India

Not Rated

Technology - Others

Semiconductors deep dive: India & the world

- Global semicon revenue to soar to US$700bn in FY25F; TSMC commanding 90% of adv. chip output & India FY24 electronics exports at 6.3% of total trade.
- India semiconductor mission with Rs7,60,000m outlay led to Rs1.56tr investments, cutting the US$60bn electronics import gap via new fabs & ATMP.
- India's first Tata-PSMC fab in Dholera costing Rs915bn will produce 50,000 wafers monthly by FY26F alongside four ATMP projects approved across India.

From electronics assembly to climbing the semicon value chain

India is undergoing a structural shift in its digital and industrial base, led by policies like the **India Semiconductor Mission (ISM)** and **IndiaAI Mission**. The government's initial thrust came through various schemes under the **National Policy on Electronics (NPE) 2019**, which positioned India as a major hub for **electronics assembly** — particularly in smartphones and consumer devices. While local **value addition in electronics manufacturing currently stands at 15–20%**, the target is to raise this to **35% or more** in the coming years. Building on this momentum, the focus is now shifting towards **higher value-adding segments** in the semiconductor chain which include **ATMP**, **wafer fabrication**, and **chip design**. With electronics imports rising (10.8% to 13.9% of total imports between FY22–FY24), achieving end-to-end capability is now central to India's push for technology sovereignty.

Building from the ground up

India's **early gains lie in ATMP and mature-node fabs** — a pragmatic entry point. But **semiconductors are a highly cyclical, capital and R&D-heavy sector**. Countries like Taiwan and South Korea succeeded because of **sustained and evolving government support**, not one-time interventions. India has shown **flexibility by updating schemes** based on feedback — but staying globally competitive in the face of US and China-scale subsidies will demand continued reinvention and deep and continuous execution support.

Winning with design and AI, losing on value

Design contributes nearly 50% value addition to the entire semiconductor value chain, and India holds **19% of the global design talent**. Yet, most of the value accrues to foreign companies that retain intellectual property or IP ownership, limiting domestic value capture. A similar gap exists in AI — India hosts about **16% of the global AI talent pool** but lacks core AI infrastructure and proprietary models. To address this, the **Design-Linked Incentive (DLI) Scheme** and the **IndiaAI Mission** aim to promote indigenous IP, domestic startups, and stronger integration between chip design and AI innovation. With rising demand for AI chips, particularly in edge and accelerator segments, capturing more of this value is key to positioning India as a global technology leader — not just a talent provider.

Gaps in execution persist

While India aims to build a full-stack semiconductor ecosystem, **execution has been uneven across certain high-impact segments**. Although the government has shown strong intent to catalyze the entire value chain, it has **struggled to attract viable investment under its flagship Display Fab Scheme** as well as the **Compound Semiconductor and ATMP Scheme**, both part of the India Semiconductor Mission. This reflects the need for **further policy refinement, improved risk-sharing mechanisms**, and **greater alignment with private sector expectations** to convert strategic intent into operational momentum.

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The heart of modern tech – Understanding semiconductors and their evolution

What are semiconductors? ➤

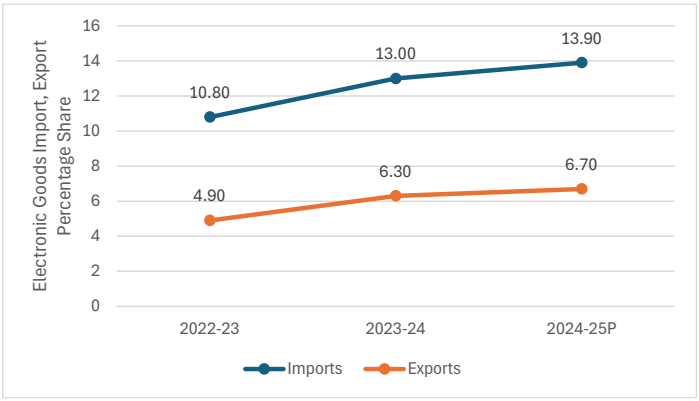
Semiconductors are materials whose electrical conductivity lies between that of conductors and insulators. **Their unique properties enable control over electrical signals, making them the foundation of modern electronics.** Semiconductors are used to build components like transistors, diodes and integrated circuits (ICs) which power everything from smartphones and laptops to satellites and missiles and AI accelerators.

The strategic importance of semiconductors ➤

Semiconductors are the "brains" behind virtually every modern machine. As countries across the world digitize and militarize simultaneously, chips have evolved from simple computing enablers to strategic geopolitical assets. This transformation is underscored by a few key dynamics:

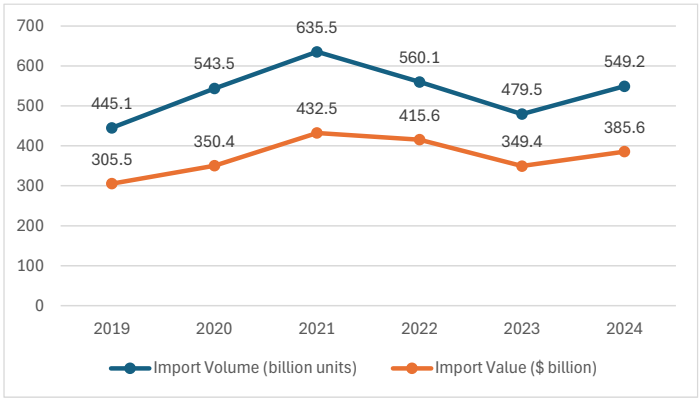
- Tech sovereignty: With growing reliance on imported chips, nations now view semiconductor independence as central to long-term economic and defence resilience. Semiconductor fabrication is especially concentrated in East Asia, with Taiwan and Korea (TSMC and Samsung, respectively) alone contributing to more than 70% of total foundry revenue worldwide.
- Export controls: In response to geopolitical tensions, the US has expanded its use of the Entity List to block high-end chip exports to China – elevating chips to the level of strategic assets like nuclear technology.
- Economic dependency: In 2023, **China imported US$385bn in semiconductors, making chips its largest import category**. In India, net electronics imports touched US$60bn in FY24, and this widening trade gap was driven by growing dependence on imported chips.
- Supply chain fragility: The chip shortage during 2020-22 exposed how concentrated and fragile the global semiconductor value chain is. Disruptions in East Asia led to multi-quarter delays in electronics and automobile manufacturing worldwide. The incident became a wake-up call for governments to pursue reshoring, friend-shoring, and supply chain resilience.

Figure 1: % Share of electronic goods in India's trade



SOURCE: ECONOMIC SURVEY, INCRED RESEARCH:

Figure 2: China's semiconductor imports



SOURCE: CHINA CUSTOMS, INCRED RESEARCH:

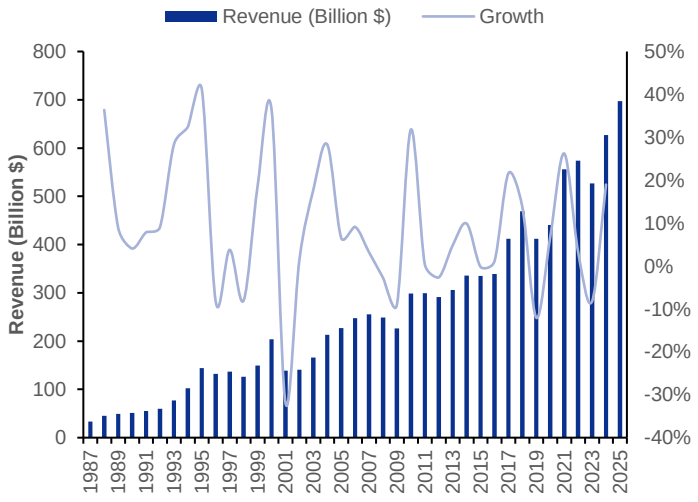
Demand drivers ➤

The global semiconductor industry has been highly cyclical due to a variety of factors like high sensitivity to economics cycles, long lead times in supply expansion (building a new fab can take years) and technology transitions. But for the future, the global semiconductor industry continues to experience strong momentum with revenue projected to top US$700 bn by 2025F. Demand is being propelled by structural tailwinds including digital transformation, growing AI adoption, and increasing localization of supply chains.

India, meanwhile, is seeing rapid growth in semiconductor-linked sectors such as consumer electronics and electric vehicles.

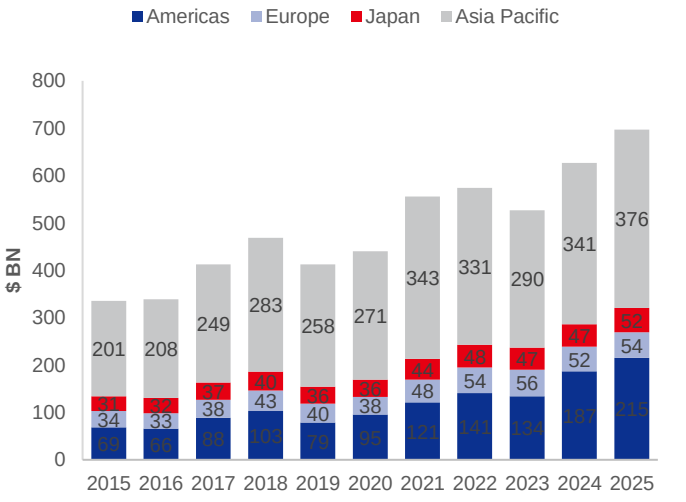
Segment-wise, consumer electronics remains the dominant demand contributor worldwide, but it is expected to grow at a CAGR of 3.5% over the next five years as compared to 18.3% growth for servers, data centres and storage segment and a 8.5% growth rate in the automotive industry.

Figure 3: Semiconductor market revenue worldwide



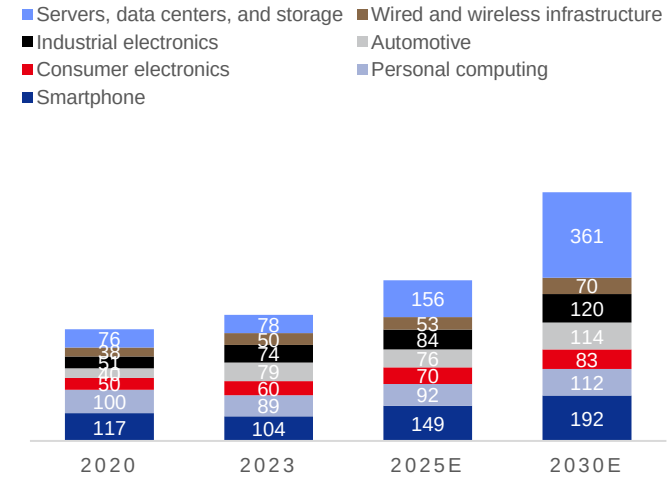
SOURCE: WSTS, INCRED RESEARCH

Figure 4: Semiconductor market sales by region



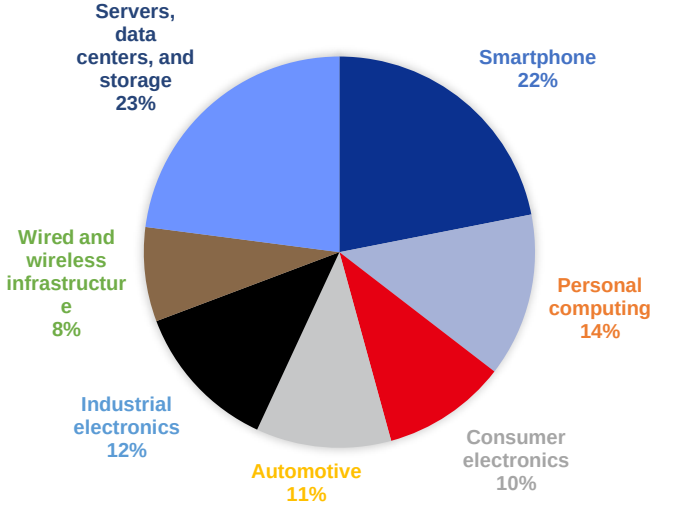
SOURCE: WSTS, INCRED RESEARCH

Figure 5: Semiconductor market revenue by end-market



SOURCE: STATISTA MARKET INSIGHTS, INCRED CRESEARCH

Figure 6: Semiconductor market share by end-market (2025)



SOURCE: WSTS, INCRED RESEEARCH

Classification of semiconductors by device type

Semiconductors can be broadly classified into four functional categories:

Figure 7: Semiconductor classification by device type

Category	Description	Key Applications	Global Share (2025F)
Integrated Circuits (ICs)	Logic, Memory, Analog, and MCU	Computing, Phones, Automotives, Data Centres	85%
Optoelectronics	Image Sensors, LEDs, Display Drivers, Photonics	Displays, Cameras, Lidar, Optical Fibre	7%
Discrete Semiconductors	Single-function Transistors/Diodes	Power Management, Inverters, EVs	5%
Sensors & Actuators	MEMS, Temperature, Pressure, Gyro	IoT, Robotics, Smart Health, Automotive	3%

SOURCE: INCRED RESEARCH

Classification by node size ➤

Originally, the node size used to describe the physical length of the transistor gate or the half-pitch of certain features (like metal interconnectors). However**, in modern usage, node size has become more of a marketing term rather than a precise physical measurement, with the actual features varying across different foundries and generations**. Chipmakers use it to signal performance and energy efficiency improvements – in line with Moore's Law. Although actual physical scaling has slowed, node labels remain critical to the branding of new chip generations and to benchmark technological advancements.

Figure 8: Semiconductor classification by feature size

Node Size	Year Introduced	Technology Example	Use-Case Examples
90nm	2003	Intel Pentium D, TI OMAP	Entry smartphones, feature phones
65nm	2005	AMD Athlon 64, TI DSP	Set-top boxes, mid-tier electronics
45nm	2007	Intel Core 2, Atom	Laptops, routers
32nm	2010	Intel Core i3/i5/i7 (1st Gen)	Desktop processors
28nm	2011	Qualcomm Snapdragon S4	Smartphones, tablets
14nm	2014	Intel Broadwell, Apple A8	Mobile SoCs, laptops
7nm	2018	Apple A12 Bionic, AMD Zen 2	High-end phones, AI, gaming GPUs
5nm	2020	Apple A14 Bionic, M1	Flagship smartphones, ML accelerators
3nm	2023	Apple A17 Pro, TSMC N3	LLM chips, servers

SOURCE: INCRED RESEARCH

Functional classification ➤

As semiconductor design has involved, so have the specialized architectures built atop them. While all modern chips are based on transistors, their architecture and function determine how they interact with software, perform computation, and optimize for power, speed or pace.

Figure 9: Semiconductor classification by function

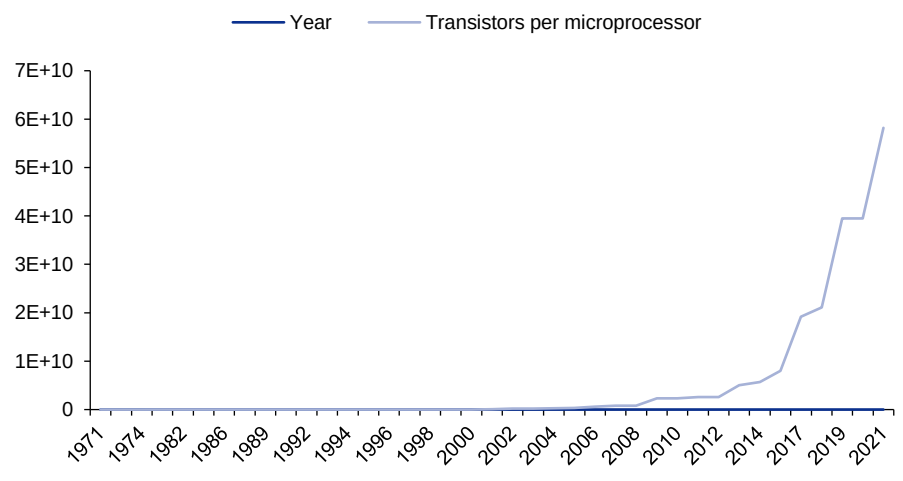
Chip Type	Description	Example Use Cases	Examples
CPU	General purpose compute	PCs, phone, servers	Intel Core, AMD Ryzen
GPU	Parallel processing for large data blocks	Gaming, AI/ML, rendering	NVIDIA RTX, AMD Radeon
NPU	Optimised for AI inference	Smartphone, edge AI	Apple Neural Engine, Google Edge TPU
ASIC	Custom logic for one function	Bitcoin mining, 5G modems	Bitmain
FPGA	Reprogrammable logic	prototyping, telecom	Intel Stratix

SOURCE: INCRED RESEARCH

Moore's Law and technology evolution

Formulated by Intel's co-founder Fordon Moore in 1985, it stated that the number of transistors on a chip would double every 18-24 months, improving performance and reducing costs. This held true for decades, propelling the digital revolution.

