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Strategizing the Relations

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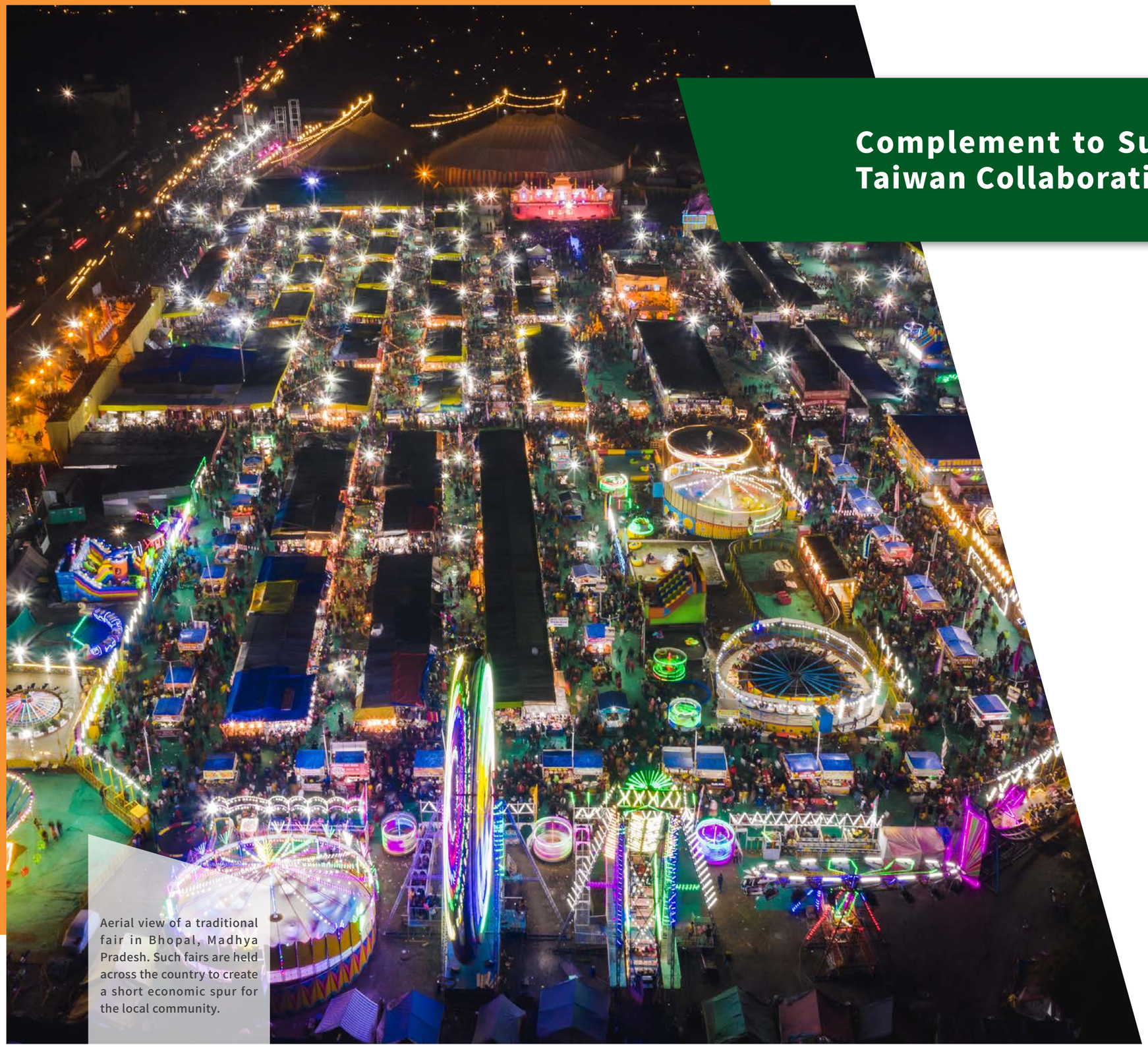

Aerial view of a traditional fair in Bhopal, Madhya Pradesh. Such fairs are held across the country to create a short economic spur for the local community.

Complement to Succeed: A Case for India-Taiwan Collaboration on Semiconductors

Arjun Gargeyas
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Introduction

Since the 1970s, the Taiwanese government and the private sector have together developed its semiconductor industry. In 2021, the country's two prominent contract foundry companies, the Taiwan Semiconductor Manufacturing Company (TSMC) and the United Microelectronics Corporation (UMC), jointly accounted for over 60 percent of the total global revenue semiconductor manufacturing.[1] Taiwan also houses companies like ASE, Siliconware Precision, and Powertech, which are leaders in the assembly, testing, and packaging segments of the semiconductor value chain.

