Box Article

The Global Chip Shortage: Implications and Opportunities for Malaysia

Background

The shortage of semiconductor chips[1], which began in late 2020, has highlighted how indispensable these components are in today's modern economy. Notably, the global chip shortage has raised concerns due to its widespread impact across economic sectors and countries. In February 2021, the global automotive industry was estimated to suffer a revenue loss of USD60 billion in 2021 due to shortages of semiconductor chips. This issue has also highlighted the high degree of geographical concentration of chip manufacturing, raising national security concerns for some major economies. This box article aims to shed some light on the dynamics behind the global chip shortage, assess the potential impact to the Malaysian economy and explore policy strategies to maintain Malaysia's strategic role as a global semiconductor player.

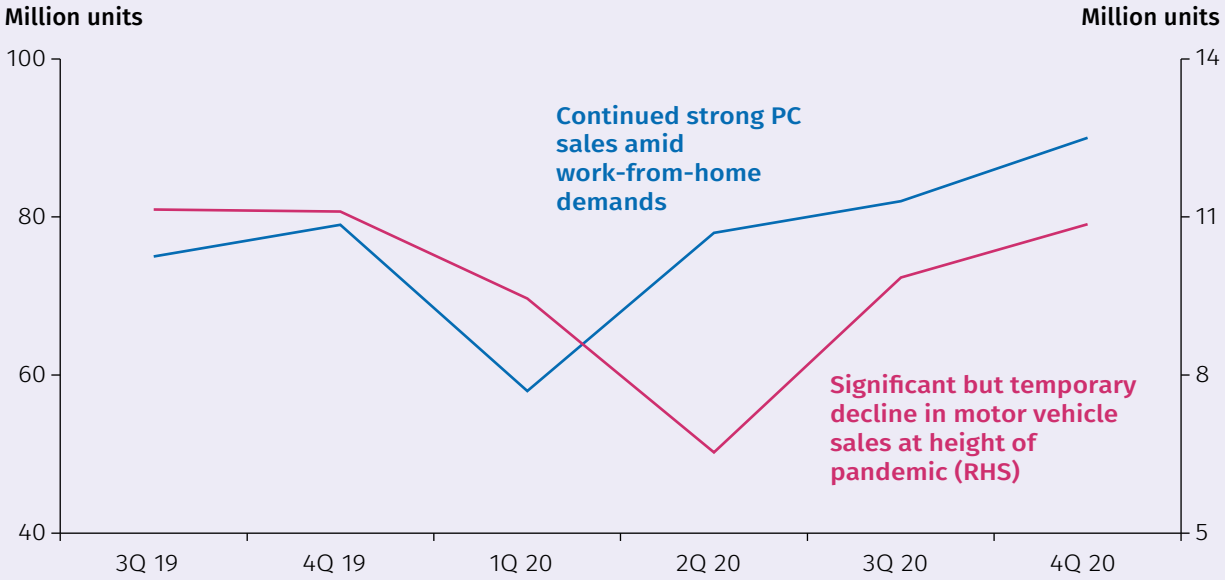
Supply-demand imbalances leading to the global chip shortage

The current shortage of semiconductor chips has been due to developments over the past few years as global megatrends[2] such as automation, electrification and connectivity propelled rising demand for semiconductors, against a backdrop of heightened uncertainty in supply and underinvestments due to the US-China trade war. From a demand perspective, the COVID-19 pandemic played a key role in accelerating trends such as the shift towards remote working, virtual learning, home entertainment, online gaming and e-commerce. This, in turn, led to a significant surge in demand for chips powering computers, laptops, cloud computing and equipment for wired communications. Initially, the increase in demand was accommodated by a cutback in production by the automotive segment, as car manufacturers reduced orders for semiconductor chips in response to the lower mobility during the pandemic. Moving into 2021 however, the automotive industry experienced a faster-than-expected recovery in demand (Chart 1) following the lifting of containment measures by various governments globally. Additionally, the just-in-time inventory management practices which contributed to the low chip inventory levels among the automotive manufacturers also fuelled further demand for chips.

[1] Microchip, chips, or more officially known as integrated circuit (IC) is the "brain" within every electronic device in the world.