Figure 10: Number of transistors per microprocessor over time



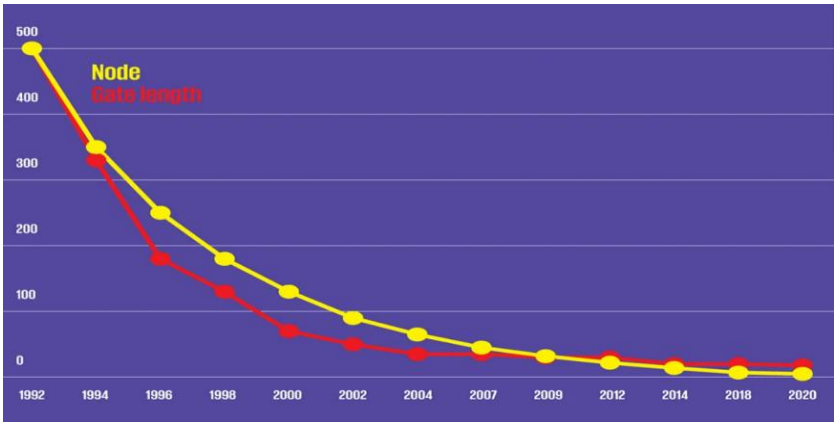
SOURCE: OURWORLDINDATA, INCRED RESEARCH

This progress was initially measured by using the feature size of the chip, primarily the metal half-pitch and the gate length. For the planar 2-D architecture of the chips used earlier, doubling of number of chips in a unit area meant reducing the

size of these two features by 30% in each successive generation. This classification worked well because the gate length and metal half pitch were roughly equivalent.

Seeking to continue historic gains in speed and device efficiency, chipmakers shrank the gate length more aggressively than other features of the device. For example, transistors made using the so-called 130-nm node actually had 70-nm gates. The result was the continuation of the Moore's Law density-doubling pathway, but with a disproportionately shrinking gate length. This divergence widened with the advent of non-planar (3D) architecture like the FinFET where transistor density is no longer strictly a function of 2D area.

Figure 11: Divergence in gate length and feature size over time



SOURCE: STANFORD NANOELECTORNICS LAB, WIKICHIP, IEEE INTERNATIONAL ROADMAP FOR DEVICES AND SYSTEMS 2020, INCRED RESEARCH

As a result of these advancements, **modern "node names" such as 7nm, 5nm or 2nm no longer correspond to any actual physical dimension on the chip**. Instead, they serve as marketing labels, loosely representing generational improvements in performance, power efficiency and density.

To address the limitations of traditional node naming, the industry has explored alternative metrics like GMT metric which quantifies the process improvement based on three factors – Gate Pitch, Metal Pitch and Number of Tiers. For example, the IRDS road map shows that the 5-nm chips have a contacted gate pitch of 48 nm, a metal pitch of 36nm, and a single tier—making the metric G48M36T1.

Figure 12: Feature size vs node size

Process	Gate pitch	Metal pitch	Year
7 nm	60 nm	40 nm	2018
5 nm	51 nm	30 nm	2020
3 nm	48 nm	24 nm	2022
2 nm	45 nm	20 nm	2025
1 nm	42 nm	16 nm	2027

SOURCE: INTERNATIONAL ROADMAP FOR DEVICES AND SYSTEMS (IEEE), INCRED RESEARCH

Looking ahead: The future of semiconductor scaling - As the industry approaches the physical limits of traditional CMOS scaling, alternative strategies are being pursued to sustain progress:

- **3D integration**: Stacking multiple layers of transistors vertically to increase density without shrinking individual transistors. This approach can lead to significant improvements in performance and energy efficiency.
- **Advanced Packaging**: Techniques like chiplet integration and heterogeneous integration allow combining different types of chips in a single package, optimizing performance and functionality.
- **New materials**: Exploration of materials beyond silicon, such as cubic boron arsenide (c-BAs), which offers high carrier mobility and thermal conductivity, potentially outperforming silicon in certain applications.
- **Beyond CMOS Technologies**: Development of novel computing paradigms, including quantum computing and neuromorphic computing, which could revolutionize processing capabilities.

Semiconductor value chain – Structure, business models & global dynamics

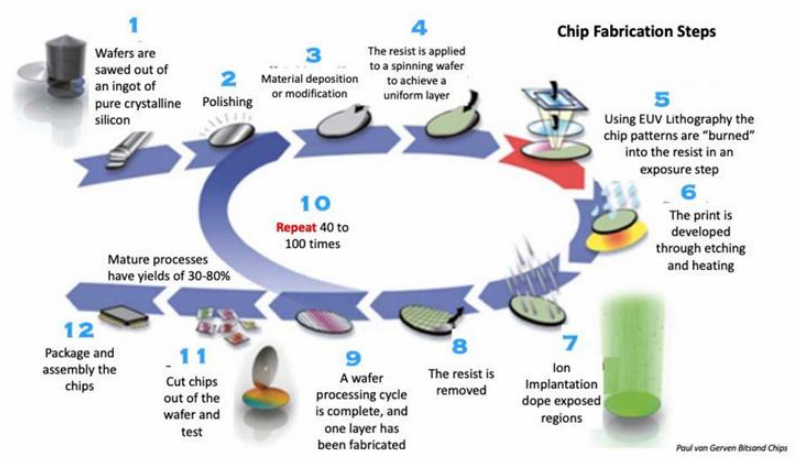
Overview of the semiconductor manufacturing process ➤

Semiconductor manufacturing is a highly complex and precise process that transforms raw materials into integrated circuits.

1. **Raw material preparation :**
   - Unlike solar-grade silicon (6N purity), which is produced by refining quartz derived from common sand, semiconductor-grade silicon (9N purity) is made from specially mined high-purity quartz — primarily sourced from Spruce Pine, North Carolina, the world's leading region for such material. Ingots are made using this silicon.
   - These ingots are sliced into ultra-thin silicon wafers, serving as the base for chip manufacturing.
2. **Wafer fabrication (front-end processing):**
   - Photolithography: A light-sensitive material (photoresist) is applied to the wafer, and patterns are etched using ultraviolet light.
   - Etching: Chemical or plasma etching removes specific parts of the wafer to define circuit patterns.
   - Deposition: Thin layers of materials (insulators, metals, semiconductors) are deposited to build up circuit structures.
   - Ion implantation: Ions are implanted into the wafer to modify electrical properties of regions.
   - Multiple layers are stacked precisely to form complex integrated circuits.
3. **Wafer testing:**
   - Electrical testing is performed on each die while still part of the wafer to identify functional units.
4. **Assembly and packaging (back-end processing):**
   - Dicing: The wafer is cut into individual dies.
   - Die bonding: Each die is mounted onto a substrate or lead frame.
   - Wire bonding or flip-chip: Electrical connections are made between the die and the package.
   - Encapsulation: The package is sealed to protect the chip.
5. **Final testing and quality control:**

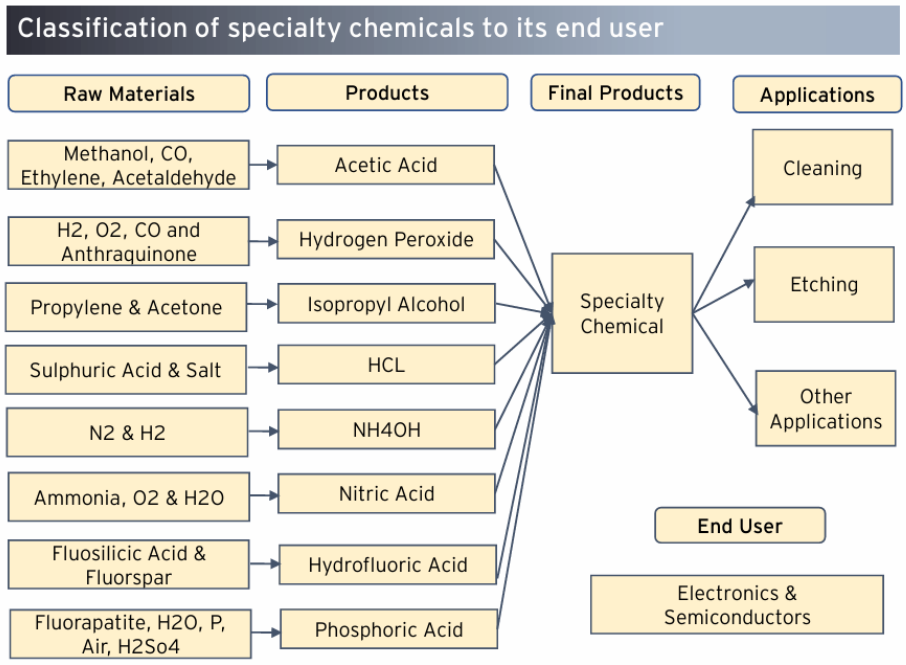
   Packaged chips undergo rigorous functional and environmental testing to ensure reliability and performance before shipment.

Figure 13: Semiconductor manufacturing process



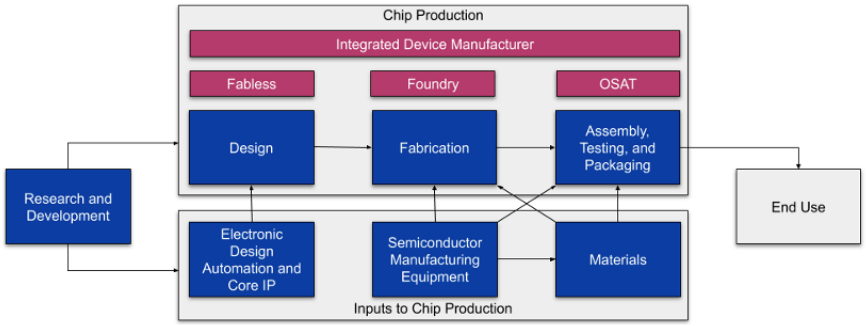
SOURCE: STANFORD, INCRED RESEARCH

Figure 14: Specialty chemicals required in the semiconductor manufacturing process



SOURCE: MORDOR INTELLIGENCE REPORT, INCRED RESEARCH

Figure 15: Semiconductor supply chain



Note: Blue: Supply chain segment; Purple: Business model for production

SOURCE: CSET, INCRED RESEARCH

Overview of the semiconductor value chain ➤

The semiconductor industry is built on a globally distributed, highly specialized value chain. The semiconductor industry requires deep specialization at each stage due to the complexity, capital intensity, and skill requirements involved. The process begins with chip architecture and design, moves into fabrication, and ends with packaging, testing and system-level integration. Each stage is a highly specialized field with geographical concentrations and corporate specializations across different parts of the supply chain. As a result, companies are moving away from vertical integration – illustrated by major players like AMD, which spun off its manufacturing arm (now GlobalFoundries) to focus solely on chip design.

Figure 16: Semiconductor supply chain overview

Stage	Description	Key Global Players	India's Status
Raw Materials	Semiconductor grade polysilicon, photoresists, rare gases, substrates	Hemlock Semiconductor, Tokuyama Corporation, Shin-Etsu, JSR, Air Liquide	Very low presence; India currently lacks PPB-level purity required for chip fabrication
Equipment (Tools)	Lithography, deposition, etching, testing machines	ASML (Dutch), Applied Materials (US), Tokyo Electron (Japan)	Very low presence; full import dependency, especially for lithography
EDA/IP	Electronic design automation tools and IP cores	Synopsys, Cadence, Arm	Moderate presence via workforce; no Indian company in the top-tier segment
Chip Design	Architecture, logic and RTL design of semiconductors	NVIDIA, AMD, Qualcomm	Strong global hub; 20% of global workforce; 50+ global design centre in India
Foundry (Fab)	Wafer fabrication using lithography and etching on wafers	TSMC, Samsung, Intel	In-development: First fab unit by Tata-PSMC is expected to start operations by 2026F
ATMP	Assembly, test, marking and packaging	ASE, Amkor, JCET	Four ATMP facilities approved under ISM with US$7bn+ of investments
System Assembly	Final integration: PCBs, casings, and devices	Foxconn, Pegatron, Dixon	Mature segment: Second-largest smartphone producer globally; string PLI-backed exports

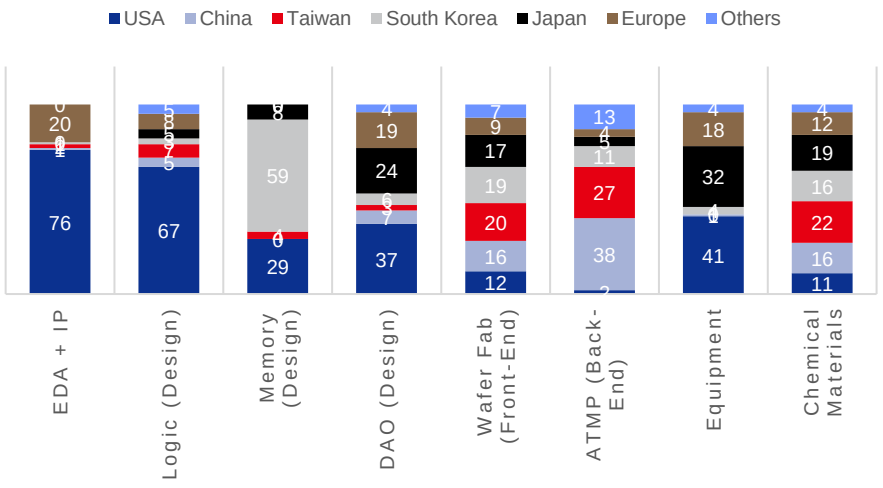
SOURCE: INCRED RESEARCH

Figure 17: R&D, capex and value addition of different segments (% of industry total, 2019)

Segment	R&D	Capex	Value Addition
Design	53	13	50
Front-end (wafer fabrication)	13	64	24
Back-end (ATMP)	3	13	6
EDA & core IP	3	1	4
Equipment tools	9	3	11
Materials	1	6	5
Pre-competitive research	18	0	0

SOURCE: SEMICONDUCTOR INDUSTRY ASSOCIATION, INCRED RESEARCH

Figure 18: Geographic specialization of supply chain by value addition (2019)



SOURCE: INTER-AMERICAN DEVELOPMENT BANK, INCRED RESEARCH

Manufacturing business models (IDM, fabless, foundry) »

Four major business models have evolved in the manufacturing segment of the semiconductor industry:

- Integrated device manufacturers (IDM):

  A vertically integrated model where the company designs, fabricates, tests, and packages its own chips. This approach offers tighter control over IP, quality, supply chain security and product performance. It is highly advantageous for mission critical or proprietary applications where tight coordination is required. However, the model is highly capital and R&D-intensive, requiring billions of dollars in upfront investment and long payback periods. Only a few players globally operate at scale in this model – which include Intel, Samsung, and Texas Instruments.

- Fabless model:

  This model focuses entirely on chip design, while outsourcing fabrication and back-end processes to third-party foundries and OSATs. This model lowers capital expenditure and allows companies to specialize in IP development, architecture optimization and software-hardware co-design. It has become the dominant structure for innovation-driven companies, particularly in AI, mobile and graphics computing. Key examples include NVIDIA, Qualcomm, and AMD.

