India’s Semiconductor Mission

This editorial is based on **“When the chips are down: On India’s Semiconductor Mission”** which was published in The Hindu on 18/12/2021. It talks about the need for creating a semiconductor manufacturing ecosystem within India and the various challenges associated with it.

For Prelims: Semiconductors, India’s Semiconductor Mission, Scheme for Promotion of Manufacturing of Electronic Components and Semiconductors (SPECS), Major Manufacturers of Semiconductor-chips, India’s initiatives for semiconductor manufacturing.

For Mains: India’s Semiconductor Mission, Significance of Semiconductor-Chips, Challenges Faced by India in establishing a chip-manufacturing ecosystem, How India can become self-reliant in chip-manufacturing, Leveraging multilateral groupings to become a semiconductor-manufacturing hub.

Electronic parts and components today account for 40% of the cost of a new internal combustion engine car, up from less than 20% two decades ago. **Semiconductor Chips account for a bulk of this increase.**

With the bulk of semiconductor manufacturing and supply capability concentrated in a handful of countries including **Taiwan, South Korea, U.S., Japan and, more recently, China,** governments worldwide have realised that it is in the national interest to treat chip manufacturing as a strategic imperative.

India being one of the countries to recently give recognition to semiconductor chip manufacturing, has **initiated a semiconductor mission to power the development of the chip and display industry.**

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.
    - The pandemic and the subsequent **lockdowns** across the world also **forced shut crucial chip-making facilities** in countries including Japan, South Korea, China and the US.
        - Its shortage causes **cascading effects**, given that the first one creates pent-up

demand that becomes the cause for the follow-up famine.

- **India's Semiconductor Demand and Related Initiatives:** India **currently imports all chips** and the market is estimated to touch $100 billion by 2025 from $24 billion now.
    - The Union Cabinet has recently **allocated an amount of ₹76,000 crore** for supporting the development of a **'semiconductors and display manufacturing ecosystem'.**
        - It is a **belated but welcome acknowledgment** of the strategic significance of integrated circuits, or chips, to a modern economy.
    - India has also launched the **Scheme for Promotion of Manufacturing of Electronic Components and Semiconductors (SPECS)** under which a budget outlay of Rs 3,285 crore is spread over a period of eight years for manufacturing of electronics components and semiconductors.

Challenges Associated

- **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 Fab 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 also not as sophisticated as the latest in the world.
- **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.
- **Insufficient Grants under PLI Scheme:** Even though **India's Production Linked Incentive (PLI) scheme** intends to give only 50% of the cost of setting up at least two greenfield semiconductor fabs by way of fiscal support, **not much of the current scheme outlay (approximately $10 billion) is likely to be left to support other elements** including display fabs, packaging and testing facilities and chip design centres.
- **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.**

Way Forward

- **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.
- **Out-strategising Designs and Functionalities:** Given the long gestation periods and rapid technology changes, India must out-strategise on design and functionality as the end product will be out only after three-four years from the moment work begins, by which point the prevailing chip shortage would have been resolved, while technology would have advanced further.
- **Role of Public Sector Enterprises (PSEs):** India's PSEs such as **Bharat Electronics Ltd** or **Hindustan Aeronautics Ltd** can be used to **set up a semiconductor fab foundry with the help of a global major.**
    - Allowing management a free hand in a joint venture where the global major has brought in **technical expertise**, and **providing them long-term policy stability** along with **proper incentives** could well lead to success.
- **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.**

    - Also, **upcoming firms should be able to sustain themselves** in the market when subsidies from the government are withdrawn.
- **Leveraging Groupings such as Quad:** For developing such critical and emerging technologies, **multilateral cooperation is a necessity for India, not a choice.** The **Quad Semiconductor Supply Chain Initiative** is a good starting point.
    - India needs to push for a Quad Supply Chain Resilience Fund to **immunise the supply chain from geopolitical and geographic risks**

Conclusion

India has realised that being entirely dependent on global supply chains for something as critical as semiconductor chips is not a wise policy. The Cabinet's decision to simultaneously establish an India Semiconductor Mission helmed by 'global industry experts' to drive long-term strategies for the sustainable development of the chip and display industry is **a step in the right direction.**

Drishti Mains Question

"Being entirely dependent on global supply chains for something as critical as semiconductor chips, which is the heart and brain of all modern electronics, is not a wise policy. India needs to become self-reliant in this sector". Analyse.
