ATMPs.
 - China started on the fab journey about 20 years ago. As the Chinese saying goes, the best time to plant a tree was 20 years ago, but the second best time is now.

Government Initiatives for Semiconductor ecosystem

- **Semicon India programme:**
 - It provides \$10 bn fiscal support and other non-fiscal measures
 - The Semicon India Program aims to provide attractive incentive support to companies/consortia that are engaged in Silicon Semiconductor Fabs, Display Fabs, Compound Semiconductors / Silicon Photonics / Sensors (including MEMS) Fabs, Semiconductor Packaging (ATMP / OSAT) and Semiconductor Design.
- **India Semiconductor Mission:**
 - It has been set up as an Independent Business Division within Digital India Corporation having administrative and financial autonomy to formulate and drive India's long-term strategies for developing semiconductors and display manufacturing facilities and semiconductor design ecosystem.
- **Production Linked Incentive scheme:**
 - The government also recently announced the PLI and DLI schemes as major steps towards building a semiconductor ecosystem in the country.
- **The Cabinet approval:**
 - The recent Cabinet approval with an outlay of 76,000 crore spread over a period of six years for the development of semiconductors and display manufacturing ecosystem is expected to be a shot in the arm.
 - This move claims to attract 1.7 lakh crore private investment in India.

Way ahead

- **Clarity on desired outcomes** would make failures easier to spot.
 - It would also make it possible to course correct before massive PLI spending has already taken place with little to show for the outflow.
- India must seize the opportunity and become an attractive **alternative destination for semiconductor manufacturing**.
 - Attracting global players to set up here would be beneficial as they come with their **customer base**.
- Government policies should also focus on assuring and securing access to foreign technology suppliers through **trade and foreign policy** to ensure a **global level of collaboration**.

Daily Mains Question

[Q] What is the potential of India's semiconductor industry? What are the challenges in developing semiconductor fabrication capabilities in India?