- Pure play foundry model:

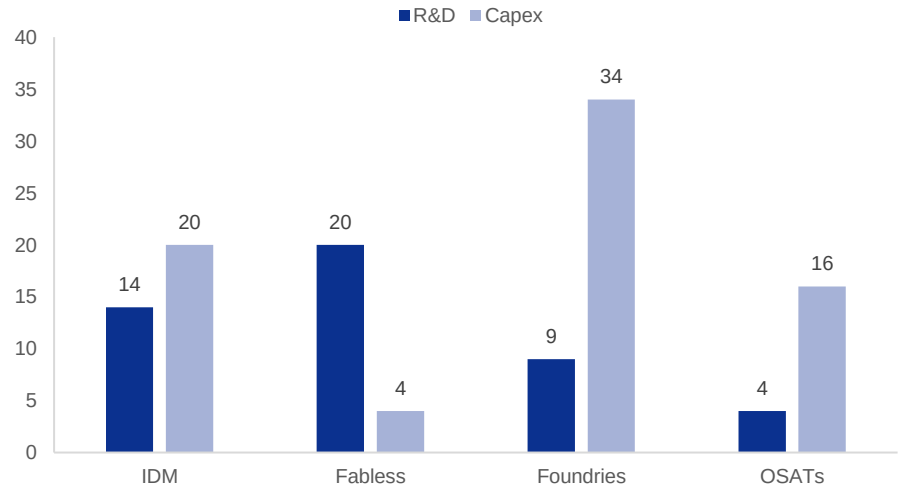
  These companies focus exclusively on fabrication services and manufacture chips designed by their clients. Foundries operate high-volume fabs and require enormous capex, technical leadership, and consistent demand to maintain profitability. Leading foundries like TSMC, GlobalFoundries, and SMIC have become the backbone of semiconductor production.

- Outsourced semiconductor assembly and testing (OSAT):

  The OSAT model handles the post-fabrication phase of chip production or the back-end manufacturing. This includes assembly, packaging, and testing. It is a low-margin, high-volume business, often serving fabless and IDM clients alike. Global leaders include ASE Group, Amkor, and JCET. India is actively building capacity here through projects like Micron's ATMP facility and Tata's TSAT plant in Assam.

  From a geographic perspective, each model has gravitated towards specialized global hubs: IDMs remain centered in the US, Korea; fabless companies dominate in the US and China; foundry capacity is concentrated in Taiwan and South Korea; OSAT hubs are primarily in Taiwan, Malaysia, Singapore, and South Korea.

Figure 19: Financial Indicators by business model (% of revenue spent on R&D & capex)



SOURCE: IDB, INCRED RESEARCH

Global supply chain concentration

The semiconductor supply chain is highly concentrated, with key choke points dominated by a few global players.

Figure 20: Global semiconductor supply chain choke points

Segment	Global Leader	Estimated Market Share	Risk Implication
Lithography	ASML (Netherlands)	100% (EUV)	Single-point failure risk
Foundry	TSMC (Taiwan)	64% (<10nm tech)	Taiwan dependency risk
EDA/IP	Synopsys, Cadence, Siemens EDA	85%	US dominance
Materials	JSR, Shin-Etsu	>70% in some	Japan-centric

SOURCE: INCRED RESEARCH

These concentrations make the industry vulnerable to geopolitical shocks, natural disasters, or export restrictions, as highlighted by the ongoing US advanced chips export restrictions to China and COVID-related disruptions.

India’s semiconductor and AI landscape

Overview of India’s semiconductor & AI value chain

India’s ambition to become a global hub for semiconductor and AI technologies is underpinned by rising electronics consumption, strategic import dependency and significant policy interventions. However, the current landscape reflects a foundational phase with strengths in design and assembly but notable weaknesses in the high value addition upstream manufacturing and infrastructure.

India’s domestic electronics market has expanded at a CAGR of ~13% over FY17 to FY23. However, this expansion was driven largely by assembly-centric activities, rather than upstream component manufacturing.

India’s current presence across the semiconductor value chain is highly uneven. **The country enjoys a strong position in chip design and embedded software, contributing to ~20% of the global design workforce.** Cities like Bengaluru, Hyderabad, Chennai and Noida host R&D centres of major multinational companies like AMD, NVIDIA, and Qualcomm. However, while India excels in design talent, the value captured in this segment is comparatively low as core IP ownership remains with foreign companies. But Indian startups like Mindgrove and Saankhya Labs are making inroads in chiplet and IoT design to overcome this issue. In fabrication**, India currently lacks an operational front-end logic fab, but the upcoming TATA-PSMC fab unit in Dholera will help overcome the absence in this segment.** On the ATMP/OSAT or the back-end manufacturing front, India has made most important strides. With **Sahasra Semiconductors and Suchi Semicon already starting operations and four major projects to be operational by FY27F, including Micron, CG-Renesas, Tata’s ATMP facility, and Kaynes Technology, India is poised to become a fast-growing hub for back-end manufacturing.** In terms of final assembly and integration, India already has strong capabilities in electronics manufacturing services (EMS). Major players such as Foxconn, Pegatron, and Dixon Technologies have increased their footprint in the country, especially after the production-linked incentive or PLI schemes launched by the government. However, a major gap remains in raw materials and semiconductor-grade equipment. **India imports nearly all its high-purity gases, wafers, and chemicals required for chip fabrication. While domestic chemical manufacturing exists, it produces chemicals with parts per million purity as compared to parts per billion purity required for semiconductor manufacturing.**

India’s current AI ecosystem is advancing rapidly in software and research. However, the country lacks national-scale compute infrastructure, foundational models, and large-scale Indian language datasets.

India’s electronics manufacturing push

India sees electronics as the backbone of its digital future – key to economic strength and national security. Over the past decade, the country has pushed hard to grow its electronics manufacturing, aiming to reduce imports, add more local value, and compete globally. **The National Policy on Electronics (NPE) was the government’s strategic pivot. Initially launched in 2012, the policy failed to generate sufficient traction – partly due to a lack of capital subsidies, scale incentives and coordination with states.** Learning from these shortcomings, the government launched a revised version – NPE 2019, aiming to achieve US$400bn in electronics production by 2025F.

To operationalize this vision, the government introduced downstream initiatives:

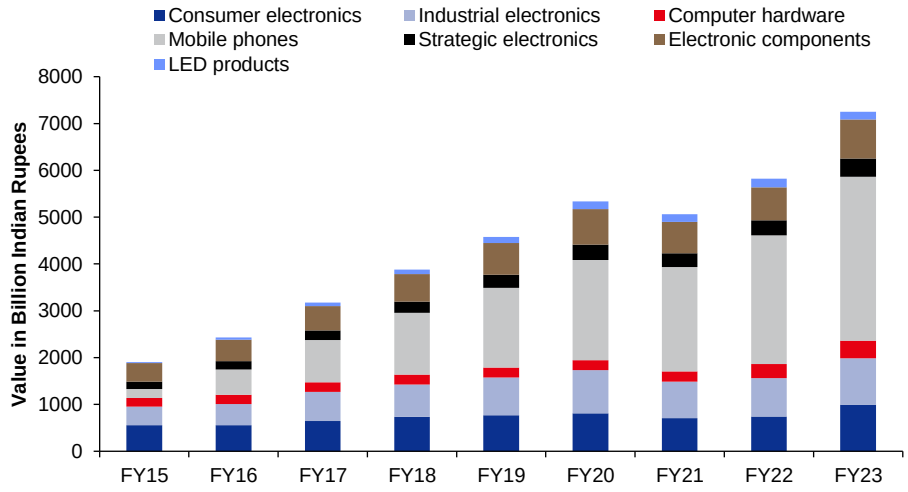
- **PLI for large-scale electronics manufacturing (2020)** – Aims to bolster domestic electronics production by offering 4-6% incentive on incremental sales of mobile phones and specified electronic components over a five-year period.
- **Scheme for promotion of manufacturing of electronic components and semiconductors (SPECS)** – This scheme offered a 25% capital subsidy for specific segments.

- **Modified electronics manufacturing clusters (EMC 2.0) scheme** – It provided financial assistance for establishing both electronics manufacturing clusters (EMCs) and common facility centres (CFCs) across the country.

The results have been significant, with data underscoring India's growing electronics manufacturing base:

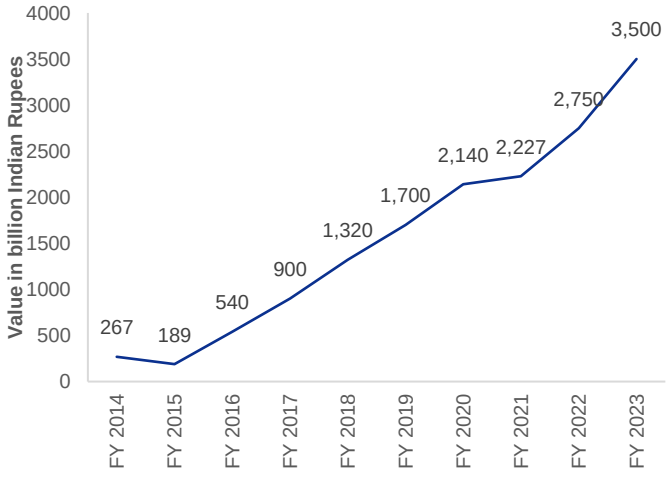
- **Electronics manufacturing grew at a CAGR of 14.8% over FY17 and FY23.**
- **Mobile phone manufacturing emerged as the strongest segment, contributing Rs3.5tr in FY23, growing at a CAGR of 44% over FY15 and FY23.**
- **Electronics exports reached US$29bn in FY23, up 27% YoY, with the share of electronics in total exports rising from 4.9% in FY22 to 6.7% in FY24.**

Figure 21: Manufacturing output of the electronics sector in India



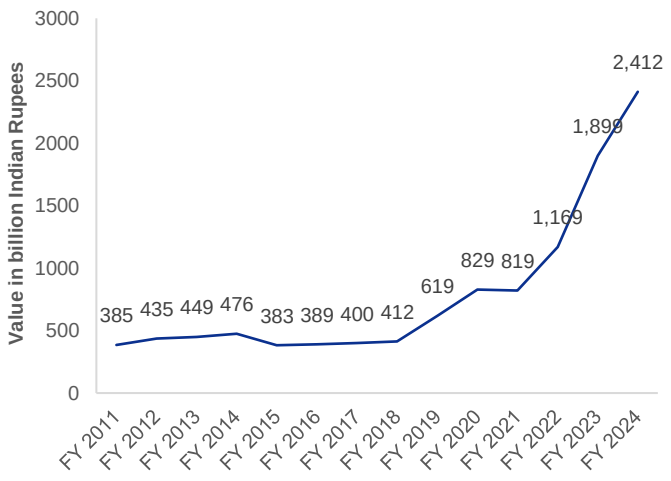
SOURCE: INDIA, INCRED RESEARCH

Figure 22: Mobile phone production in India in value terms



SOURCE: GOVERNMENT OF INDIA, INCRED RESEARCH

Figure 23: India's electronics product exports in value terms



SOURCE: RBI, INCRED RESEARCH

However, the value addition challenge remains. **India's Electronics System Design and Manufacturing sector is still largely assembly-led, with domestic value addition estimated at just 15-16%.** Critical upstream inputs such as semiconductors, displays, and camera modules are mostly imported currently, with limited domestic capability in tooling, materials or fabrication.

India's policy landscape, however, shows a trend of learning and iteration. The government has repeatedly revised and recalibrated its approach. The initial NPE 2012 was followed by the more structured NPE 2019. The first semiconductor fab policy launched in 2021, which saw no global interest, was revised in 2023 with

improved fiscal terms and a pivot to mature nodes (28nm+). Similarly, PLI schemes have been expanded and restructured to improve adoption.

India's semiconductor mission

India launched the India Semiconductor Mission (ISM) in 2021 with an outlay of Rs760bn and aims to build a semiconductor and display ecosystem in the country. This holistic approach of the mission aims to cover the entire value chain – from design to manufacturing and packaging.

It comprises four main schemes –

- Semiconductor fab scheme –

  Objective: To attract large investments for setting up semiconductor wafer fabrication facilities in the country to strengthen the electronics manufacturing ecosystem and help establish a trusted value chain.

Key incentives & eligibility:

Figure 24: ISM – Semiconductor fab scheme subsidies

	2021	2023
Node Size	65/45/28 nm or advanced (including intermediate nodes)	For all node size
Operational Experience	Applicant companies/consortia /joint ventures should have the following experience: A. Own and operate 65/45/28nm (including intermediate nodes) or advanced nodes process(es) in silicon CMOS semiconductor fab or B. Own or possess production grade licensed technologies for 28nm process and demonstrate the roadmap to advanced nodes technologies through licensing or development	Applicant companies/consortia/joint ventures should have the following experience: Own or possess production grade licensed technologies for proposed technology process and demonstrate the roadmap to advanced nodes technologies through licensing or development
Fiscal support from Government of India	Fiscal support: 28nm or lower - up to 50%; Above 28 nm to 45nm - up to 40%; Above 45 nm to 65nm - up to 30%	Fiscal support as percentage of project cost - 50 %

SOURCE: GOVERNMENT OF INDIA, INCRED RESEARCH

Relaunch history: When the scheme was initially launched in 2021, the focus was on attracting advanced node semiconductor fabs. Key features included graded fiscal support depending on the chip size, emphasis on cutting edge technologies and large-scale investment (minimum capital investment of Rs200bn) and strict eligibility – companies needed prior fab experience and partnerships with leading tech firms.

However, this approach received a limited response due to the capital-intensive nature of advanced fabs, and lack of supporting infrastructure and supply chain maturity at the time.

In response to the industry feedback and global semiconductor supply challenges, the government relaunched the scheme, easing the requirements in terms of node size and operational experience and removing the graded fiscal support, making it more investor friendly. This strategic realignment reflects India's urgency to kickstart the ecosystem and focusing on mature technologies where domestic demand is high.

Approved projects:

1) Tata Electronics in partnership with PSMC

- Display fab scheme –

  Objective: To attract large investments in setting up display fabrication facilities in the country to strengthen the electronics manufacturing ecosystem.

Key incentives and eligibility:

Figure 25: ISM – Display fab scheme subsidies

	2021	2022
Technology	Generation 8 or above for TFT LCD OR Generation 6 or above for AMOLED	
Capacity	60,000 panels/month or more for TFT LCD 30,000 panels/month or more for AMOLED	
Operational experience	Applicant companies/consortia/joint ventures should have the following experience: A. Own and operate a commercial display fab facility with TFT LCD technology of Generation 6 or above or B. Own or possess licensed technologies for Generation 8 of TFT LCD technology or Generation 6 of AMOLED technology; and demonstrate the roadmap to advanced technologies through licensing or development	
Capital investment threshold	Minimum capital investment of Rs100bn	
Fiscal support from GoI	Fiscal support as percentage of project cost - up to 50% with a maximum support of Rs120 bn	Fiscal support as a percentage of project cost is 50%

SOURCE: GOVERNMENT OF INDIA, INCRED RESEARCH

Relaunch history: The scheme was initially launched in 2021 but was relaunched in 2022 with the only change being removal of the incentive cap of Rs120bn.

Status: No deals have currently been approved under this scheme.

Additional observations: Displays constitute a significant portion of the total Bill of Materials (BoM) of electronic products. For instance, displays account for over 25% of the BoM in case of smartphones and over 50% in case of LCD / LED TVs. As per estimates, India's display panel market is estimated to be ~US$7bn (Rs525bn) and is expected to grow to ~US$15bn (Rs1.13tr) by 2025F. Current requirements are met exclusively through imports. This highlights the importance of the government to help set up a display fab plant in India.

- Compound semiconductor & ATMP scheme –

  Objective: To attract investments for setting up compound semiconductors / silicon photonics (SiPh) / sensors (including MEMS) fabs and semiconductor ATMP/OSAT facilities in the country to strengthen the electronics manufacturing ecosystem and help establish a trusted electronics value chain in the areas of application of these fabrication and packaging technologies.

