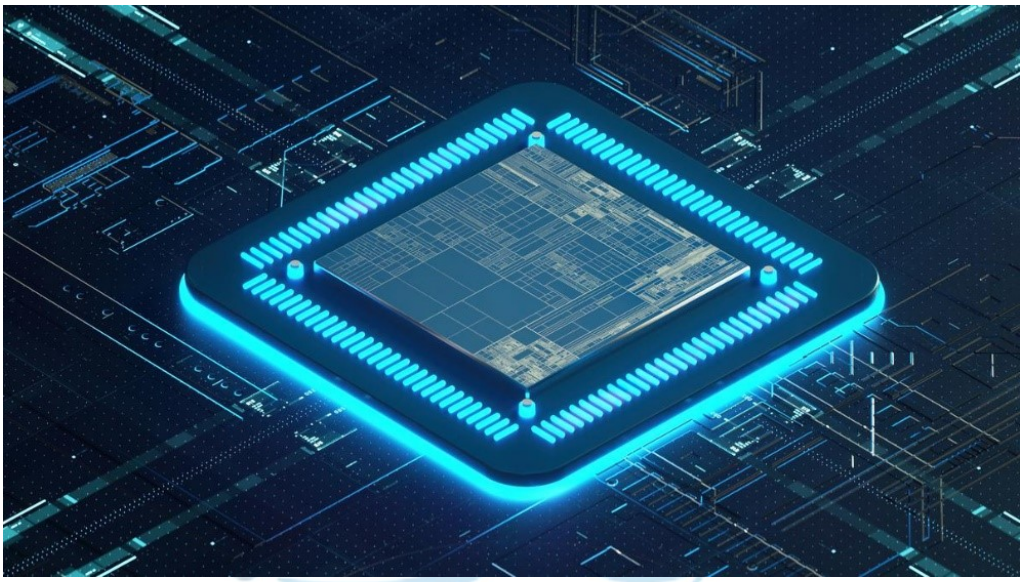
4. India's Semiconductor Dreams: A Strategic Shift in Focus and Incentives

Prelims Syllabus: Science and Technology

Mains Syllabus: GS-III Science and Technology - Awareness in the fields of it, Space, Computers, Robotics, Nano-Technology, Bio-Technology, Pharma Sector & Health Science



Why in News?

- India's semiconductor policy should shift focus from attracting global giants like Intel to leveraging existing facilities and developing domestic solutions for electronics markets.
- The US Department of Commerce and India's Ministry of Commerce and Industry recently signed a memorandum of understanding to ensure subsidies do not hinder India's semiconductor ambitions.
- However, the likelihood of Intel investing in a greenfield 300mm wafer fabrication plant in India remains low due to its focus on fabs in the US.

Semiconductors:

- Semiconductors are materials that have properties that are in between those of conductors (such as copper) and insulators (such as rubber).
- They have the ability to conduct electricity under certain conditions, but not under others.
- The conductivity of semiconductors can be manipulated through the introduction of impurities or doping with other materials.
- This process alters the electronic properties of the material and creates regions of excess or deficit of electrons, called p-type and n-type regions respectively.

- The interface between these regions is known as a p-n junction, which is a fundamental building block of many semiconductor devices.

Applications:

- Semiconductors are a fundamental component of modern technology and have significant importance in many areas of our daily lives.
- **Electronics industry:** Semiconductors are a crucial component in the electronics industry, which is one of the fastest-growing industries in the world. Semiconductors are used in a wide range of electronic devices, from smartphones and computers to medical equipment and home appliances.
- **Miniaturization:** The ability to miniaturize electronic components using semiconductors has led to the development of smaller, more powerful, and more energy-efficient devices. This has enabled the development of portable devices, such as smartphones and laptops, which have become an essential part of our daily lives.
- **Energy efficiency:** Semiconductors have enabled the development of energy-efficient devices, which are crucial in the context of climate change and global warming. Energy-efficient lighting, for example, uses semiconductor materials such as LEDs, which consume far less energy than traditional incandescent bulbs.
- **Renewable energy:** Semiconductors are also essential in the development of renewable energy technologies such as solar cells and wind turbines. Solar cells, for example, use semiconductor materials to convert sunlight into electrical energy.
- **Medical applications:** Semiconductors are also used in a wide range of medical applications, from imaging devices to implantable medical devices. In particular, semiconductor-based biosensors are becoming increasingly important for disease diagnosis and monitoring.

India's semiconductor policy:

- India has launched a new semiconductor policy called the National Policy on Electronics (NPE) in 2019, with the aim of creating a globally competitive electronics manufacturing industry in the country.
- The policy aims to attract investment in semiconductor fabrication units, also known as fabs, and encourage the development of a domestic ecosystem for semiconductor design and manufacturing.

The key objectives of the policy:

- **Attracting investment:** The policy aims to attract global semiconductor companies to set up manufacturing units in India by providing them with incentives such as financial support, tax incentives, and land at subsidized rates.
- **Promoting domestic manufacturing:** The policy aims to promote domestic manufacturing of semiconductor components by providing incentives such as production-linked incentives, subsidies, and preferential market access to products made in India.
- **Developing human resources:** The policy aims to develop a skilled workforce in the semiconductor sector by providing training and education programs in collaboration with leading academic institutions.
- **Encouraging research and development:** The policy aims to encourage research and development in the semiconductor sector by providing financial support to research institutions and startups.

India's semiconductor policy: What it needs?

- The Semi-Conductor Laboratory (SCL) was established in Mohali in 1983 to create an electronics ecosystem.
- Market liberalization in 1991 and a fire in 1989 derailed these plans, but the facility still has the potential to support India's semiconductor ecosystem.

Shifting Focus:

- The Ministry of Electronics and Information Technology (MeITy) has been trying to attract Intel to India, but their efforts may not be fruitful.
- A better approach would be to leverage SCL's existing assets and focus on the More than Moore segment of semiconductors (>180 nm node) for automotive electronics, PV-Inverters, 5G infrastructure, and railway electronics.

Incentives and Subsidies:

- Subsidies should target fabless design houses with proven designs willing to fabricate at the SCL in the 180nm+ node.
- Incentives should also be provided to global design companies with products aimed at India-specific markets.
- The existing DLI/PLI schemes do not provide such incentives, and a course correction is needed.

Leveraging Existing Infrastructure:

- Efforts to open up subsidies to global small and medium-sized enterprises in the upstream supply chain are welcome.
- However, coupling these efforts with the defined incentives and targeted upgrades is essential for success.
- **Leadership and Execution:** To achieve this vision in the next five years, the SCL needs a full-time director with prior "More than Moore" foundry experience, as opposed to a career scientist from the Department of Space.

Conclusion:

- India's semiconductor policy should shift focus from attracting global giants like Intel to leveraging existing facilities and developing domestic solutions for electronics markets. This will require a strategic shift in focus, targeted incentives, and strong leadership. Failure to act may result in India missing out on the semiconductor fabrication bus once again.