

## Developing ASEAN's Semiconductor Industry: Insights from Taiwan and South Korea

By Lili Yan Ing and Ria Fortuna Wijaya

*To advance up the regional value chains, ASEAN countries need to invest in semiconductor capabilities and collaborate, with each nation specialising in different supply chain aspects for a more resilient industry.*

The global semiconductor industry is a cornerstone of modern technology, driving innovation across a wide array of sectors such as consumer electronics, computers, automotive, information and communication technologies (ICT), digital technologies, and artificial intelligence (AI). As the demand for semiconductors continues to surge, the ASEAN region has been gaining recognition for its pivotal role in this field. The growth of the semiconductor industry in ASEAN has been partly driven by rising tensions between the US and China, as well as the well-established semiconductor sectors in Southeast Asia, particularly in Singapore and Malaysia.

The US-China tensions in trade, technology, and security have positioned ASEAN as an alternative for the diversification of input imports and for FDI relocation. In terms of trade diversification, total exports of goods from ASEAN increased by 26.1 percent, from

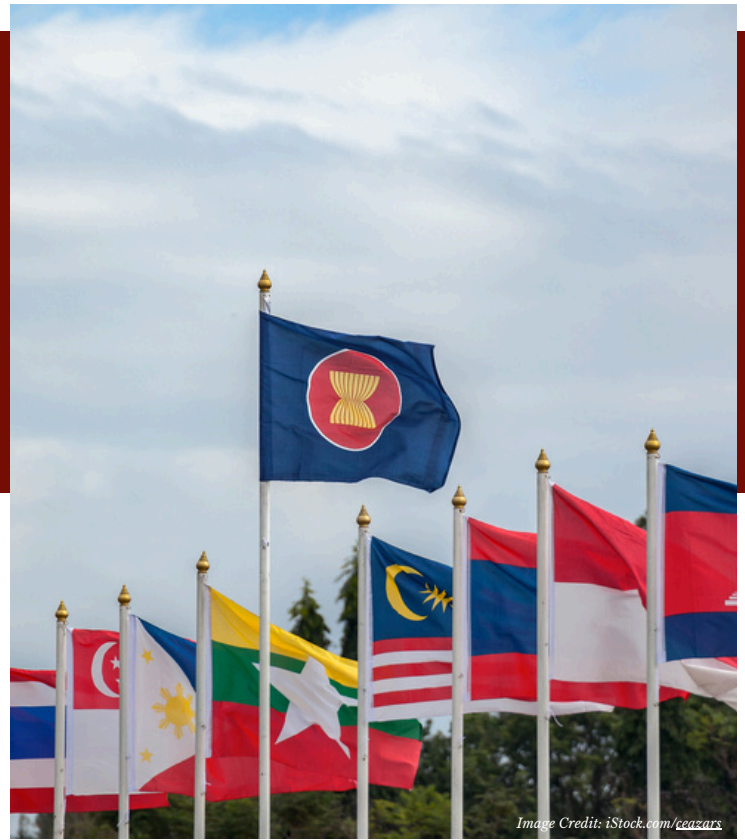


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USD 1.43 trillion in 2018 to USD 1.81 trillion in 2023. In 2023, ASEAN exports to the US surged by 68.4 percent, from USD 142.4 billion in 2018 to USD 269.8 billion, while exports to Europe rose by 11 percent, from USD 141.1 billion in 2018 to USD 156.6 billion. During the same period, while FDI into China dropped by 91.5 percent, FDI into ASEAN increased by 58 percent (aseanstats.org, accessed on 30 July 2024).

In 2023, ASEAN's top export categories by value to the world included electrical machinery and equipment, fuels and oils, and mechanical appliances. Notably, the region saw significant growth in semiconductor exports, which increased by 41.6 percent, rising from USD 189.9 billion in 2018 to USD 268.8 billion in 2023. This growth highlights ASEAN's substantial role in the global semiconductor market. In 2023, the total value of the world's semiconductor exports reached USD 1.14 trillion, with ASEAN

contributing USD 268.8 billion, accounting for 23.6 percent of the global semiconductor exports (ITC Database, accessed on 31 July 2024).

To further develop the semiconductor industry in ASEAN, the success stories of Taiwan and South Korea—two of the world’s semiconductor powerhouses—can offer valuable lessons that ASEAN countries can learn from and apply.

### Strategic Investments

One of the fundamental factors behind the success of Taiwan and South Korea in the semiconductor industry is the proactive role of their governments in developing not only hard infrastructure, but also soft infrastructure. In Taiwan, the government laid the groundwork for the semiconductor industry as early as the 1980s by establishing the Hsinchu Science Park, a hub for technology and innovation. This initiative was complemented by **substantial government investment in research and development** (R&D), creating a fertile environment for companies like Taiwan Semiconductor Manufacturing Company (TSMC) to thrive. Today, TSMC is the world’s largest contract chipmaker, accounting for over 50 percent of the global semiconductor market share.

