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Q16

India aims to become a semiconductor manufacturing hub. What are the challenges faced by the semiconductor industry in India? Mention the salient features of the India Semiconductor Mission.

UPSC Civil Services Mains 2025 · GS III · 15 marks · Indian Economy

Indian Economy and issues relating to planning, mobilization of resources, growth, development and employment.

Core demand of the question

- **Challenges:** capital, water, chemicals, talent, geopolitics, power, ecosystem
- **ISM features:** ₹76,000 crore, fabs, packaging, compound semis, design-linked incentive

Revision summary

India designs many chips but still makes few, because fabs need capital, ultra-pure water, chemicals and restricted tools.

Geopolitics and long project time add risk.

The India Semiconductor Mission (2021) has about ₹76,000 crore for fabs, display, compound semiconductors and packaging.

A design-linked incentive targets the talent India already has.

Mature nodes and ATMP are the realistic near path; leading-edge logic will follow slowly if at all.

Introduction

A **semiconductor** is the brain of every phone, car and missile. The world that makes them is a **handful of geographies**: Taiwan, Korea, the United States, Japan, China. India wants a **hub**, not only a market. The **India Semiconductor Mission** is the cheque and the rulebook. The challenges are why the cheque had to be large.

Body

Challenges

A leading-edge **fab** costs **tens of billions of dollars** and drinks **ultra-pure water and reliable power**. India has **talent in design** (a large share of global chip designers are Indian-trained) and a **thin fab history**. **Chemical and gas** supply chains, **speciality equipment** (ASML-type tools are political objects), and **patient capital** are scarce. **Geopolitics**: export controls after the US-China chip war can deny tools even to friends if rules shift. **Land and time**: a fab is a decade, not a budget year. **Packaging and testing** (ATMP) is the realistic first mountain; logic at 3 nanometres is not India's 2026 job. **China+1** helps, but Vietnam and Malaysia already sit on packaging. **Water stress** in Gujarat or Karnataka is not a footnote for a wet fab.

India Semiconductor Mission

Launched in **2021** with about **₹76,000 crore**, ISM offers **fiscal support for fabs, display fabs, compound semiconductors, and ATMP/OSAT**. A **design-linked incentive** pays chip-design firms. A **compound semiconductor** window (SiC, GaN) fits EVs and 5G. **India Semiconductor Mission** also funds **workforce** and tries to cluster (Dholera and other announced sites have moved in steps with **Micron** packaging as a flagship private bet, and other fab MoUs that have **slipped and returned** - the answer should not freeze a 2024 headline as eternal fact).

- **Salient features: capex support as a share of project cost, technology-agnostic** windows for mature nodes that still matter for autos, **design** as well as silicon, and a **trust** structure under MeitY.
- **A hub is an ecosystem:** tool vendors, chemicals, designers, and a State that does not change the deal every election. ISM is necessary. It is not yet Taiwan.

Flow diagram

Challenges: capital water tools geopolitics -> HUB
 ISM 76000 crore 76000 crore -> Fab ATMP compound
 ISM 76000 crore -> Design linked incentive
 Fab ATMP compound -> HUB
 Design linked incentive -> HUB

Conclusion

Chip making needs huge capital, water, tools and geopolitics that India does not yet own. The India Semiconductor Mission, with about ₹76,000 crore, subsidises fabs, packaging, compound chips and design. That is the right start; a hub will take a decade of ecosystem, not a ribbon.

Facts & figures

ISM outlay

About ₹76,000 crore committed under the India Semiconductor Mission for manufacturing and design support.

ATMP / OSAT

Assembly, testing, marking and packaging - the step after a wafer, and India's most plausible near-term foothold.

Micron-type packaging

A large announced OSAT investment in India, often cited as the first big private packaging bet under the new policy.