  Key incentives and eligibility:

  Compound semiconductors/silicon photonics (SiPh)/sensors (including MEMS) fab –

Figure 26: ISM – Compound semiconductor/ SiPh/ sensors scheme subsidies

	2021	2022
Technology	Wafer size: 150/200mm or more; Capacity: 500 or more wafer starts/month (in 100 mm equivalent)	
Operational experience	The applicant companies/joint ventures should have the following experience: A. Own and operate commercial compound semiconductors/silicon photonics (SiPh) / Sensors (including MEMS) fab/discrete semiconductors fab or silicon semiconductor fab or B. Own or possess licensed process technologies for the proposed fab	
Capital investment threshold	Minimum capital investment of Rs1bn for compound semiconductors / silicon photonics (SiPh) / sensors (including MEMS)/ discrete semiconductors fab	
Fiscal support from GoI	30% of capital expenditure	50% of capital ependiture

SOURCES: GOVERNEMNT OF INDIA, INCRED RESEARCH

Semiconductor assembly, testing, marking and packaging (ATMP) / Outsourced semiconductor assembly and test (OSAT) facility –

Figure 27: ISM – OSAT/ATMP scheme subsidies

	2021	2022
Operational experience	Applicant companies/joint ventures should have the following experience: A. Own and operate a commercial semiconductor packaging unit or B. Own or possess licensed technologies for the proposed semiconductor packaging unit and demonstrate the roadmap to advanced packaging technologies through licensing or development	
Capital investment threshold	Minimum capital investment of Rs500m	
Fiscal Support from GoI	30% of capital expenditure	50% of capital expenditure

SOURCE: GOVERNMENT OF INDIA, INCRED RESEARCH

Relaunch history: Initially launched in 2021 and modified in 2022, the only modification was the increase in fiscal support from 30% of the capex to 50% of the capex,

Approved deals:

- Tata Semiconductor Assembly and Test (TSAT)
- CG Power & Renesas Electronics (Japan)
- Kaynes Semicon
- Micron Technology

Additional observations: This has been the most successful scheme in the ISM with four approved projects worth more than Rs600bn.

- Design-linked initiative scheme –

  Objectives: The design-linked incentive (DLI) scheme shall offer financial incentives as well as design infrastructure support across various stages of development and deployment of semiconductor design for Integrated Circuits (ICs), Chipsets, System on Chips (SoCs), Systems & IP Cores and semiconductor-linked design over a period of five years with the objectives such as:

  - Nurturing 100 domestic companies of semiconductor design for Integrated Circuits (ICs), Chipsets, System on Chips (SoCs), Systems & IP Cores and semiconductor-linked design, and facilitating the growth of not less than 20 such companies to achieve a turnover of more than Rs15bn in the next five years.
  - Achieving significant indigenization in semiconductor and electronic products and IPs deployed in the country, thereby facilitating import substitution and value addition in the electronics sector in the next five years.
  - Strengthening the design infrastructure through incubators for semiconductor design and facilitating access to startups and MSMEs.

Key initiatives and incentives:

Figure 28: ISM – DLI scheme support

Categories of support

Scheme component	Description
Design infrastructure support for startups / MSMEs	(i) National EDA Grid (ii) IP Core Repository (iii) Prototyping (iv) Post-Silicon Validation
Product design-linked incentive	Reimbursement of 50% of the eligible expenditure subject to a ceiling of Rs150m incentive per application.
Deployment-linked incentive	Reimbursement of 6% to 4% of net sales over five years, subject to a ceiling of Rs0.3bn incentive per application

SOURCE: GOVERNMENT OF INDIA, INCRED RESEARCH

Relaunch history: This scheme is still in its first version and hasn't been modified till now.

Approved projects: A total of 69 companies have been approved for EDA Tool Support. This provides access to software tools and services for designing electronic systems specifically focusing on ICs and semiconductor chips. Apart from this, 17 companies have been provided with financial support under this scheme.

Additional observations: India already accounts for ~20% of the global semiconductor design workforce, and this scheme helps strengthen the IP monetization ecosystem. Moreover, the total electronic design market in India, estimated at Rs350bn in 2020 and growing at a CAGR of ~15.4%, necessitates fostering the domestic semiconductor design industry to not only meet the domestic requirement and service global customers but also achieve self-reliance and mitigate the security concerns of this strategic sector.

India AI mission ➤

Objective: The IndiaAI mission aims to build a comprehensive ecosystem that fosters AI innovation by democratizing computing access, enhancing data quality, developing indigenous AI capabilities, attracting top AI talent, enabling industry collaboration, providing startup risk capital, ensuring socially impactful AI projects, and promoting ethical AI.

Launched with a budget of Rs103bn, key components of the IndiaAI mission include:

- IndiaAI compute capacity - Focuses on building a scalable AI ecosystem with 10,000+ graphics processing units or GPUs via public-private partnerships, offering AI services and resources.
- IndiaAI innovation centre - Focuses on developing and deploying indigenous large multimodal models (LMM) and domain-specific foundational models.
- IndiaAI datasets platform - Focuses on streamlining the access to high-quality non-personal datasets for AI innovation.
- IndiaAI application development initiative - Develops, scales, and promotes impactful AI solutions for large-scale socio-economic transformation.
- IndiaAI future skills - This pillar aims to expand AI education at all academic levels and establish data and AI labs in Tier-2 and Tier-3 cities.
- IndiaAI startup financing - This pillar accelerates deep-tech AI startups by streamlining access to funding for innovative AI projects.
- Safe & trusted AI - Focuses on ensuring responsible AI via projects, tools, checklists, and governance frameworks for responsible development and use.

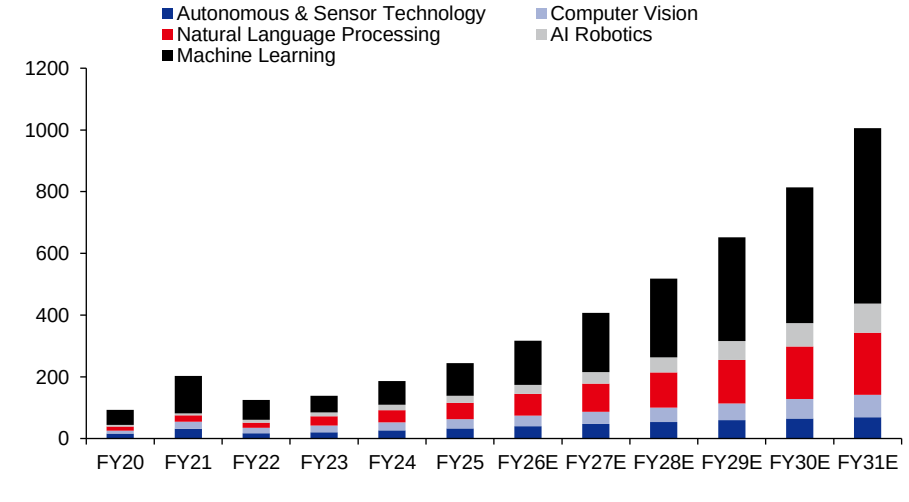
Additional observations : **The global AI market capitalization is expected to grow at a CAGR of 27% over FY24 to FY31F.** Alongside this expansion, the global adoption of AI has accelerated, with 42% of global enterprises already integrating AI into their operations. India, in specific, leads in this area with 59% of its companies already integrating AI into their operations and another 27% exploring to do the same, which is much higher than its global peers such as the US (33%) and China (26%).

In terms of workforce, India is playing a fast-expanding role in this ecosystem. **According to the Stanford's HAI report, India leads the world in AI skill penetration, with relative AI skill penetration at 2.5 times the global average, lagging just behind US. Moreover, India recorded the highest growth in AI hiring globally in 2024 at 33.4% YoY.**

Despite these advances, a significant talent gap remains. While India's AI job market is expected to create 2.3m jobs by 2027F, the available skilled workforce is projected to reach only 1.2m, indicating a gap which the government aims to bridge through reskilling and upskilling via this mission.

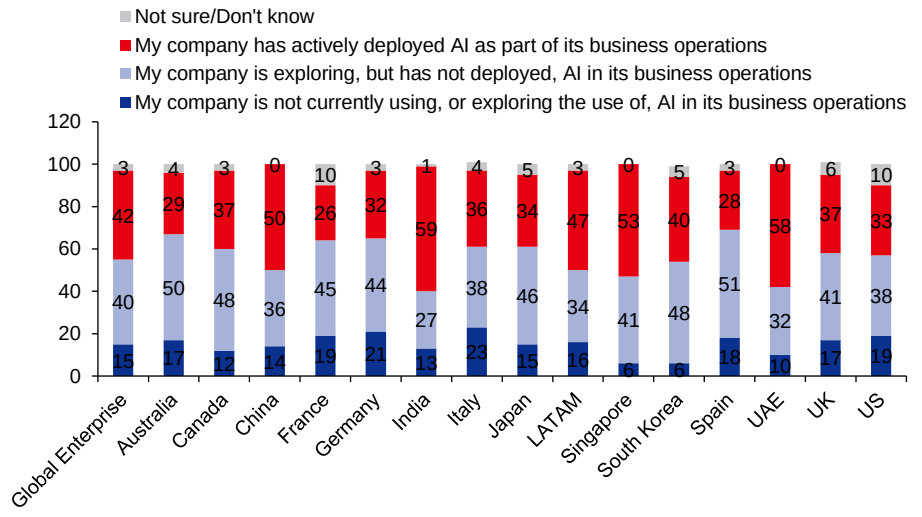
As a part of its IndiaAI compute capacity initiative, the government recently concluded the bidding for provisioning 10,000+ GPUs via public-private partnerships. Yotta Data Services, E2E Networks, and NxtGen Cloud Technologies were selected to deliver AI compute resources at subsidized rates (under US$1/hour) — among the lowest globally — to support startups, research, and public sector innovation. This move is expected to accelerate AI experimentation and accessibility amid global GPU shortage and rising demand.

Figure 29: AI market size worldwide



SOURCE: STATISTA, INCRED RESEARCH

Figure 30: Global AI adoption



SOURCE: IBM, INCRED RESEARCH

Role of state governments ➤

While the central government's schemes and policies have provided the strategic blueprint and the fiscal backbone for semiconductor development, the role of individual states has been equally critical in shaping on-ground execution. As seen in electronics manufacturing, many clusters have developed in the country like Tamil Nadu, Maharashtra, and Uttar Pradesh which attracted investments by complementing the central government's emphasis on electronics manufacturing through schemes like EMC 2.0, SPECS, and PLI schemes.

Semiconductor manufacturing is deeply dependent on infrastructure, clean water, uninterrupted power and land availability – factors managed primarily at the state level. In recent years, several Indian states have launched dedicated semiconductor and electronics policies, offering capital incentive, non-fiscal support like logistical support and infrastructure support to attract investments in their states.

- Gujarat –

  Gujarat already had an electronics policy which it launched in 2020 and became the first state in India to launch a dedicated semiconductor policy in 2022. The semiconductor policy provides capital assistance at the rate of 40% of capex assistance given by the Government of India or GoI, subsidy on land purchase, water, power, and additional non-fiscal incentives.

Figure 31: State incentives for semiconductor manufacturing

Type	Amount
Investment	40% of capex assistance by the Government of India (20% of the total project cost)
Power	Power tariff subsidy of Rs2/unit for 10 years; electricity duty exemption
Land	75% on first 200 acres, 50% on additional
Water	Rs12/cubic metre for the first five years; 50% subsidy on capex of desalination plant
Fees	One-time reimbursement of 100% of stamp duty and registration fee

SOURCE: GOVERNMENT OF GUJARAT, INCRED RESEARCH

Apart from the policy support, Gujarat also has a strong manufacturing and business environment. It was ranked top in Ease of Doing Business, Logistics Performance Index, Good Governance Index and in terms of infrastructure, Gujarat has a 1,600km+ coastline with 48 seaports, 5,300km+ railway lines, and 19 airports.

In terms of the semiconductor value chain, Gujarat is the chemical hub of India producing nearly 50% of chemicals in the country. It has a well-established supply chain for several key chemicals consumed by the semiconductor industry such as sulphuric acid, hydrochloric acid, aromatic compounds, aliphatic compounds, etc. Many domestic companies have expressed interest in augmenting their facilities to meet the demand from the semiconductor sector. It has one upcoming semiconductor fab and several ATMP plants to solidify its position in the entire value chain.

With advantages such as these and the early-mover advantage, Gujarat has managed to attract four of the five investments approved by the Government of India under the ISM which are currently under construction. The state also has received investments from other companies like **Sahasra Semiconductors (ATMP) and Suchi Semicon (ATMP)** which have already started operations and several other MoUs were signed recently in the Gujarat Semicon Connect Conference 2025, including Jabil India's Rs10bn initiative to set up a new silicon photonics unit, NextGen's Rs100bn intent to set up a compound semiconductor fab and optoelectronics facility, and Taiwan Surface Mounting Technology's Rs5bn plan to set up a new EMS unit in Gujarat.

- Assam –

  Assam has emerged unexpectedly as a semiconductor destination by leveraging its location and India's Act East Policy. The northeastern region has the advantage of grabbing the opportunity of the growing ASEAN market.

Figure 32: Assam government incentives for semiconductor manufacturing

Type	Amount
Investment	40% of capex assistance by the Government of India (20% of the total project cost)
Power	Incentives in power tariff up to 50%
Land	Nominal prices; freehold transfer of land rights on case-to-case basis
Water	Rs5/cubic metre for the first 5fiveyears; further subsidy on water tariff on a case-to-case basis
Fees	100% exemption of stamp duty
Others	SGST reimbursement, payroll assistance

SOURCE: GOVERNMENT OF ASSAM, INCRED RESEARCH

The state of Assam has been successful in attracting Tata Electronics to set up its OSAT facility at Jagiroad with an investment outlay of Rs270bn.

- Tamil Nadu –

  The Tamil Nadu Electronics Hardware Manufacturing Policy 2020 and the special incentives for sunrise sectors under the Tamil Nadu Industrial Policy 2021 have played a vital role in attracting sizeable investments from key players in the electronics hardware manufacturing space due to which Tamil Nadu has become one of the most successful Indian states in the ESDM sector, with the state's industrial corridors attracting investments from major global players such as Foxconn and Pegatron. In FY23-24, Tamil Nadu exported US$9.56bn of electronic items, which accounted for nearly 33% of the total national share of electronics exports.

  Now, with the Tamil Nadu Semiconductor and Advanced Electronics Policy in 2024, the state aims to foray into advanced electronics manufacturing encompassing design, component and equipment manufacturing and the strategic nature of the semiconductor industry.

Figure 33: Tamil Nadu government incentives for semiconductor manufacturing

Type	Amount
Investment	50% of capex assistance by the Government of India (25% of the total project cost)
Special training incentive	Rs10,000 per person for 12 months for residents of Tamil Nadu
Product testing & prototyping Incentive	A subsidy of 25% of the capex for establishing product testing and prototyping facilities, subject to a ceiling of Rs10m.
Power	Electricity tax exemption for a period of five years
Others	Land cost incentive, stamp duty incentive, enhanced quality certification incentive, enhanced IP incentive, and interest subvention

SOURCE: GOVERNMENT OF TAMIL NADU, INCRED RESEARCH

- Karnataka –

  Karnataka, particularly Bengaluru, has firmly positioned itself as India's primary semiconductor design and fabless innovation hub. The state hosts over 85 fabless chip design houses and more than 400 R&D centres, making it the core of India's semiconductor IP development ecosystem. Major global companies like Intel, Qualcomm, Texas Instruments, Synopsys, MediaTek, and Analog Devices have significant R&D operations in Bengaluru.

  The Karnataka Electronics System Design and Manufacturing (ESDM) Policy 2017–22 provided vital support for semiconductor R&D, infrastructure development, and startup incubation. Going ahead, Karnataka is actively promoting next-generation semiconductor segments like AI accelerators,

photonics, and high-performance computing chipsets through enhanced research collaboration and focused skilling initiatives.