[2] As a result of these megatrends, the content of semiconductor per unit of product has risen given the greater need for speed and connectivity (e.g. the latest 5G phones require 40% more electronic components compared to older versions, while the semiconductor content per car is expected to reach close to USD600 per car by 2022 compared to USD300 per car in 2013)

C1 Global Personal Computer Sales and Global* ex-China Motor Vehicles Sales

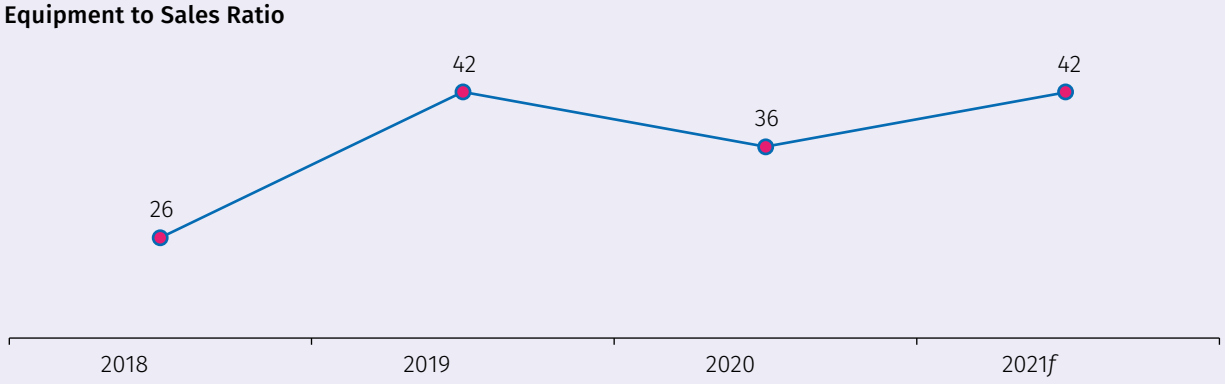


*Refers to 24 countries including Australia, India, Indonesia, Japan, Malaysia, Pakistan, Philippines, Singapore, South Korea, Chinese Taipei, Thailand, Vietnam, Portugal, Russia, Turkey, South Africa, Argentina, Brazil, Canada, Chile, Colombia, Mexico, Panama, and United States. China was excluded as COVID-19 affected China mainly in 1Q 21, unlike other countries.

Source: Gartner, CEIC

From the supply perspective, chip manufacturers were unable to keep pace with the rising demand due to the lack of new capacity and underinvestment during the early stages of the pandemic (Chart 2). As global foundries operate at close to full capacity and efforts to build new foundry capacities require about 2-3 years to be production-ready, chip manufacturers were unable to accommodate the sudden surge in chip demand.

C2 Equipment Spending to Sales Ratio by TSMC and Samsung



Source: Counterpoint Research

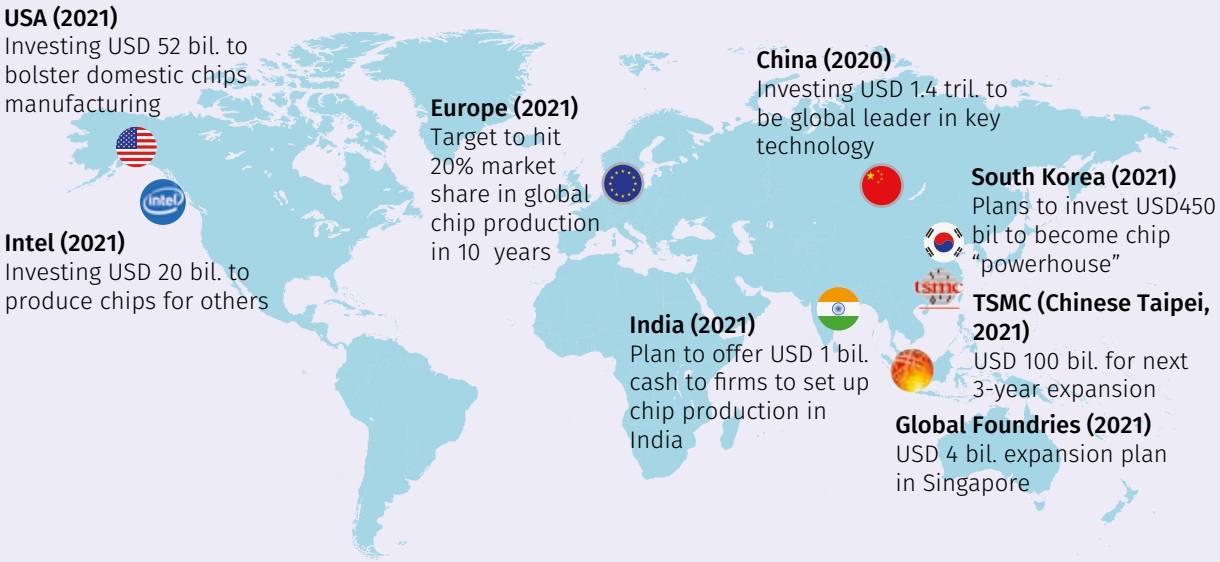
There is also evidence that the shortages were contributed by the race to build buffer stock by some clients who were concerned about supply chain security amid US-China trade tension. Additionally, these shortages were exacerbated further in 2021 by sudden disruptions in production caused by winter storms in the United States, a fire outbreak in the plant of a key Japanese producer, and COVID-19 outbreak in chip manufacturing plants in Chinese Taipei.