India, over the years, has attracted major semiconductor firms to set up their R&D centres for chip development in the country. Of the ten largest fabless semiconductor companies by revenue in 2019, as many as seven have design houses in India (including the Taiwanese firm MediaTek). With a vast pool of skilled human talent, a world-class semiconductor design services industry has also emerged. Many engineers in this cohort have handled the entire Integrated Chip (IC) design cycle over three and half decades. India also has expertise in the downstream assembly of electronic components, with top Taiwanese contract manufacturers such as Wistron and Foxconn and South Korea's Samsung setting up bases in India.

Given these complementary strengths, semiconductors can become a crucial driver for the India-Taiwan relationship. Not only is this collaboration essential, but the supply chain vulnerabilities exposed by the COVID-19 pandemic and the ongoing geopolitical turmoil have made diversification of the supply chain an urgent matter. A resilient semiconductor supply chain will benefit not just India and Taiwan but the world at large.

In this article, we provide a brief overview of the history of India-Taiwan technology ties, identify critical drivers for the partnership, and propose tangible recommendations for collaboration between the two nations.

A Brief History of India-Taiwan Technology Ties

Although technology trade between the two countries has blossomed in information technology (IT), solar cells, and electronics in recent years, bilateral trade is dominated by metals, minerals, and chemicals. In 2018, India exported US$ 38.34 million worth of apparatus for communications equipment while it imported US$ 71.12 million worth of integrated circuits.[2]

The picture is much brighter when it comes to technology investments. In 2015, the electronics manufacturing firm Hon Hai (also known as Foxconn) had expressed interest in constructing twelve factories in India to manufacture Apple's iPhones. Foxconn started manufacturing Gionee phones in India back in 2016. In March 2021, news reports claimed that Foxconn's Tamil Nadu plant would assemble Apple iPhone 12, making it the first flagship product made outside China.[3] The Taiwanese semiconductor design firm MediaTek has a prominent presence, with the firm deciding to triple its Indian workforce back in 2019. MediaTek's investment in India also includes a subsidiary in Noida, an R&D centre in Bengaluru, and a stake in the e-commerce company PayTM.[4]

Initiatives like the 'Make in India' scheme have also improved Taiwan's technology engagement with India. A US$ 200 million investment deal between the Indian telecommunications firm Optiemus Infracom and the Taiwanese company Wistron Corporation was struck in 2018 to initially manufacture telecommunications equipment in India over the next five years.[5] Additionally, the Taiwan Electrical and Electronic Manufacturers' Association (TEEMA) and the Chinese smartphone manufacturer Oppo jointly proposed an 'electronic manufacturing cluster' in Noida in 2019.[6]

Foxconn and Wistron have also been approved under the Production-linked Incentives (PLI) for IT hardware. They stand to receive incentives for increasing manufacturing in their India plants. Subsequently, in August 2021, Wistron signed an agreement with Optiemus Electronics to make mobile devices in addition to IT hardware, and telecom products.[7]

With deepening partnerships between companies in electronics assembly, semiconductors serve as a perfect step for deepening this collaboration. Taiwan's New Southbound Policy (NSP) and India's Act East Policy provide the impetus to strengthen technology ties.

The Key Drivers

Three key global drivers are necessitating a particular focus on semiconductors: geopolitical, economic, and technological.

Geopolitically, semiconductors have become an area of confrontation between the United States and the People's Republic of China (PRC). The pandemic has further exacerbated the situation leading to an acute shortage of chips for automobiles, medical devices, and other sectors. A hyper-globalized semiconductor supply chain with inherent dependencies has been a critical driving force for the rapid improvements in the performance capabilities of electronics devices around us. This supply chain structure prevents even the most technically advanced states from achieving complete self-resiliency, hence making partnerships between like-minded nations to secure the semiconductor supply chain an absolute necessity. Recognising this, the Quad countries — United States, Japan, Australia, and India — announced a Semiconductor Supply Chain Initiative in the first in-person Summit meeting in September 2021.[8] Taiwan, home to over 60 percent of the world's contract chip manufacturing, is a crucial player in the race for building a robust semiconductor supply chain. By involving Taiwan in this Semiconductor Supply Chain Initiative, all five countries will be able to address the weaknesses they possess in the semiconductor value chain and reduce dependence on strategic adversaries.

Economics-wise, it is not straightforward to scale the manufacturing supply to meet the increasing demand. Taiwan and its foundries alone cannot meet the increased demand for the 8-inch and 12-inch wafers. There has been a capacity override for different chipsets, with the utilisation for the eight and 12-inch wafers reaching 100 percent.[9] The capacity increase rate remains slower than the demand increase rate, with foundries reluctant to expand the 8-inch wafer capacity and companies taking almost 1.5-2 years to build a 12-inch wafer fab. Further delays caused by power outages and accidents due to fires, storms have effectively discouraged firms from scaling up operations. Hence, foundries like TSMC have signed contracts to build fabs on international soil, such as the upcoming 12-inch fabrication facility in the Arizona state of the United States. Major foundries are looking to expand their operations to different countries which can provide them with facilities to meet the future demands for semiconductor chipsets. As a semiconductor design powerhouse, India has the potential to be one of the favourable destinations for Taiwanese semiconductor manufacturing firms to set up fabrication facilities for meeting global demands.