- Maharashtra –

  Maharashtra, with its strong industrial base around Pune and Aurangabad, has shown strong intent to attract semiconductor projects through its Electronics Policy 2016 and more recently through focused efforts toward semiconductor-specific investments. Although the state initially succeeded in attracting significant proposals—such as the joint venture between the Adani Group and Tower Semiconductor—that partnership has since been paused as the Adani Group is reconsidering the strategic implications and the state is now awaiting major new investments. Maharashtra remains a prime contender for ATMP units, semiconductor design centres, and supply chain manufacturing hubs, supported by its skilled workforce, excellent port logistics through JNPT, and robust financial ecosystem anchored by Mumbai. The state is also working on finalizing a dedicated semiconductor incentive policy to further strengthen its competitiveness.

- Uttar Pradesh –

  Uttar Pradesh, backed by its Electronics Manufacturing Policy 2020 and the newly launched UP Semiconductor Policy 2024, is rapidly scaling its capabilities in electronics and semiconductor manufacturing. The state is already home to Samsung's Noida plant, the world's largest mobile factory, and is developing new industrial corridors near Jewar Airport to attract high-tech investments.

  The UP Semiconductor Policy 2024 offers significant incentives such as a 50% capital subsidy (matching central government incentives), land cost reimbursement up to 75%, 100% stamp duty waiver, infrastructure support, and power tariff subsidies to attract fabs, ATMPs, and design units.

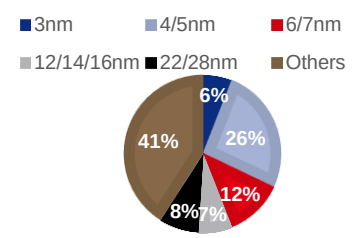
  Notably, Uttar Pradesh has attracted the proposed HCL-Foxconn Semiconductor Fab, which is currently awaiting central government approval. The project, if cleared, would firmly establish Uttar Pradesh as a major semiconductor manufacturing state alongside its existing electronics strengths.

Tracking India's semiconductor investment wave ➤

India's semiconductor push is bearing fruit with Rs1.56tr worth of investments approved and underway. This includes 70% fiscal support from central and state governments. These include India's first chip fabrication plant, multiple ATMP plants and over 80 startup-led design initiatives.

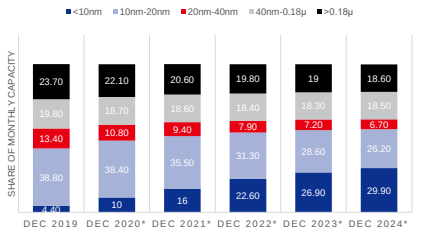
The first semiconductor chip fabrication plant will manufacture chips ranging from 28-110nm. The latest of this, the 28nm technology was launched in 2011. While this investment of Rs910bn in a 14-year+ old technology might seem outdated compared to a 2nm or 5nm fab, it serves as a strategic investment to kickstart the semiconductor ecosystem. Mature nodes (28nm+) still account for ~40% of global installed capacity and revenue. Moreover, the cost of setting up a single fab can range between US$5bn to US$20bn depending on the size, technology and location, with advanced node fab requiring a much higher capex than mature nodes.

Figure 34: Revenue share by feature size



SOURCE: INCRED RESEARCH

Figure 35: Share of monthly wafer capacity worldwide



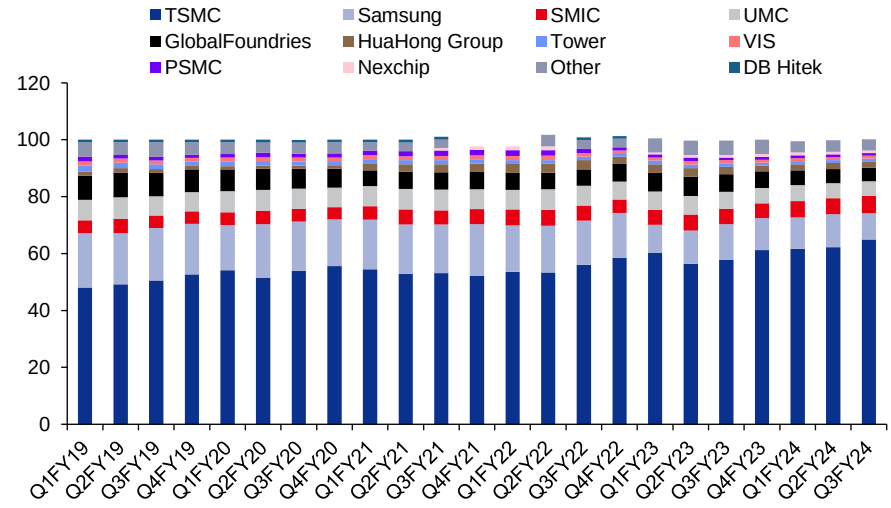
SOURCE: IC INSIGHTS, INCRED RESEARCH

In the initial semiconductor fab scheme of the government, the government tried to incentivize advanced chip fabrication more than mature node fabrication but that scheme failed to gain traction from the private players to invest. The government's focus on this industry has since evolved towards a more pragmatic phased approach, prioritizing mature node fabs, ATMP/OSAT facilities, and semiconductor design initiatives as the first step. This shift aims to build foundational capabilities, strengthen the domestic ecosystem, and gradually move towards advanced node manufacturing over time.

- Tata Electronics and PSMC Semiconductor Fab –

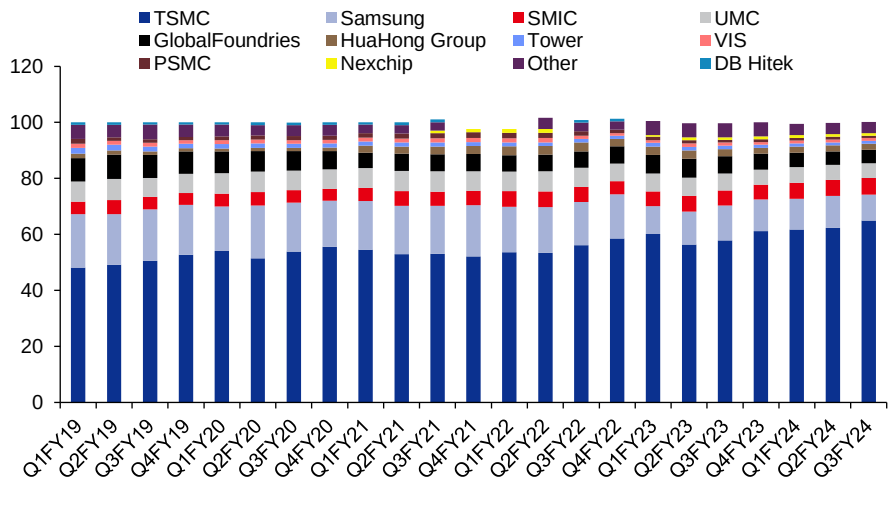
  Tata Electronics was established in 2020 as a greenfield venture of the Tata Group with fast emerging capabilities in electronics manufacturing services (EMS), semiconductor assembly and test, semiconductor foundry and design services. Powerhouse Semiconductor Manufacturing Service (PSMC) is a Taiwanese company that has a major global semiconductor foundry (ninth biggest by revenue), known for its expertise in advanced memory and logic chips.

Figure 36: Foundries market revenue worldwide (2019-24)



SOURCES: TRENDFORCE, INCRED RESEARCH

Figure 37: Revenue share of foundries worldwide (2019-24)



SOURCE: TRENDFORCE, INCRED RESEARCH

This fab is set to open in 2026F in Dholera and will have manufacturing capacity of up to 50,000 wafers per month. The new semiconductor fab will manufacture chips for applications such as power management IC, display drivers, microcontrollers (MCU) and high-performance computing logic on 28-110nm technologies, addressing the rising demand in markets such as computing,

communication, automotive, IoT and data storage. The total investment in this project is up to Rs915.26bn, of which the company will bear 30% of the cost, the central government will bear 50% and the Gujarat will bear 20% of the cost.

- Tata Electronics OSAT facility -

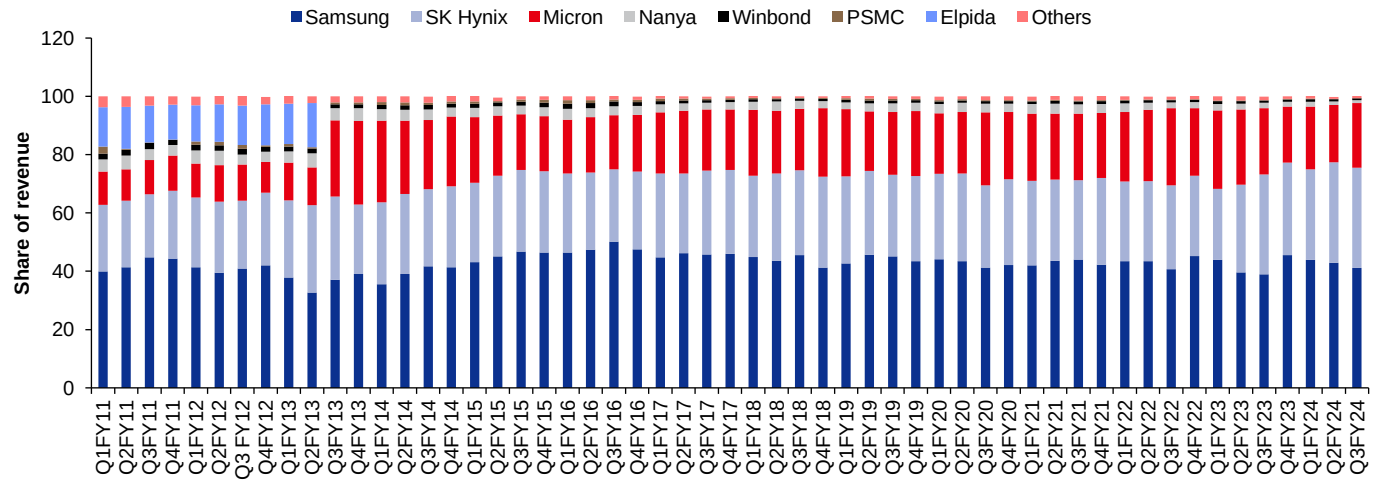
  This is the second facility being set up by Tata Electronics to expand its presence in the semiconductor value chain. This state-of-the-art, greenfield semiconductor assembly and test facility will be set up at Jagiroad in Assam at a cost of Rs270bn. This facility is designed to produce up to 48m chips per day using advanced packaging technologies like Wire Bond, Flip Chip, and a differentiated offering called Integrated Systems Packaging (ISP), with plans of expanding the roadmap to advanced packaging technologies in the future.

  This facility is expected to start operations in mid-2025F and the reason for this location stems from factors like the Government of India's northeastern push, and proximity to fast-growing emerging ASEAN market.

- Micron's ATMP facility –

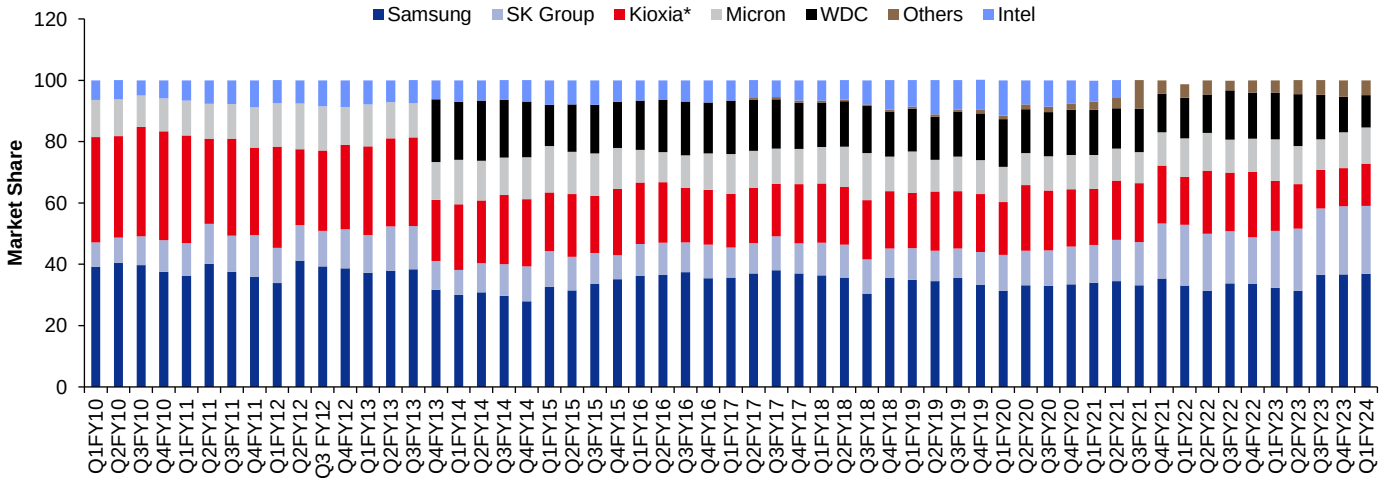
  Micron Technology is a US-based global leader in memory (DRAM and NAND) chips. It is the fourth-largest NAND Flash manufacturer worldwide by revenue and holds a 11.8% market share in that segment and it is also the third largest DRAM manufacturer worldwide by revenue and holds a 22.2% market share in that segment.

Figure 38: DRAM manufacturers' revenue share worldwide



SOURCES: TRENDFORCE, INCRED RESEARCH

Figure 39: NAND manufacturers' revenue share worldwide



SOURCE: TRENDFORCE, INCRED RESEARCH

It announced a Rs270bn investment for an ATMP facility at Sanand in Gujarat. Micron's new facility will focus on transforming wafers into ball grid array (BGA) integrated circuit packages, memory modules and solid-state drives. It will cater to data centres, smartphones and IoT devices.

- CG Power, Renesas and Stars Microelectronics –

  CG Power and Industrial Solutions is a major player in the electrical engineering industry and offers a diverse range of products in its two business lines - industrial systems and power systems. Since Nov 2020, the company has become a part of the renowned Murugappa Group. Renesas Electronics, based in Tokyo, is a prominent player in microcontrollers and System on Chip (SoC) solutions. It is a global leader in the automotive semiconductor market. Stars Microelectronics, located in Thailand, is a total electronic solutions provider to Outsource Semiconductor Assembly and Test (OSAT) and electronics manufacturing services (EMS).

  CG Power and Industrial Solutions is setting up its semiconductor OSAT unit at Sanand in Gujarat, which is in partnership with Renesas Electronics America Inc. and Stars Microelectronics (Thailand) Public Co. with a total investment of approximately Rs76bn. The JV will be 92.3% owned by CG, with Renesas and Stars Microelectronics each holding equity capital of approximately 6.8% and 0.9%, respectively. The JV will manufacture a wide range of products – ranging from legacy packages such as QFN and QFP to advanced packages such as FC BGA, and FC CSP. The JV will cater to industries such as automotive, consumer, industrial, 5G, to name a few.

- Kaynes Semicon –

  Kaynes Technology is a leading end-to-end and IoT solutions-enabled integrated electronics manufacturer in India with capabilities across the entire spectrum of ESDM services. In 2023, Kaynes ventured into the semiconductor domain by establishing a wholly-owned subsidiary, Kaynes Semicon Pvt. Ltd., focusing on OSAT services.

  The company received approval under the ISM to set up a state-of-the-art OSAT facility at Sanand in Gujarat with an investment of Rs33bn. This facility will produce chips that will cater to a wide variety of applications which include segments such as industrial, automotive, electric vehicle, consumer electronics, telecom, mobile phone, etc.

- Other emerging players in India's semiconductor ecosystem –

  Apart from ISM-supported projects, companies like Sahasra Semiconductors and Suchi Semiconductors are also contributing to India's semiconductor manufacturing ecosystem through other government schemes. Sahasra Semiconductors has set up an ATMP facility for memory chip packaging at Bhiwadi in Rajasthan, with an investment of approximately Rs7.5bn, focusing on DRAM modules, SSDs, and embedded solutions. Suchi Semiconductors is establishing an OSAT (Outsourced Semiconductor Assembly and Test) facility at Surat in Gujarat, with a planned investment of around Rs8.7bn, aiming to serve sectors like automotive, consumer electronics, and industrial electronics. Importantly, both Sahasra and Suchi have not availed subsidies under the India Semiconductor Mission (ISM) but have leveraged benefits under SPECS and state-level incentive programs.