Globally, the impact from the chip shortages was first felt by the automotive industry. Automotive players faced longer lead-times when demand recovered sharply, as chip manufacturers were unable to reprioritise chip supplies back to the automotive industry, especially for those that have cancelled chip orders earlier. This has led some automotive players to suspend production or leave out certain non-essential features due to inability to source vital components. The effects of the shortage, however, have since extended beyond the automotive sector, with other industries such as consumer electronics facing longer lead-times, minimal inventories, and higher costs to secure chips.

Ongoing capacity expansion and reshoring efforts to address shortages

As the global chip shortage continues, businesses and governments are looking for longer-term solutions by rethinking their entire semiconductor manufacturing supply chain structure. On one hand, Integrated Device Manufacturers, who are involved in both designing chips and operating own foundries have intensified investment efforts to expand capacities. Fabless chip designers, who have outsourced manufacturing to third parties, have less flexibility as they are highly reliant on a few large global chip manufacturers to fulfil orders (the Top 3 semiconductor contract manufacturers account for close to 80% of global foundry revenue in 2020). This concentration has propelled Governments around the world to push for self-sufficiency and strengthen national security by developing domestic chip manufacturing capabilities (announced in 2020 and 2021, Chart 3). In particular, major economies including the US, EU and China are incentivising the reshoring of chip manufacturing back to domestic markets, so as to enable better control of the supply chain and prevent future disruptions.

C3 Efforts by Selected Semiconductor Companies and Policymakers



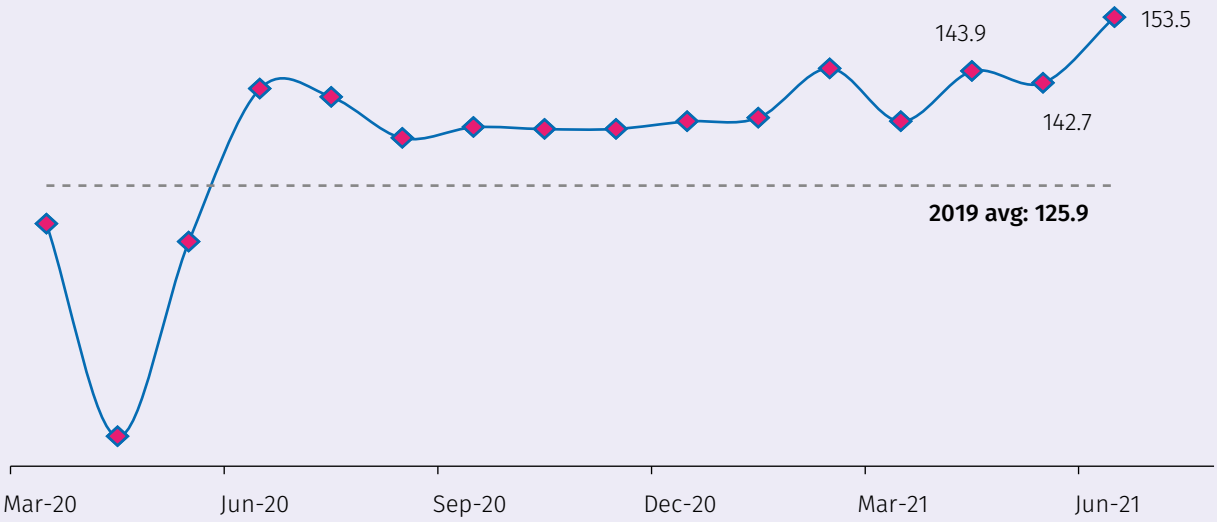
Source: Various newsflows

Malaysia has been able to withstand the impact of chip shortages

With a major presence in the global semiconductor value chain (approximately 7% of global semiconductor trade flows through Malaysia) it is critical to assess the implications of the chip shortage on Malaysia's E&E production. Since the height of containment measures globally in April 2020, E&E production activity has recorded a strong rebound and continues to record markedly high levels. In particular, production has been above pre-pandemic levels since June 2020 (Chart 4).