Third, emerging technologies need high-performance semiconductor chips with ample computing power (specifically those less than 7 nanometre technology). The telecommunications infrastructure to be deployed for 5G will include satellites and mobile edge computing technology that require advanced chips.[10] Artificial Intelligence (AI) deployment needs new computational architectures to handle increased in-chip data flows. As these technologies evolve, the semiconductor design and manufacturing processes also need to grow to meet customers' needs. These developments offer another area for cooperation between the two semiconductor industries.

Potential Collaboration Areas

There are significant opportunities for India-Taiwan collaboration across the entire semiconductor supply chain. We list a few ideas below.

Semiconductor R&D

The two governments could set up centres of excellence (CoE) for new design architectures, new technical standards, or composite semiconductors research.[11] The CoE can bring together universities and companies from both countries. Research in these critical areas will help not just India and Taiwan but the world at large.

Semiconductor IC Design

The two governments can play a significant role in enabling strategic cooperation between the companies of both countries. Whether it is licensing agreements, cross-licensing agreements, technology exchange, visitation and research participation, or joint development, each of these modes of cooperation needs government support. For instance, easing restrictions on capital flows could facilitate more licensing agreements between companies. Faster visa processing and lowering cross-border employment barriers can fasten technology exchange and joint development. Taiwan itself became an industry powerhouse due to a favourable trade and technology transfer regime.

Moreover, Taiwan also has a thriving fabless industry, with design firms like MediaTek dominating the landscape in the country. India, a dominant force in

the semiconductor design services market, can offer an extremely well-equipped workforce to help Taiwanese IC design companies. More Taiwanese companies setting up their design shops in India can have mutual benefits.[12]

Semiconductor IC Manufacturing

Given the semiconductor supply crunch, the United States, European Union, and Japan are courting Taiwanese companies to set up new leading-edge semiconductor manufacturing facilities. The opportunity for India-Taiwan collaboration here is a complementary one. Instead of focusing on the leading-edge nodes, India and Taiwan can look towards specialized analog fabs built on older technology nodes (such as the 65-nanometre feature size). Focusing on the older technology nodes will reduce the economic risk of failures.

Further, semiconductor manufacturing is a capital-intensive stage requiring billions of dollars of upfront and recurring investment.[13] Therefore, lowering import tariffs or customs duties on products and equipment necessary for semiconductor manufacturing are critical for attracting investment from Taiwan.

Semiconductor IC Assembly, Testing, and Packaging

There is a lot more promise in the Outsourced Assembly and Test (OSAT). These plants test the manufactured chips for defects and ensure protective packaging for all finished chips. This stage requires high capital investment, though not of the same order as the manufacturing stage requires. Further, this stage requires large numbers of relatively low-skilled labour, whereas the manufacturing stage requires a sizeable high-skilled workforce. With low-skilled labour better available in India, Taiwanese firms like ASE Technology and Powertech Technology can benefit by offshoring these operations to India.[14] The Indian government has also announced several incentives in this area that Taiwanese companies can avail themselves. [a]

Besides these bilateral initiatives, the two countries can also do more on multilateral initiatives. The complexity of the semiconductor supply chain means that multilateralism is a necessity and not a choice. Even a Quad Semiconductor Supply Chain Initiative cannot by itself eliminate all bottlenecks in the supply chain. Thus, it would be beneficial to make the Quad Semiconductor Supply Chain Initiative a platform that, over time, brings onboard Taiwan and other major powers in this arena.

Conclusion

Semiconductors are a meta-critical technology that will drive many other critical and emerging technologies in the future. The economics of this hyper-globalised industry is such that no country can afford to become fully self-reliant. India and Taiwan have complementary strengths in this area and stand to benefit by implementing the recommendations highlighted in this article. ■

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[a] The Scheme for Promotion of Manufacturing of Electronic Components and Semiconductors (SPECS) by the Ministry of Electronics and Information Technology (MeitY), India will provide financial incentive of 25% on capital expenditure for the identified list of electronic goods that comprise downstream value chain of electronic products, i.e., electronic components, semiconductor/ display fabrication units, ATMP units, specialized sub-assemblies and capital goods for manufacture of aforesaid goods, all of which involve high value-added manufacturing.

The Scheme will be applicable to investments in new units and expansion of capacity/ modernization and diversification of existing units. Application under the Scheme can be made by any entity registered in India. The capital expenditure will be total expenditure in plant, machinery, equipment, associated utilities and technology, including for Research & Development (R&D).

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