Figure 40:

Project	Location	Total Capex (in Rs m)	Central Government (in Rs m)	State Government (in Rs m)	Company (in Rs m)
Tata Electronics and PSMC Semiconductor fab	Dholera, Gujarat	9,15,260	4,57,630	1,83,052	2,74,578
Tata Electronics OSAT facility	Jagiroad, Assam	2,70,000	1,35,000	54,000	81,000
Micron's ATMP facility	Sanand, Gujarat	2,70,000	1,35,000	54,000	81,000
CG Power, Renesas and Stars Microelectronics OSAT facility	Sanand, Gujarat	76,000	38,000	15,200	22,800
Kaynes Semicon OSAT facility	Sanand, Gujarat	33,000	16,500	6,600	9,900
	Total	**15,64,260**	**7,82,130**	**3,12,852**	**4,69,278**

SOURCES: INCRED RESEARCH, COMPANY REPORTS

Comparative benchmarking

Overview ➤

The global semiconductor value chain today is shaped by decades of industrial policy, private sector innovation and geopolitical strategy. Countries such as Taiwan, South Korea, the US, Japan and China didn't just grow chip capacity, they strategically built ecosystems aligned with their competitive advantages. By analyzing the historical trajectory and current position in the global value chain and the present-day policy response and future strategic direction for these countries, we can get an understanding of India's future journey in this segment.

US: The birthplace of semiconductors ➤

- Birthplace and early dominance –

  The story of semiconductors is, at its core, a story of American invention. In 1947, at Bell Labs, three scientists — William Shockley, John Bardeen, and Walter Brattain — invented the transistor, laying the foundation for the modern digital world.

  By 1957, a group of restless innovators from Shockley's lab, famously known as the 'Traitorous Eight', founded Fairchild Semiconductor in Santa Clara Valley (today's Silicon Valley).

  Fairchild Semiconductor not only pioneered the planar process and integrated circuits but also birthed a culture of relentless innovation that became Silicon Valley's DNA.

  Through the 1960s and 1970s, the US dominated both semiconductor design and manufacturing, leading breakthroughs in logic chips (processors) and memory chips.

- Cold War alliances and the rise of Asia –

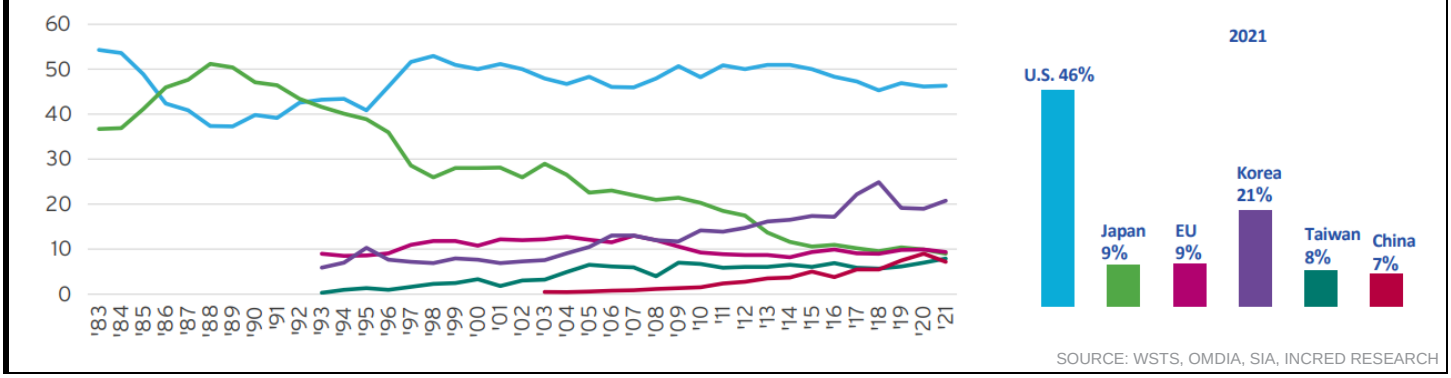
  The Cold War era magnified semiconductors' importance. The US government, led by agencies like DARPA, funded strategic R&D programs in microelectronics, helping invent FinFET transistors, satellite systems, and radars.

  During the 1960s–1980s, the US actively supported Japan, South Korea, and Taiwan to build up semiconductor capacity — partly as a Cold War strategy to counter Soviet and Chinese influence in Asia.

  Initially, Japan was welcomed as an ally. But by the late 1980s, Japanese companies had captured over 50% of the global DRAM memory market, posing an economic threat to US semiconductor companies.

  This triggered the 1986 US-Japan Semiconductor Agreement, attempting to rebalance the playing field.

Figure 41: Global market share in the semiconductor industry



SOURCE: WSTS, OMDIA, SIA, INCRED RESEARCH

- Offshoring, profit fixation, and market share decline –

  In the early 1960s, Fairchild Semiconductor made a small but fateful decision: to outsource semiconductor assembly and packaging to Hong Kong — seeking lower labour costs and political stability.

This move marked the start of offshoring in the semiconductor value chain, eventually leading backend operations (and later, parts of fabrication) to shift to Asia.

By the 1990s, American semiconductor companies were driven increasingly by financial priorities: Companies became more focused on quarterly profits. Leadership shifted from engineers to finance and MBA executives. R&D budgets shrank; risk appetite declined. Meanwhile, Taiwanese and Korean companies, often backed by state financing, invested aggressively during downturns, grabbing market share.

- Rise of fabless model and specialized chips –

  Facing rising fabrication costs, many US companies pivoted to a new model in the 1990s: fabless semiconductor design — where companies focused on R&D and IP, while outsourcing manufacturing to pure-play foundries (mainly TSMC, later Samsung).

  This gave rise to giants like Qualcomm, Broadcom, and most notably, Nvidia. Nvidia's breakthrough came in 2006, when it launched CUDA, a software platform that allowed its GPUs to be used for AI and high-performance computing, not just graphics.

  Meanwhile, big cloud companies like Google, Amazon, and Microsoft began designing their own customized chips (e.g., Google TPUs) to optimize AI and server workloads.

  This shift marked a deep fragmentation of semiconductor markets: No longer just "faster general CPUs" (Intel model), now specialized chips for specific domains (AI, networking, autonomous systems)

- Where the US stands today –

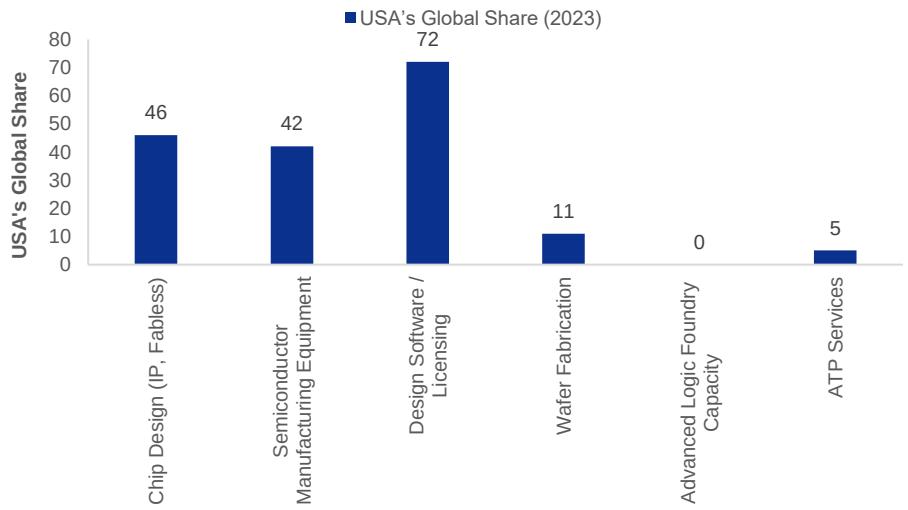
  The US continues to lead in semiconductor design, IP development, and manufacturing equipment, but it lags in leading-edge fabrication and backend assembly and testing (OSAT). US-based companies control nearly 48% of global semiconductor sales, with design leaders such as Nvidia, Qualcomm, and AMD, and dominate EDA software with around 85% global share through Cadence, Synopsys, and Siemens EDA.

  In semiconductor equipment, the US holds a strong position with about 40% global share, driven by players like Applied Materials and Lam Research. However, in advanced logic fabrication, the gap is visible. Currently, the most advanced node being fabricated inside the US is Intel's 7 process (roughly equivalent to TSMC's N7), with Intel 4 (5nm-class) expected to ramp in FY24. In contrast, TSMC and Samsung already mass-produce chips at 3nm overseas. TSMC's Arizona facility is scheduled to produce 4nm and 3nm nodes by 2025–26F, but ramping volume production remains a challenge.

  On the backend side, US companies account for less than 5% of global OSAT capacity, as packaging and testing operations remain heavily concentrated in Taiwan, China, and Southeast Asia.

  Thus, while the US retains leadership in design, innovation, and tooling, advanced chip manufacturing and packaging remain strategic vulnerabilities — a gap that the CHIPS and Science Act aims to address over the next decade.

Figure 42: US global revenue share in semiconductor manufacturing



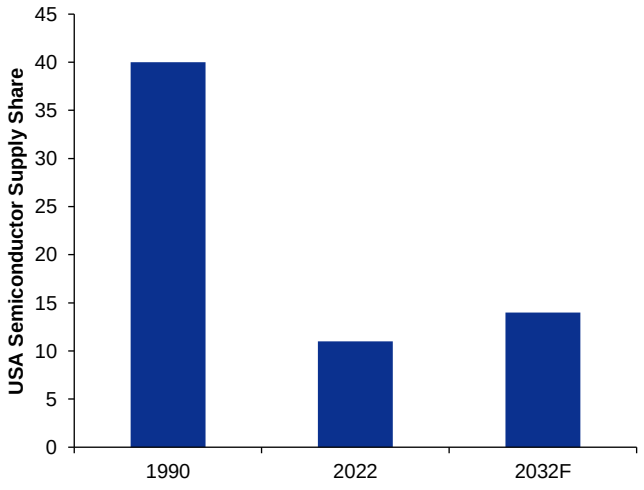
SOURCE: CONGRESSIONAL RESEARCH SERVICE, INCRED RESEARCH

- Future focus areas -

  Today, the US is racing to reverse decades of manufacturing decline. The CHIPS and Science Act (2022) represents a US$52.7bn commitment to rebuilding America's semiconductor ecosystem.

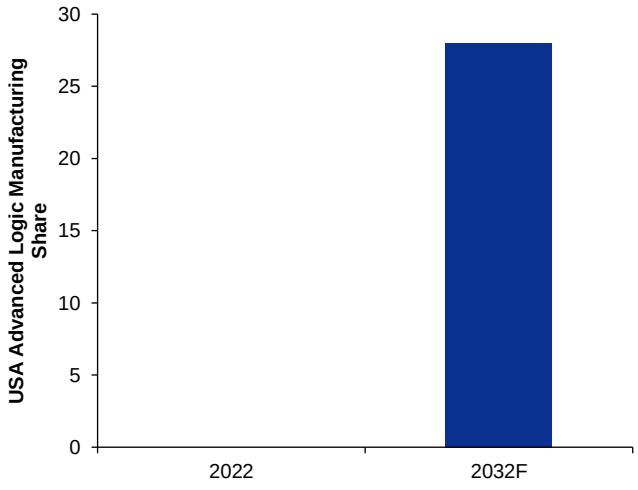
  Signed into law in Aug 2022, the Creating Helpful Incentives to Produce Semiconductors (CHIPS) and Science Act is intended to lure microchip manufacturing back to the US after several decades of individual companies offshoring the technology. Although the country produced close to 40 per cent of the world's semiconductor supply in 1990, that statistic has slipped to just 12 per cent.

Figure 43: US semiconductor supply share



SOURCE: SIA, INCRED RESEARCH

Figure 44: US advanced logic manufacturing share



SOURCE: SIA, INCRED RESEARCH

The CHIPS Act represents a US$52.7bn federal investment aimed at revitalizing the domestic semiconductor ecosystem.

Figure 45: CHIPS Act incentives breakdown

Funding Area	Allocation
Manufacturing Incentives	US$39bn
R&D and Technology Hubs (NSTC, Advanced Packaging Program)	US$13.2bn
Workforce Development and National Security	~US$500m

SOURCE: INCRED RESEARCH

- Strategic goals and expected growth –

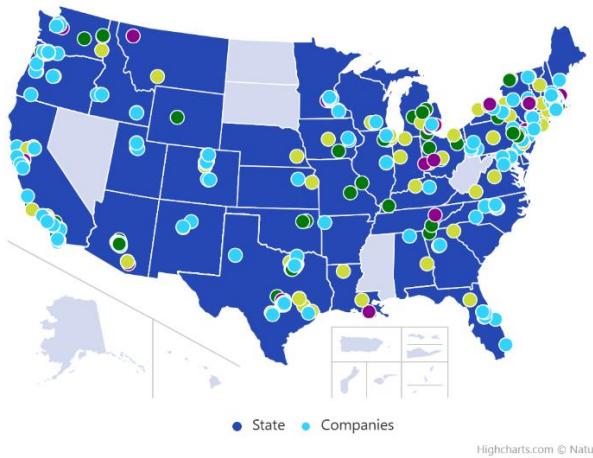
  The CHIPS Act is designed not merely to patch supply chain vulnerabilities, but to position the US as a global semiconductor powerhouse over the next decade.

According to SIA projections: Over US$200bn in private investments have already been announced by companies in semiconductor manufacturing, equipment, and materials since the CHIPS Act was passed, more than 50 new semiconductor ecosystem projects — including fabs, assembly/test facilities, and material plants — have been announced across 20 US states.

The goal is to raise US global semiconductor manufacturing share from ~10% today to ~14% by 2030F, with a particular focus on advanced-node (<5nm) fabrication.

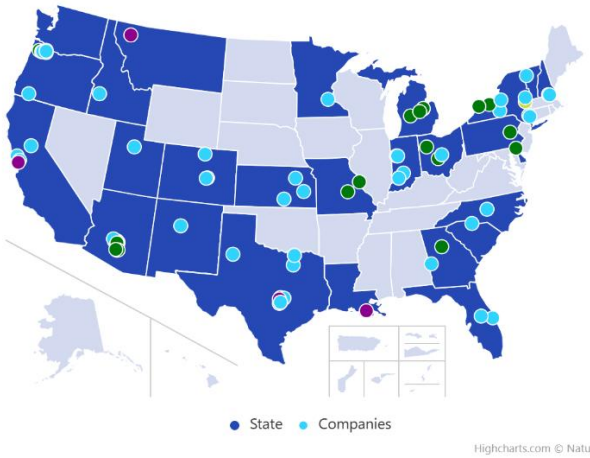
Specific targets include establishing 2nm and 3nm process node fabs domestically (e.g., Intel Ohio, TSMC Arizona) and building National Advanced Packaging Manufacturing Program (NAPMP) hubs to leapfrog in chiplet, 3D packaging, and heterogeneous integration technologies.

Figure 46: Existing semiconductor facilities in the US



SOURCE: SIA, INCRED RESEARCH

Figure 47: Announced new and expansion semiconductor projects in the US



SOURCE: SIA, INCRED RESEARCH

Japan

- Rise through US alliance, manufacturing excellence, & strategic innovation –

  Japan's semiconductor rise in the post-war era was closely intertwined with US Cold War policy. After 1945, America encouraged Japan's industrial recovery, providing technology transfers, licensing of semiconductor designs, and trade access to strengthen a key regional ally.

