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SEMICONDUCTOR INDUSTRY OF INDIA

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Introduction to India’s semiconductor industry

India’s semiconductor sector is now viewed as critical to its economy and digital infrastructure.Securing a domestic chip industry is seen as key to technology sovereignty under the Atmanirbhar Bharat program and national security.Chips power everything from smartphones and 5G networks to data centers, artificial intelligence and the Internet of Things. In 2024–25 India’s digital economy – underpinned by this hardware – contributes well over 12% of GDP.

India’s semiconductor mission

Objectives

Establish Semiconductor & Display Fabs – enabling large-scale chip and panel production domestically.

Develop the Entire Value Chain – from design to fabrication, packaging, testing, and research.

Promote R&D and Innovation – in areas such as silicon photonics, compound semiconductors (GaN, SiC), and advanced packaging.

Create High-Skilled Employment – in fabrication, process engineering, and semiconductor design.

Enable Self-Reliance in Strategic Sectors – such as space, defence, and critical infrastructure electronics.

Four Major Schemes under ISM

1.Scheme for Semiconductor Fabs

Incentive: Up to 50% of project cost.

Focus on setting up large-scale wafer fabrication units.

Example: Tata Electronics–Powerchip fab at Dholera, Gujarat (?91,000 crore).

2.Scheme for Display Fabs

Incentive: Up to 50% of project cost.

Target: LCD, AMOLED production units.

3.Scheme for Compound Semiconductors, Silicon Photonics, Sensors Fabs & ATMP/OSAT

Incentive: Up to 50% of capex for compound semiconductor manufacturing and chip packaging/testing units.

Example: Micron’s ATMP facility in Sanand (?22,516 crore).

4.Design-Linked Incentive (DLI) Scheme

Support: Reimbursement of R&D, prototyping, and design tool expenses.

Impact: 22 Indian startups supported with ?234 crore as of 2024.

Importance of semiconductor units for India

1.Strategic Technology Sovereignty : Domestic fabs reduce dependence on imports (India currently imports ~90–95% of chips).

Example: Tata–Powerchip fab in Gujarat aims to produce 50,000 wafers/month, lessening reliance on Taiwan/South Korea.

2. Boost to Digital Economy & Electronics Manufacturing : Chips are core to mobiles, laptops, 5G gear, EVs, AI servers—key to India's $300+ B electronics market target by 2026.

Example: Micron's ATMP plant in Gujarat to supply memory chips for domestic electronics assembly.

3. Job Creation & Skill Development : Fab and packaging plants generate thousands of high-skill and support jobs.

Example: India Semiconductor Mission's "Chips to Startup" program targets training 85,000 engineers in VLSI/fab tech.

4. National Security & Defence Applications : Indigenous chips for radar, satellites, secure communications strengthen strategic autonomy.

Example: Indian-designed chips used in Chandrayaan-3's navigation system.

5. Supply Chain Resilience & Geopolitical Leverage : Local manufacturing hedges against global disruptions (e.g., Taiwan Strait tensions)**.**

Example: CG Power–Renesas fab to supply automotive and industrial chips domestically.

6. Attracting Foreign Direct Investment (FDI) : Global firms set up facilities, bringing capital, tech, and partnerships.

Example: Intel–Lockheed Martin ?1,943 cr 3D-packaging unit in Odisha.

Challenges regarding its development :

High Capital Intensity

Setting up a semiconductor fab involves massive fixed capital expenditure—an advanced-node fab can cost.

Example: Tata–Powerchip's fab at Dholera, Gujarat, is budgeted at ?91,000 crore (~US$10.9 B) despite operating only at 28nm–65nm nodes.

Water and Power Requirements

Fabs need continuous utility supply: 10–20 million liters/day of ultra-pure water, and high-quality electricity with <1% voltage fluctuation.Interruptions can scrap batches of wafers worth millions.

Long Gestation Period

From land acquisition to production, a fab takes 3–5 years to become operational, delaying ROI and exposing investors to technology obsolescence risk.

Talent & Skill Gaps

India has a large chip design talent pool but limited fab process engineers, equipment maintenance experts, and contamination control specialists.

Example: “Chips to Startup” program targets training 85,000 engineers in VLSI design and fabrication, but fabs like CG Power–Renesas will still require foreign experts in the initial years.

Global Market Competition

Taiwan, South Korea, USA, Japan, and China have decades-old ecosystems, strong supplier networks, and proven scale economies.Competing requires price competitiveness, consistent quality, and guaranteed large orders.

Lack of Upstream Supply Chain

India currently lacks domestic production of silicon wafers, photoresists, high-purity gases, and specialty chemicals.This forces dependence on imports from Taiwan, Japan, South Korea, and Germany, which adds to cost and vulnerability to supply disruptions.

Way forward

l**Fast-Track Project Clearances :** Establish a single-window clearance for semiconductor projects to avoid delays in land, environmental, and utility approvals.

l**Skill Development at Scale :** Expand “Chips to Startup (C2S)” and partner with global universities for fab process engineering training.

l**Public–Private Partnerships for R&D :** Establish national-level Semiconductor Research Centres co-funded by government and industry for lithography, packaging, and AI chip design.

l**Infrastructure Reliability :** Create dedicated water recycling plants and captive power stations for fab clusters to ensure uninterrupted operations.

l**Continuous Policy Support :** Maintain stable incentives for at least 10 years to give investors confidence, avoiding mid-course policy rollbacks.