



# Perspective: Semiconductor Industry & India

## Why in News?

India is aiming to become the **global hub for semiconductor design**, manufacturing and technology development. However, the shortage of semiconductor chips has **exposed vulnerabilities in the [semiconductor supply chain](#)** and highlighted the need for increasing domestic manufacturing capacity.

## What are Semiconductor Chips?

- **About:** Semiconductors are materials which have a **conductivity between conductors and insulators**. They can be pure elements, silicon or germanium or compounds; gallium, arsenide or cadmium selenide.
- **Significance of Semiconductor Chips:** They are the basic building blocks that serve as the heart and brain of all modern electronics and information and communications technology products.
  - These chips are now an **integral part of contemporary automobiles**, household gadgets and essential medical devices such as ECG machines.
- **Recent Increase in Demand:** The **Covid-19 pandemic**-driven push to take sizable parts of daily economic and essential activity online, or at least digitally enable them, has highlighted the centrality of the chip-powered computers and smartphones in people's lives.
  - Its shortage causes cascading effects, given that the first one creates pent-up demand that **becomes the cause for the follow-up famine**.

## What is the Significance of Semiconductors?

- **Semiconductors** are **essential to almost all sectors of the economy** including aerospace, automobiles, communications, clean energy, information technology and medical devices etc.
  - Demand for these critical components has outstripped supply, **creating a global chip shortage** and resulting in lost growth and jobs in the economy.
- In December 2021, the centre govt sanctioned ₹76,000 crore under the **Production-Linked Incentive (PLI)** scheme to encourage the manufacturing of various semiconductor goods within India.
- Semiconductors and displays are the foundation of modern electronics driving the next phase of digital transformation under **Industry 4.0**.

## Why is there a Need for Promoting the Semiconductor Industry?

- Semiconductor chips are the **lifeblood of the modern information age**. They enable electronic products to compute and control actions that simplify our lives.
- These semiconductor chips are the drivers for **ICT (Information and Communication Technologies)** development and **one of the key reasons for the current flattening of the world**.

- They are used in **critical infrastructures** such as **communication, power transmission**, etc., that have implications for national security.
- **Development of the semiconductor** and display ecosystem will have a multiplier effect across different sectors of the economy with deeper integration to the global value chain.
- There are not many countries in the world that manufacture these chips.
  - The **industry is dominated by the** United States of America, Taiwan, South Korea, Japan, and the Netherlands.
  - Germany is also an **emerging producer of ICTs**.

## Where does India Stand in the Semiconductor Market?

- India currently imports all chips and the market is estimated to touch \$100 billion by 2025 from \$24 billion now. However, for the domestic manufacturing of semiconductor chips, **India has recently launched several initiatives**:
  - The Union Cabinet has allocated an amount of ₹76,000 crore for supporting the development of a **'semiconductors and display manufacturing ecosystem'**.
    - Consequently, a significant amount of incentives would be provided to design companies to design chips.
  - India has also launched the **Scheme for Promotion of Manufacturing of Electronic Components and Semiconductors (SPECES)** for manufacturing of electronics components and semiconductors.
  - In 2021, the MeitY also launched the **Design Linked Incentive (DLI) Scheme** to nurture at least 20 domestic companies involved in semiconductor design and facilitate them to achieve a turnover of more than Rs.1500 Crore in the next 5 years.
- India's own consumption of semiconductors is **expected to cross USD 80 billion by 2026 and to USD 110 billion by 2030**.

## What are the Challenges?

- **High Investments Required:** Semiconductors and display manufacturing is a very complex and technology-intensive sector involving huge capital investments, high risk, long gestation and payback periods, and rapid changes in technology, which require significant and sustained investments.
- **Minimal Fiscal Support from Government:** The level of fiscal support currently envisioned is minuscule when one considers the scale of investments typically required to set up manufacturing capacities in the various sub-sectors of the semiconductor industry.
- **Lack of Fabrication Capacities:** India has a decent chip design talent but it never built up chip fab capacity. The **ISRO** and the **DRDO** have their respective fab foundries but they are primarily for their own requirements and are also not as sophisticated as the latest in the world.
  - India has **only one old fab** which is located in Mohali, Punjab.
- **Extremely Expensive Fab Setup:** A semiconductor fabrication facility (or fab) can cost multiples of a billion dollars to set up even on a relatively small scale and lagging by a generation or two behind the latest in technology.
- **Resource Inefficient Sector:** Chip fabs are also very thirsty units requiring millions of litres of clean water, an extremely stable power supply, a lot of land and a highly skilled workforce.

## What can be the Way Forward?

- **Need to Become a Key Player:** India should aim to become a key player in a trusted, plurilateral semiconductor ecosystem that keeps key adversaries out.
  - Favourable trade policies are critical for building a plurilateral semiconductor ecosystem.
- **Sufficient Fiscal Support for All the Elements:** Considering India's considerable talent and experience, it may be best if the new mission focuses fiscal support, at least for now, on other

parts of the chip-making chain including design centres, testing facilities, packaging, etc.

- **Maximising Self-Reliance:** Future chip production shouldn't be a one-trick pony and must develop an ecosystem from design to fabrication, to packing and testing.
  - India must also improvise research and development in this sector where it is currently lacking.
- **Connectivity and Capability Related Measures:** Many factors need to come together for India to make a mark in the niche chip-making and designing industry.
  - The immediate need for the Indian government is to connect related industries in India to create the chip manufacturing ecosystem. National capability needs to be enhanced.
- **High Investments Required:** Semiconductors and display manufacturing is a very complex and technology-intensive sector involving huge capital investments, high risk, long gestation and payback periods, and rapid changes in technology, which require significant and sustained investments.
- **Enhancing the Important Component:** There are three components of the chip:
  - Hardware (raw materials)
  - Design
  - Fabrication
  - The **design itself is the component that creates the value** and if India is able to harness this capability the no one in the world can beat the country

## Conclusion

As there is a need of Semiconductors as well as a global demand also to which India can cater to but that would require building upon the existing capabilities, putting robust policy mechanisms and ecosystems in place. It is also required for the industry and the government to work together.

All these advantages have been there for a long time and it's now necessary to connect with them.

### Previous Year's Questions (PYQs)

**Q. Which one of the following laser types is used in a laser printer? (2008)**

- (a) Dye laser
- (b) Gas laser
- (c) Semiconductor laser
- (d) Excimer laser

**Ans: (c)**