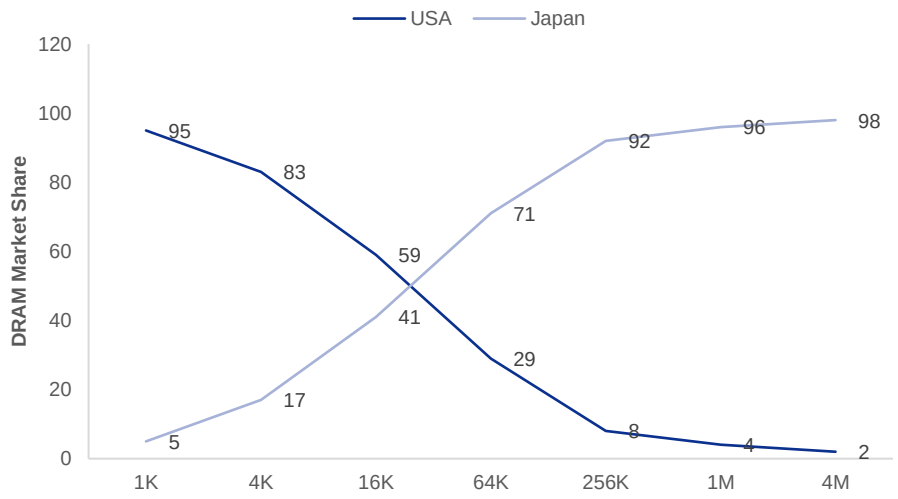
  Japanese companies, notably NEC, Fujitsu, Toshiba, and Hitachi, seized this opportunity — not only adopting US designs but outperforming them in manufacturing quality and yield. A key example was DRAM memory: although Intel invented DRAM, Japanese companies achieved significantly higher manufacturing yields, enabling them to dominate global memory markets by the early 1980s, reaching over 80% global DRAM share.

  Beyond semiconductors, Japan built global leadership in consumer electronics through products like pocket calculators (Casio, Sharp) and Sony's Walkman, combining miniaturization expertise with mass production efficiency.

  Japan's success was further aided by government support via MITI (coordinated R&D and industrial policy), strong engineering talent investment and a favourable export environment, with a relatively weaker yen making Japanese products globally competitive.

  By the mid-1980s, Japan had emerged as a semiconductor and electronics powerhouse, triggering competitive concerns in the US and shaping the industry's next phase.

Figure 48: Maximum market share of DRAM device (%)



SOURCE: DATAQUEST (RESEARCHGATE), INCRED RESEARCH

- Gradual decline: Economic stagnation and competition –

  Japan's dominance in the global semiconductor market began to erode by the late 1980s, driven by a mix of internal economic challenges and rising external competition. The collapse of Japan's asset price bubble around 1990 ushered in a prolonged period of economic stagnation, often referred to as the "Lost Decade." With corporate profits under pressure, private sector investment in semiconductor R&D slowed significantly at a time when technological advancement was becoming increasingly capital-intensive.

  At the same time, growing friction with the US over Japan's semiconductor market practices led to the signing of the 1986 US-Japan Semiconductor Trade Agreement. Under this agreement, Japan agreed to open its domestic semiconductor markets to foreign suppliers and refrain from dumping DRAM chips at below-cost prices abroad. While intended to rebalance trade, the agreement also placed constraints on Japanese companies' ability to compete aggressively during a critical transition period for the industry.

  Meanwhile, new competitors rapidly emerged. South Korean companies like Samsung and Hyundai Electronics (later SK Hynix) entered the DRAM market with significant government support, investing heavily to match and eventually surpass Japanese manufacturers. Taiwan, too, made a strategic move with the founding of TSMC in 1987, creating a pure-play foundry model that allowed fabless chip designers to flourish without owning manufacturing facilities — a structural shift Japan was slow to adapt to.

  Compounding these challenges was Japan's heavy reliance on DRAM and memory products, even as the global semiconductor landscape shifted toward logic chips, system-on-chip (SoC) designs, and specialized processors. Japan's limited presence in these emerging segments further accelerated its relative decline. By the mid-1990s, Japan's share of global semiconductor sales had fallen below 25%, a dramatic drop from its near-50% peak a decade earlier, as the industry's centre of gravity moved toward the US, South Korea, and Taiwan.

- Japan's role in today's value chain -

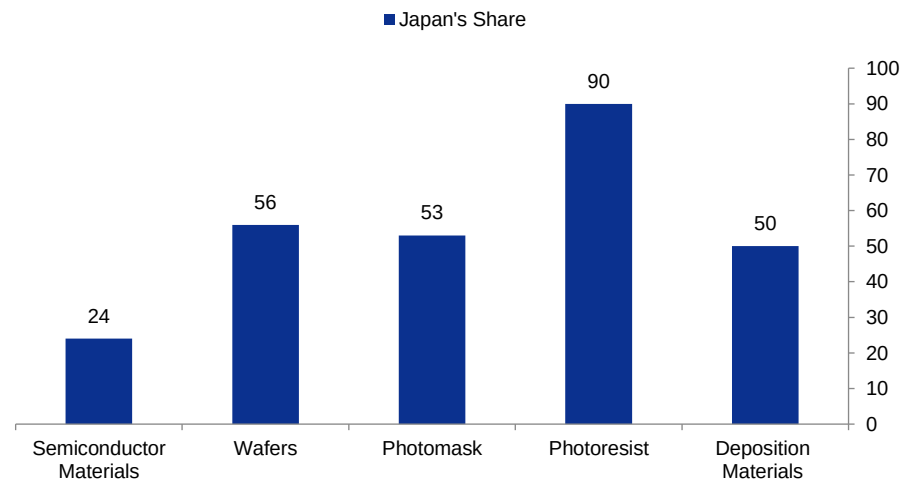
  Japan no longer leads global semiconductor manufacturing in volume terms but remains a critical enabler of the industry through its strength in equipment and materials. Japanese companies account for about 35% of the global semiconductor equipment market, led by players like Tokyo Electron, Canon, Nikon, and Advantest, supplying essential etching, deposition, and testing tools.

  In materials, Japan's position is even stronger. Companies such as Shin-Etsu, Sumco, and JSR meet over 50% of the global demand for silicon wafers,

photoresists, and specialty chemicals. For EUV lithography in advanced nodes, Japan dominates photoresist supply, contributing over 90% globally.

Although Japan plays a limited role in chip design and logic manufacturing today, its upstream ecosystem remains essential. Even the world's most advanced fabs rely heavily on Japanese tools and materials, securing Japan's place as a foundational pillar of the global semiconductor value chain.

Figure 49: Japan's dominant share in the semiconductor supply chain (%)



SOURCE CENTER FOR SECURITY AND EMERGING TECHNOLOGY, INCRED RESEARCH

- Future focus areas –

Japan is executing a focused semiconductor revitalization strategy led by the Ministry of Economy, Trade and Industry (METI), targeting leadership in advanced manufacturing, materials, and supply chain security.

The centrepiece of this strategy is the Rapidus project, a consortium backed by major Japanese companies such as Toyota, Sony, NEC, and Denso, in collaboration with IBM and IMEC, aiming to develop 2nm logic chips with pilot production expected by 2027F. Parallelly, TSMC's Kumamoto facility, developed with Sony and Denso, is scheduled to begin operations by 2024–2025F, focusing on mature-node chips (22nm/28nm) crucial for automotive and industrial applications.

From an economic security perspective, over the past three years, Japan has allocated approximately ¥3.9tr (~US$27.5bn), equivalent to 0.71% of its GDP, through supplementary budgets to support the semiconductor industry. This includes ¥1.2tr committed to TSMC's Kumamoto project and ¥920bn allocated to Rapidus for advancing next-generation semiconductor R&D and manufacturing.

The funding structure broadly covers: Manufacturing capacity support (e.g., fab construction subsidies), advanced R&D investments (2nm technology, packaging innovation), supply chain resilience programs (domestic materials production and rare gas security).

Beyond fabrication, Japan is reinforcing its global dominance in semiconductor materials — commanding over 50–60% share in areas such as silicon wafers, photoresists, and CMP slurries — while also pushing aggressively into compound semiconductors like gallium nitride (GaN) and silicon carbide (SiC) to power EVs and next-gen communications.

Supply chain security is another strategic pillar, with Japan actively reshoring critical semiconductor supply lines and strengthening ties with partners such as the US and the EU to reduce overdependence on China.

Rather than competing purely on volume, Japan's strategy is to become indispensable to the global semiconductor ecosystem through advanced technology leadership, materials expertise, and resilient supply chains.

Taiwan: The foundry powerhouse ➤

- Strategic beginnings: From assembly to advanced manufacturing –

  Taiwan's semiconductor journey initially began in the electronics assembly sector during the 1960s and 1970s, leveraging low-cost labour to attract US companies looking to outsource production. Major American companies established assembly lines for consumer electronics, setting the foundation for Taiwan's industrial growth.

  Recognizing the need to move up the value chain, Taiwan's government made a strategic decision in the late 1970s to invest in higher-value semiconductor manufacturing. Through the Industrial Technology Research Institute (ITRI), Taiwan began building technical expertise. A critical turning point came when the government recruited Morris Chang, a former senior executive at Texas Instruments, to spearhead this transformation.

  The government provided Morris Chang with substantial financial backing and strategic autonomy to establish a new semiconductor model focused solely on manufacturing. Rather than following the traditional Integrated Device Manufacturer (IDM) approach, Chang pioneered the pure-play foundry model, concentrating exclusively on chip fabrication for external clients without internal design operations.

  This led to the founding of Taiwan Semiconductor Manufacturing Company (TSMC) in 1987, with significant government support. TSMC's business model of serving global fabless companies confidentially and efficiently would go on to fundamentally reshape the global semiconductor landscape.

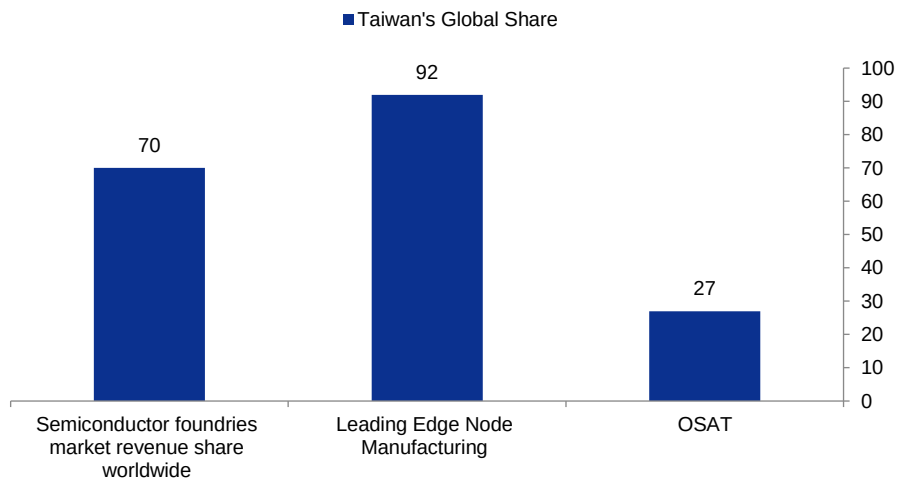
- Taiwan's rapid rise to foundry dominance –

  Through the 1990s and 2000s, TSMC and UMC (United Microelectronics Corporation) expanded rapidly, riding the rise of fabless giants like Qualcomm, Nvidia, and Broadcom. As chip design and fabrication became more expensive at smaller nodes, the traditional IDM model became increasingly burdensome. Companies like AMD split off manufacturing arms (forming GlobalFoundries), specializing purely in design, while Intel, which retained the IDM model, faced growing challenges in keeping pace at leading-edge nodes.

  Meanwhile, TSMC's pure-play foundry strategy allowed it to aggregate global fabless demand, scale rapidly, and lead process technology migration. Leveraging this specialization, Taiwan transitioned from being a low-cost electronics assembler to the world's leading centre for advanced semiconductor manufacturing. Additionally, Taiwan's drive to move up the value chain was also motivated by national security concerns. As mainland China continued to develop its own low-cost manufacturing capabilities, there was a significant risk that Taiwan's cost advantage in assembly could be undercut. Moving into higher value-added semiconductor manufacturing was seen as critical to maintaining economic competitiveness and strategic independence. Today, TSMC manufactures ~90% of the world's leading-edge chips (5nm and 3nm) and dominates global foundry revenue.

  Taiwan's semiconductor position:

Figure 50: Taiwan's dominance in the semiconductor supply chain (%)



SOURCE: INCRED RESEARCH

- Taiwan's role in today's value chain –

  Taiwan sits at the centre of global semiconductor manufacturing, particularly at leading-edge nodes: TSMC dominates pure-play foundry services, ASE Group leads in outsourced semiconductor assembly and testing (OSAT).

  Taiwan has strong capabilities in advanced packaging technologies (2.5D and 3D integration) essential for AI and HPC chips. However, Taiwan's dominance also presents geopolitical vulnerabilities, especially given rising cross-Strait tensions and dependence on foreign EDA tools and equipment.

- Future focus areas –

  Facing rising geopolitical risks and intensifying global competition, Taiwan's semiconductor strategy focuses on expanding technological and operational resilience.

  On the technology front, TSMC is making significant investments into 2nm node development, targeting mass production by 2025–26F. Parallel R&D into next-gen node class technologies is also underway to maintain its leading-edge advantage. Recognizing the geopolitical risks of supply chain concentration, TSMC is pursuing geographic diversification. New fabrication facilities are being developed in Arizona (US) for 4nm and 3nm production, Kumamoto (Japan) for 22/28nm nodes with future advanced node expansions, and Dresden (Germany) focused on mature-node manufacturing to serve the automotive and industrial sectors.

  In parallel, Taiwan is consolidating leadership in advanced packaging and next-generation 3D chip stacking technologies critical for AI accelerators and High-Performance Computing (HPC) systems. Supply chain resilience remains a priority, with efforts underway to localize specialty gases, chemicals, and semiconductor-grade materials to mitigate foreign dependency risks.

  Thus, while Taiwan retains an unmatched technological lead today, the coming decade will test its ability to balance cutting-edge innovation with geographic diversification, supply chain security, and geopolitical risk management.

China

- Late start but strategic focus –

  China's semiconductor industry started significantly later than those of the US, Japan, or Taiwan. In the 1990s and early 2000s, China was primarily a low-cost manufacturing hub for electronics assembly, with limited indigenous chip design or fabrication capabilities.

  Recognizing semiconductors as a cornerstone for technological self-sufficiency, China launched its first major national strategy in 2000 with the 'National IC Industry Promotion Outline.' This was followed by stronger

initiatives like the ‘Made in China 2025’ plan announced in 2015, which specifically targeted boosting China's semiconductor design and manufacturing capabilities.

Massive state funding through vehicles like the National Integrated Circuit Industry Investment Fund (‘Big Fund’), established in 2014 with over US$30 bn in initial capital, catalyzed growth. China prioritized domestic champions such as SMIC (foundry), HiSilicon (design, under Huawei), YMTC (memory), and CXMT (DRAM).

- Rapid growth but persistent gaps –

  Throughout the 2010s, China made significant progress: HiSilicon's Kirin series rivalled top global smartphone processors, SMIC advanced from 40nm to 14nm manufacturing nodes and has reportedly made early progress on 7nm technology under heavy US export restrictions, and YMTC launched 128-layer 3D NAND memory chips, closing the gap with Korean and American leaders.

  However, China’s semiconductor system has also faced structural weaknesses. Lack of strong intellectual property (IP) protection, inconsistent enforcement of contracts, and widespread issues of technology misappropriation created long-term credibility challenges. These factors discouraged deeper foreign collaboration and led to scepticism among leading technology companies, limiting knowledge transfer and joint ventures that could have accelerated China's progress.

  In addition, despite these achievements, China remains heavily reliant on foreign technology: EDA software, lithography tools (e.g., ASML’s EUV machines), and advanced manufacturing equipment are dominated by the US Japanese, and Dutch companies, 14nm and above manufacturing nodes are widely available, but China lags in sub-7nm mass production, and US export controls imposed in 2019–2023, including restrictions on advanced equipment and AI chip access, have further slowed China's progress.

- China’s role in today’s value chain -

  China is the largest consumer market for semiconductors globally, driven by its massive electronics, automotive, and data centre industries.

  In manufacturing, China holds approximately 30% of the world’s semiconductor manufacturing capacity, largely concentrated in mature-node technologies. It also leads in packaging and testing (OSAT), accounting for around 30% of the global OSAT market, with major companies like JCET and Tongfu Microelectronics among the world's top OSAT players.

