

AIR Spotlight - Semiconductor Industry in India

AIR Spotlight is an insightful program featured daily on the All India Radio Newsonair. In this program, many eminent panellists discuss issues of importance which can be quite helpful in [IAS exam](#) preparation. In this article, the progress of the semiconductor industry in India is discussed.

Participants:

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Context: To give a boost to the semiconductor sector, India recently hosted the **Semicon India Conference**. At the conference, the Prime Minister of India highlighted India's ambition in becoming the global electronics and semiconductor design and manufacturing hub.

What is a Semiconductor?

- Semiconductors are the materials which have a conductivity between conductors (generally metals) and non-conductors or insulators (such as ceramics).
- Semiconductors can conduct electricity under preferable conditions or circumstances. This unique property makes it an excellent material to conduct electricity in a controlled manner as required.
- Unlike conductors, the charge carriers in semiconductors arise only because of external energy (thermal agitation).
- Semiconductors can be modified by doping to make semiconductor devices suitable for energy conversion, switches, and amplifiers.

Know more about [Semiconductor Industry & India](#).

Importance of Semiconductors:

- Semiconductor chips are essential for making life easier, stimulating digital disruption, and propelling the economy forward.
- Companies across the semiconductor value chain use a variety of processes and technologies to achieve economic efficiency.
- Most companies have not been able to achieve complete autonomy in having an end-to-end set up in the same geography, which has resulted in shortage concerns during the recent pandemic lockdowns. Know more about [Semiconductor Shortage](#).
- Chip scarcity can affect production in almost any industry, emphasising the importance of diversifying chip supply.

- Semiconductor manufacturers have decided to expand their production facilities as chip demand grows.
- Furthermore, governments all over the world have been developing strategies to improve domestic chip manufacturing capability.

Semiconductor Industry in India:

- Taiwan, Singapore, Hong Kong, Thailand, and Vietnam, like other countries around the world, import 100% of their chips.
- By 2026, India's semiconductor consumption is expected to reach a worth of \$80 billion, and \$110 billion by 2030.
- India has a strong semiconductor design talent pool, accounting for up to 20% of all semiconductor design engineers worldwide.
- Almost every one of the top 25 semiconductor design firms has a design or R&D centre in the United States.
- Five global Semicon majors have submitted investment proposals to set up a semiconductor and display fab in India.

Government Initiatives:

- **FDI:** The Government of India has allowed 100 percent Foreign Direct Investment (FDI) under the automatic route in the Electronics Systems Design & Manufacturing sector.
- **PLI Scheme for Semiconductors:** The Centre has launched the [production-linked incentive \(PLI\) scheme](#) to encourage the manufacturing of various semiconductor goods within India. The scheme is being implemented in response to a global shortage of semiconductor chips. The scheme will provide financial assistance to companies that want to manufacture a variety of semiconductor products in India.
- **India Semiconductor Mission:** The [India Semiconductor Mission \(ISM\)](#) has been established 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.
- **Design Linked Incentive (DLI) Scheme:** The [DLI scheme](#) aims to provide financial and infrastructural support to companies setting up fabs or semiconductor making plants in India.

Why is India's focus on semiconductor manufacturing strategically important?

- Increased semiconductor production in India could help the country establish itself as a global hub for electronic goods, as well as create jobs and attract investment from leading companies around the world.
- The scheme to boost semiconductor production will bring in massive investments and create a large number of jobs, which will help the country reduce its reliance on imports.

- Given factors such as low labour costs and large production capacity, boosting domestic semiconductor manufacturing has significant strategic benefits.
- It would not only help domestic companies reduce their reliance on semiconductor imports, but it would also generate revenue from other countries' exports.
- It will prevent a sudden shortage of chips from causing massive price increases in various segments of electronics, automobiles, and high-tech goods.

Know more about the Significance of [Semiconductors for Industry 4.0](#).

Challenges for the Semiconductor sector in India:

- **Geopolitical Significance:** Semiconductor manufacturing is a complex, intertwined global ecosystem, making the supply chain vulnerable to macroeconomics, geopolitics, and natural disasters. Semiconductor companies operate in a variety of countries and jurisdictions, and they are highly reliant on one another.
- **International Laws and Environment Regulations:** Semiconductor companies must comply with both national and international laws governing health and environmental regulations. This expedites the companies' efficient operations.
- **Impact on Environment:** Chip production is an energy and water-intensive process that generates hazardous waste. Toxic gases and chemicals are also released during the manufacturing process, which contribute to [greenhouse gas](#) emissions. India should consider the environmental impact as it develops its semiconductor ecosystem.
- **Peculiarity of the supply chain:** The semiconductor manufacturing ecosystem is constrained, with only a few countries capable of designing or manufacturing them globally. Any material supply chain disruption, such as that caused by the Ukraine crisis, will have a significant impact on the semiconductor industry.
- **Lack of Expertise:** The manufacturing process of semiconductors is so complex, and the ecosystem of players is so diverse, that a slew of business models have emerged, with companies aiming for scale through market leadership or level of expertise.
- **Availability of Raw Materials:** The semiconductor manufacturing process necessitates very specific raw materials and chemical substances, which are sometimes scarce. These are not widely available due to their unique and specialised nature, and can sometimes only be mined in conflict zones. Any disruption in these materials' supply has an immediate impact on production.

Lessons that India could learn from other countries

- **China:** China dominates the global market for outsourced semiconductor assembly and test (OSAT) and is now branching out into integrated circuit (IC) design. Semiconductor devices with longer investment periods and more time and money spent on R&D and design have a smaller market share in China, and India could learn from this blunder in the future to become an R&D-driven technology leader.

- **Taiwan:** With effective policies such as subsidies, tax breaks, and public infrastructure such as the creation of major research and industrial parks, Taiwan has created an environment in which the semiconductor industry can thrive and earn an international reputation. India can suffocate Taiwan by putting in place a similar cluster of favourable policies, subsidies, and infrastructure for the semiconductor industry's growth in a small geographic area.
- **South Korea:** South Korea has overtaken the United States as the world's second-largest semiconductor manufacturer. India, like South Korea, can build a massive industrial chain, with each semiconductor factory surrounded by a variety of supporting businesses that include layers of outsourcing and subcontracting.
- **Japan:** Raw materials with high purity requirements, equipment, and small active-passive components have always been Japan's strengths in semiconductors. India, too, has similar favourable raw material conditions, and the semiconductor industry in India can reach similar heights with the recent government push.

Conclusion:

Developing domestic semiconductor manufacturing capabilities will have a multiplier effect across the economy, helping to achieve a USD 1 trillion digital economy and USD 5 trillion GDP by 2025. Not only will the initiative boost semiconductor production, but it will also assist India in achieving self-sufficiency, improving data security, and gaining digital independence.

India has demonstrated its ability to design and manufacture its own semiconductors while also establishing a complete supply chain within the country. India already has the right environment, which, when combined with strategic resource deployment and government support, could be a game-changer for the country.
