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A multi-pronged strategy—improving infrastructure, investing in R&D, developing skills, diversifying supply sources, and building partnerships—can help India advance its semiconductor ambitions



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This article is part of the essay series - Nations, Networks, Narratives: World Telecommunication and Information Society Day 2025.

India's semiconductor industry is on the cusp of transformative growth, driven by a massive growth in telecommunications, consumer electronics, AI and IoT applications. In principle, India is strategically positioned to meet domestic and global semiconductor needs. However, the heavy reliance on imports and other resources, which currently stands at 90 percent of the country's semiconductor requirements, is addressed through external dependencies, exposing vulnerabilities within technological self-reliance and supply chain resilience.

The Indian electronics manufacturing sector is expected to grow significantly, reaching US\$ 520 billion by 2025. The increasing adoption of AI and IoT technologies is further accelerating this momentum, powering innovations from smart devices to industrial applications. In the semiconductor space, AI, in particular, has begun to revolutionise chip design. Encouragingly, India's semiconductor market is projected to grow from US\$ 52 billion in 2024 to over US\$ 103 billion by 2030, highlighting immense growth potential.

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This appears to be an opportune moment to build a comprehensive semiconductor ecosystem aimed not only towards reducing import dependency but also towards catalysing the country's rapidly growing electronics manufacturing sector. Through a combination of fiscal incentives, research, development and manufacturing initiatives, and international collaborations, India can lay the foundation for a resilient and competitive semiconductor ecosystem that can support long-term economic and digital growth.

Current Efforts

India is advancing its semiconductor ecosystem through strategic policy initiatives, global partnerships, and skill development drives. With targeted financial incentives, specialised training programmes and newer forms of cooperation, the nation aims to position itself as a global hub for semiconductor manufacturing, innovation, and talent development.

- **Policy Support:** India has taken strides to strengthen its semiconductor ecosystem through a series of enabling policy initiatives. The National Policy on Electronics, 2019, lays the foundation by offering special incentive packages for mega high-tech projects such as semiconductor fabrication units. Building on this, the Semicon India Programme, with an outlay of INR 76,000 crore, aims to develop a comprehensive semiconductor and display manufacturing ecosystem. It provides fiscal support on project costs for setting up Silicon (CMOS) semiconductor fabs, display fabs, compound semiconductor units, and assembly, testing, marking, and packaging (ATMP) facilities. A key component is the Design Linked Incentive Scheme, offering up to 50 percent support for product design expenses and 4 to 6 percent deployment incentives to boost chip design capabilities.

Additionally, the Indian Semiconductor Mission (ISM) has been established as an independent division within Digital India Corporation to coordinate the strategic execution of such initiatives. ISM oversees modified schemes to attract large-scale investments across the semiconductor value chain, from wafer fabrication and display manufacturing to advanced packaging and sensor production.

- **Skill Development:** India has taken significant initiatives to build a skilled workforce to support its growing semiconductor ecosystem, recognising that semiconductor manufacturing is a highly complex and technology-intensive sector. To address the talent gap, the All India Council for Technical Education (AICTE) has introduced specialised academic programmes, in Electronics Engineering—(Very Large Scale Integration (VLSI) Design and Technology), in Integrated Circuit (IC) Manufacturing, among others, aiming to create a strong foundational talent pool.

Additionally, India's Chips to Startup (C2S) programme is a flagship initiative designed to train 85,000 industry-ready professionals in VLSI and Embedded Systems Design across 113 institutions, with over 43,000 students already enrolled. The establishment of the Skilled Manpower Advanced Research and Training (SMART) Lab at NIELIT Calicut further accelerates nationwide training, having already equipped over 42,000 engineers with critical skills in VLSI and embedded systems.

Moreover, the India Semiconductor Mission (ISM) has signed key MoUs to foster industry-academia collaboration. Partnerships with IISc and Lam Research aim to train 60,000 engineers through the semi-verse platform over the next decade. Collaborations with IBM provide students and professionals access to research labs and internships, while the Purdue University MoU focuses on promoting cutting-edge research, talent development, and commercialisation in semiconductors. These strategic efforts underscore India's commitment to nurturing a world-class semiconductor workforce.

- **International Collaborations:** India has strengthened its semiconductor ecosystem by forging strategic international collaborations with major global partners. For instance, through a Memorandum of Understanding with the United States (US), India aims to enhance supply chain resilience, facilitate commercial opportunities and enhance innovation ecosystems while aligning with the U.S. CHIPS and Science Act, and India's Semiconductor Mission, while promoting joint research and talent development.

With the European Union, India has established both government and industry level cooperation to build a robust and diversified semiconductor supply chain. Additionally, its Memorandum Of Cooperation (MoC) with Japan focuses on leveraging mutual strengths to enhance semiconductor capabilities, foster digital technology advancement, and create employment opportunities in IT, reinforcing India's global semiconductor cooperation efforts.

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The Road Ahead

India's semiconductor ecosystem faces a range of complex challenges that could delay its emergence as a global manufacturing hub. Nonetheless, timely mitigating measures may help overcome these barriers to success.

- **Ensuring Policy Stability and Predictability:** One of the primary challenges is the highly capital-intensive nature of semiconductor fabrication, requiring substantial investments, continuous financial backing, and stable long-term policies. Although the Semicon India programme provides incentives covering up to 50 percent of project costs, setting up and running wafer fabrication plants (fabs) continues to be a hurdle, as India is still in the nascent phase of developing its first major fabs. In this context, stable, consistent and long-term policy support is crucial to build investor confidence and nurture the emerging semiconductor ecosystem.

- **Overcoming Infrastructure Challenges:** Infrastructure shortcomings, such as unreliable power supply and inadequate access to ultra-pure water, both critical for chip fabrication, pose additional hurdles. Despite possessing 6 percent of global rare earth reserves, India tends to depend on certain other countries for critical raw materials, indicating the need for supply chain diversification and enhancing domestic mineral processing capabilities.

- **Building a Talent Pool:** The shortage of manufacturing-skilled manpower is another pressing concern. Although India has a large chip design talent pool, the manufacturing side lacks trained personnel. While initiatives like the Chips to Startup (C2S) programme and Centres of Excellence are steps in the right direction, scaling them to industry standards is essential.

Furthermore, India's still-growing domestic R&D capacity may limit its competitiveness. This makes strategic partnerships with countries like the US, Japan, and the EU crucial, not only for technology transfers but also for enhancing supply chain resilience.

To negotiate these challenges, India must adopt a multi-pronged approach: strengthen domestic infrastructure, invest in R&D, expand skill development, diversify raw material and critical mineral supply sources, and develop technology partnerships. With sustained efforts in this area, India could move closer to realising its ambition of becoming a global semiconductor manufacturing powerhouse.