Similarly, the South Korean government played a crucial role in the rise of its semiconductor industry. The ‘Miracle on the Han River,’ a term that describes **South Korea’s rapid industrialisation and**

**economic growth, was partly fuelled by substantial government support** for key industries, including semiconductors. The South Korean government provided tax incentives and developed infrastructure to bolster semiconductor firms. Companies like **Samsung Electronics and SK Hynix benefitted** from these policies, enabling them to become global leaders in semiconductor manufacturing and memory chips.

For ASEAN, the lesson is that government support is crucial. Countries like Singapore, Malaysia, and Vietnam have recognised this by offering incentives to attract semiconductor investments. However, it is important to ensure that these incentives are focused on providing infrastructure and encouraging innovation and R&D, with a clear framework outlining how to obtain these incentives and a defined exit strategy. This approach will prevent governments from being trapped in a cycle of providing endless incentives without any evident outputs and/or outcomes. Additionally, a more coordinated regional approach could further strengthen ASEAN’s position. This initiative should be agreed upon and supported by all ASEAN countries, with **Singapore and Malaysia** potentially leading the effort, as they are relatively advanced in the semiconductor industry compared to their peers. Establishing semiconductor hubs, akin to Taiwan’s Hsinchu Science Park, and investing in R&D are essential steps for ASEAN countries to develop a competitive edge in this high-tech industry.

### Industry–Academia Collaboration

Another key factor in the success of Taiwan and South Korea's semiconductor industries is the strong collaboration between industry and academia. In Taiwan, the **Industrial Technology Research Institute (ITRI)** played a pivotal role in bridging the gap between research and industry. ITRI's efforts in semiconductor R&D provided the technical expertise that local companies needed to innovate and compete on a global scale. This collaboration has been instrumental in driving continuous innovation, enabling Taiwan to stay at the forefront of semiconductor technology.

South Korea adopted **a similar approach**, with both **the government and private sector investing** heavily in education and training programs specifically tailored to the semiconductor industry. Universities, vocational training centers, and research institutions in South Korea work closely in collaboration with companies like **Samsung and SK Hynix** to ensure a steady pipeline of skilled engineers, researchers, and workers. This symbiotic relationship between academia and industry has been vital in maintaining South Korea's competitive advantage in semiconductors.

ASEAN countries can learn from this model by fostering stronger ties between universities, research institutions, and the semiconductor industry. Developing specialised programmes focused on semiconductor technology and ensuring that academic research aligns with industry needs can help ASEAN build a workforce capable of driving innovation in this field. Countries like

**Singapore**, which already have a robust education system and research infrastructure, can lead this effort by establishing centres of excellence dedicated to semiconductor research and innovation.

### **Building a Robust Regional Supply Chain**

The semiconductor industry is highly complex and demands a well-established supply chain that supports each stage of production, from the procurement of raw materials to the delivery of finished products. Taiwan and South Korea have successfully built robust supply chains, which have enabled them to maintain leading positions in the global semiconductor market.

In semiconductors, there are three main stages of production: R&D, wafer fabrication, and assembly, testing, and packaging (ATP). In Taiwan, the semiconductor supply chain is tightly integrated, with companies like TSMC, ASE Technology, and MediaTek playing crucial roles at different stages of the production process. **This integration has enabled Taiwan** to maintain high levels of efficiency and quality control, which are essential for producing advanced semiconductors. Likewise, **South Korea has developed a strong supply chain, supported by its conglomerates**, or chaebols, such as Samsung and LG. These conglomerates have vertically integrated their operations, controlling everything from semiconductor design to manufacturing and distribution. This level of integration not only ensures a steady supply of components but also fosters greater innovation and responsiveness to

market demands.

In the case of ASEAN, building a robust semiconductor supply chain presents a critical challenge. The region is already a significant player in wafer fabrication and ATP. Singapore and Malaysia are key contributors to the global semiconductor industry, with Vietnam also emerging as a notable player recently. Singapore specialises in wafer fabrication, accounting for about 11 percent of global production (ITC Database, accessed on 1 August 2024), while Malaysia focuses on ATP, contributing approximately 5.4 percent to global ATP (ITC Database, accessed on 1 August 2024). To advance up the regional value chains, ASEAN countries need to invest in developing capabilities across the entire semiconductor ecosystem, from wafer fabrication and design to R&D. Collaboration among ASEAN countries is crucial, with each nation specialising in different aspects of the supply chain to create a more integrated and resilient regional semiconductor industry.

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