  Despite these strengths, China's semiconductor ecosystem remains incomplete. Critical areas like advanced logic fabrication (sub-7nm nodes), Electronic Design Automation (EDA) tools, and cutting-edge memory technologies continue to rely heavily on foreign suppliers, particularly from the US, Japan, and the Netherlands.

  However, China is making notable strides to overcome these gaps. SMIC is reported to be manufacturing 7nm, 6nm, and developing 5nm process nodes by using advanced Deep Ultraviolet (DUV) lithography and multi-patterning techniques, bypassing the need for restricted EUV machines. This approach showcases China's growing technical ingenuity under sanctions.

  It stands in contrast to the experience of the Soviet Union during the Cold War, which primarily relied on copying Western designs and continually lagged years behind American semiconductor innovations. In comparison, China is actively trying to innovate around restrictions rather than merely replicate past technologies.

  Geopolitical factors, particularly US-led export restrictions targeting critical equipment and technologies, have exacerbated these vulnerabilities. As a result, China is intensifying efforts to localize its semiconductor supply chain, investing aggressively to close technology gaps and achieve greater self-reliance.

Additionally, systemic issues such as a historically weak framework for intellectual property (IP) protection, inconsistent contract enforcement, and earlier episodes of technology misappropriation have created long-term credibility challenges. These factors discouraged deeper foreign collaboration and slowed the pace of knowledge transfer and partnerships that could have otherwise accelerated China's technological growth.

- Future focus areas –

  China's semiconductor strategy today is centered on achieving self-sufficiency and mitigating risks from external sanctions. The government has intensified efforts to close technological gaps and build a fully indigenous semiconductor ecosystem.

  A major area of focus is advanced process technology. China continues to push the development of smaller nodes and enhance indigenous capabilities in chip manufacturing, aiming to gradually reduce its reliance on foreign technologies. Memory manufacturing is another priority. Companies like YMTC and CXMT are expanding NAND flash and DRAM production, although they remain behind Korean and US leaders in technological sophistication.

  To address supply chain vulnerabilities, China is supporting domestic EDA software and semiconductor equipment initiatives, backing players like Empyrean Technology to reduce the reliance on US suppliers. In addition, China is prioritizing AI chip development and domain-specific processors, aiming to build capabilities in edge computing and custom server chips as an alternative to direct competition with US GPU giants.

  The second phase of the Big Fund, with an estimated size of over US$45 bn, is being deployed to finance semiconductor startups and manufacturers across the value chain.

  While challenges persist, including a reliance on imported manufacturing equipment and structural inefficiencies, China's scale of investment and policy focus suggest it will continue closing gaps selectively in the semiconductor value chain over the next decade.

South Korea ➤

- Rise through state-led industrialization –

  South Korea's ascent in the semiconductor industry began in the late 1970s and 1980s as part of its broader strategy of export-led industrialization. Recognizing the strategic importance of electronics, the government supported chaebols (large conglomerates) like Samsung, Hyundai Electronics (now SK Hynix), and LG to enter the semiconductor sector.

  Initial progress was driven through technology licensing agreements with US and Japanese companies, supplemented by aggressive state support in terms of subsidies, infrastructure, and workforce development. By the mid-1980s, South Korean companies had begun to manufacture memory chips competitively.

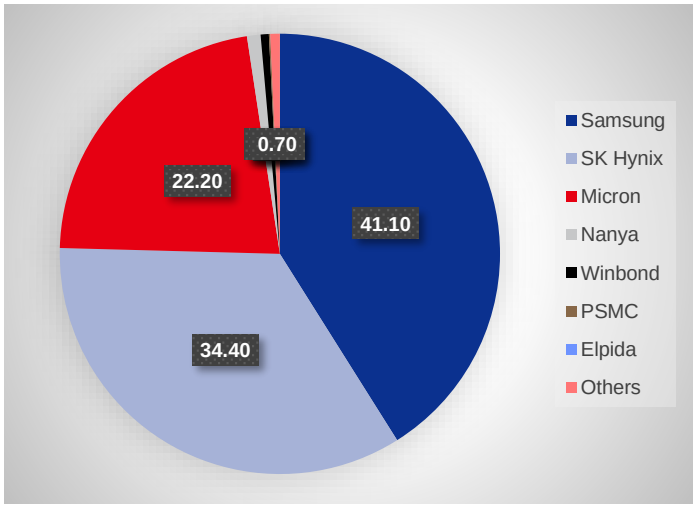
  In 1992, Samsung became the world's leading producer of DRAM memory, overtaking Japanese companies that had dominated the segment in the 1980s. This marked the beginning of South Korea's rise to global semiconductor leadership.

- Dominance in memory, expansion into logic –

  Through the 1990s and 2000s, South Korea consolidated its leadership in memory chips (DRAM and NAND flash), with Samsung and SK Hynix emerging as two of the top three global memory manufacturers.

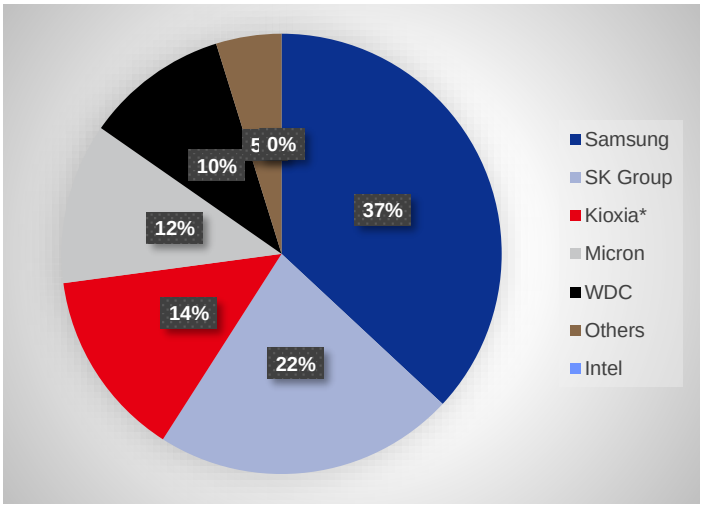
  Today, South Korea holds 75% share of DRAM market and ~60% share of NAND market and ~11% revenue share of the global semiconductor market.

Figure 51: DRAM manufacturers' revenue share worldwide (2024) (%)



SOURCE: TRENDFORCE, INCRED RESEARCH

Figure 52: NAND manufacturers' revenue share worldwide (2024)



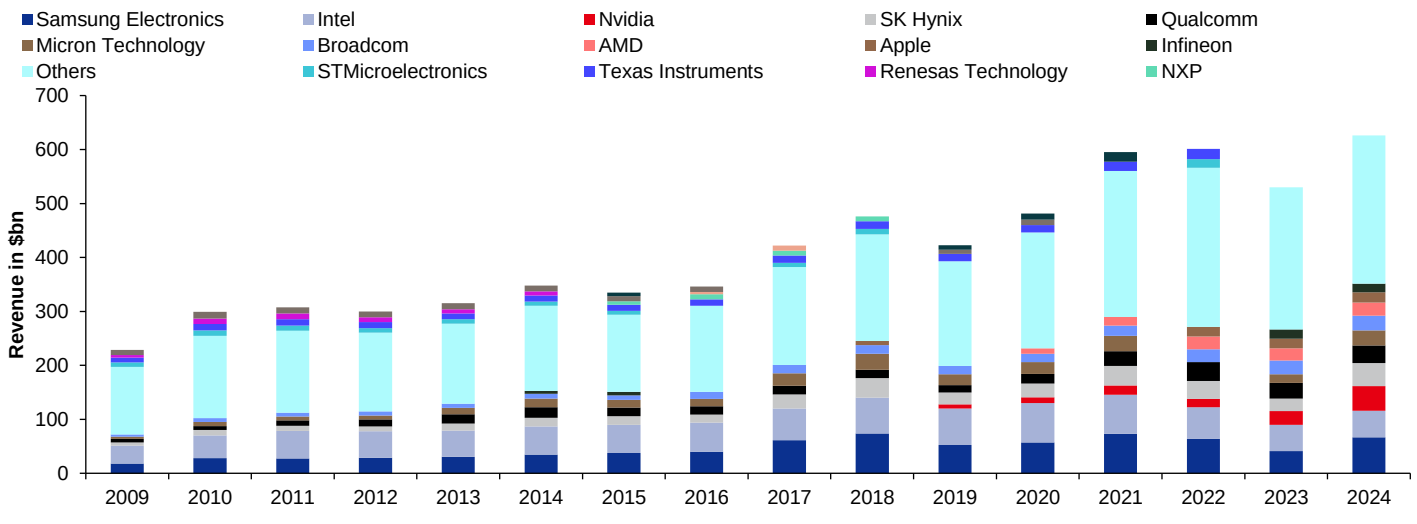
SOURCE: TRENDFORCE, INCRED RESEARCH

Samsung Electronics is the largest and most influential semiconductor company in South Korea and one of the most significant globally. Samsung is the world's largest memory chip producer and consistently ranks among the top two in overall semiconductor revenue. It operates across DRAM, NAND flash, and has an aggressive presence in foundry services, competing with TSMC in leading-edge nodes.

Samsung was the first to start volume production at the 3nm gate-all-around (GAA) transistor structure, ahead of TSMC, and is investing heavily into 2nm process technology, aiming to commercialize it by 2025–26F. Beyond manufacturing, Samsung is pushing hard into AI semiconductors, automotive chips, and next-generation packaging technologies to diversify its semiconductor revenue streams.

While both Samsung and Intel historically operated under the IDM (Integrated Device Manufacturer) model, Samsung has outperformed Intel by continuously investing heavily across the entire value chain and adapting faster to market shifts. Intel, meanwhile, faced significant delays and execution challenges in transitioning to smaller process nodes. Samsung's disciplined capital investments, strategic diversification into memory and foundry businesses, and aggressive process innovation helped it stay competitive globally, whereas Intel struggled with manufacturing setbacks and increased dependence on external foundry services.

Figure 53: Semiconductor companies' market revenue worldwide during 2009-24



SOURCE: GARTNER, INCRED RESEARCH

Global semiconductor landscape: Current benchmarks and future outlook ➤

The strategic semiconductor policies implemented by countries such as the US, Taiwan, South Korea, Japan, China, and the EU have already started to reshape the global manufacturing map. Each country's approach — whether through direct subsidies, R&D support, or supply chain localization — reflects their unique competitive advantages and geopolitical priorities.

The table below summarizes the key strengths, policy priorities, and manufacturing specializations of major semiconductor regions today. It provides a snapshot of where each player currently stands in the race to control critical portions of the semiconductor value chain.

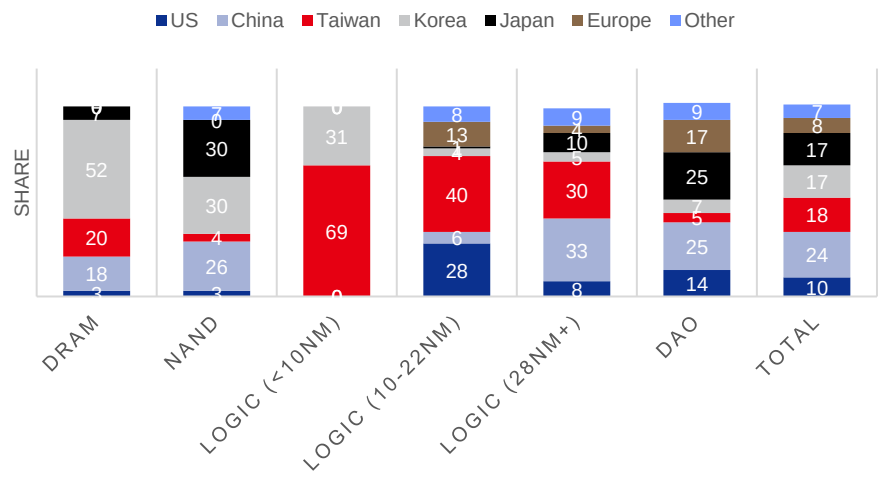
Figure 54: Analysis of semiconductor policies of different countries

Region	Key Incentive Amounts	Target	Key Initiatives	Guidance Measures	Impact (New Fab & ATP Investments Since 2020)
United States	US$52.7bn	Achieve resilience in semiconductor supply chain	CHIPS and Science Act; 100-day supply chain review	Grants under CHIPS Act; state-level support; private-public education programs	100+
Mainland China	US$150bn + from 2014-30F	Reach 70% self-sufficiency by 2025F	Big Fund I, II, III and local funds	State-owned enterprise leaders; tax credits	300+
European Union	US$47bn in grants and loans under EU Chips Act	Gain 20% global share by 2030F	Grants and loans under EU Chips Act; Digital Compass 2030F	State aid allowances; Industry-academia co-operation; tax credits	8
Japan	US$17.5bn in grants	Earn US$112bn in sales by 2030F	National fiscal funding; Leading-Edge Semiconductor Technology Centre	National science fund; industry-academia collaboration	4
South Korea	US$55bn in tax incentives	Secure foothold in logic; bolster fab leadership	Tax incentives under K-Chips Act; K-Belt Semiconductor Strategy	Industry-academia cooperation; tax credits	3
Taiwan	US$16bn in tax incentives	Breakthrough 1nm by 2030F	Financial subsidies under the Chip Innovation Program	Grants under the Chip Innovation Program	7

SOURCE: INCRED RESEARCH

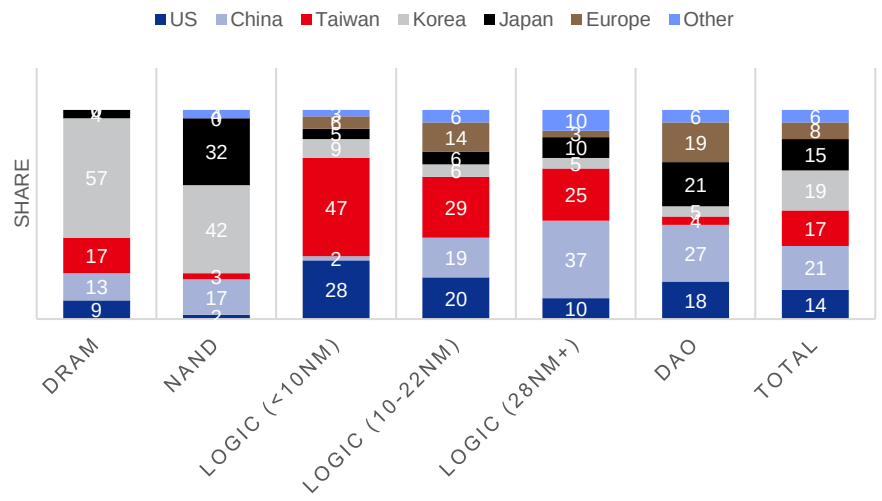
Going ahead, the global semiconductor value chain is poised for significant shifts. Regional fabrication capacities are expected to diversify, with emerging investments altering the traditional dominance patterns. Governments' active roles in incentivizing fabrication at both leading-edge and mature nodes will change not only where chips are made, but also how innovation ecosystems evolve around these hubs.

Figure 55: Global wafer capacity by technology by region (2022) (%)



SOURCE: DEPARTMENT OF COMMERCE, SEMI, INCRED RESEARCH

Figure 56: Global wafer capacity by technology by region (2032F) (%)



SOURCE: DEPARTMENT OF COMMERCE, SEMI, INCRED RESEARCH

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Add	The stock's total return is expected to exceed 10% over the next 12 months.
Hold	The stock's total return is expected to be between 0% and positive 10% over the next 12 months.
Reduce	The stock's total return is expected to fall below 0% or more over the next 12 months.

The total expected return of a stock is defined as the sum of the: (i) percentage difference between the target price and the current price and (ii) the forward net dividend yields of the stock. Stock price targets have an investment horizon of 12 months.

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Neutral	A Neutral rating means stocks in the sector have, on a market cap-weighted basis, a neutral absolute recommendation.
Underweight	An Underweight rating means stocks in the sector have, on a market cap-weighted basis, a negative absolute recommendation.

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Neutral	A Neutral rating means investors should be positioned with a neutral weight in this country relative to benchmark.
Underweight	An Underweight rating means investors should be positioned with a below-market weight in this country relative to benchmark.