C4 Industrial Production Index (E&E)

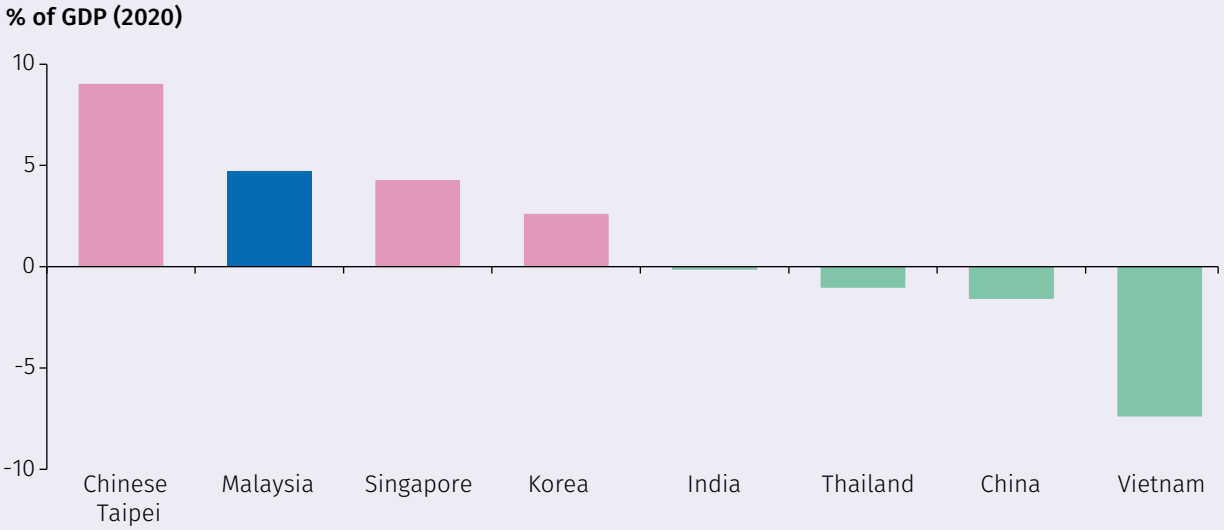
Index (2015=100), seasonally adjusted



Source: Department of Statistics Malaysia and Bank Negara Malaysia estimates

The strong and sustained production levels suggest that Malaysia's E&E sector is currently benefitting from the chip shortages. Malaysia holds a strategic position in global value chains, being among the larger net exporters of semiconductor products (Chart 5), with a significant share of firms within the semiconductor value chain involved in the production of chips. As such, strong demand for semiconductors is benefitting a large segment of the industry, outweighing the impact of shortages on segments that use chips as intermediate inputs. In particular, firms involved in front-end semiconductor manufacturing have experienced a surge in orders as they serve to address the global supply gap. In tandem with the strong foundry activities globally, other parts of the domestic semiconductor value chain, namely local OSAT (Outsourced Semiconductor Assembly and Testing) players and Assembly and Test Equipment (ATE) manufacturers have also benefitted from higher demand.

C5 Global Semiconductor Trade Balance



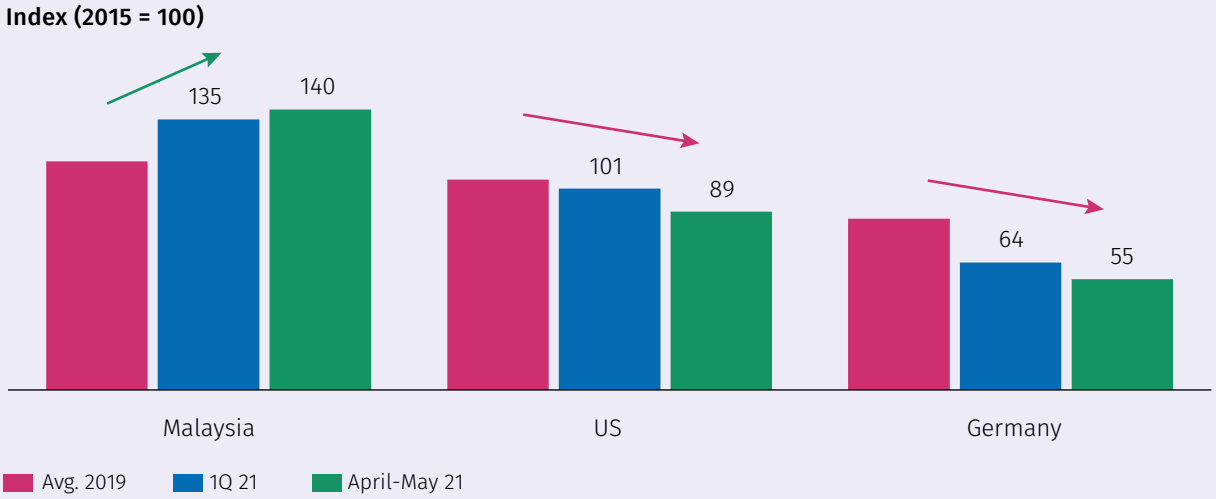
Source: International Trade Centre, IMF

As the strength of global tech cycle continues, this is expected to lend support to the performance of the E&E industry going forward. Based on the Bank's industrial engagements, most E&E firms have secured higher order bookings in advance, with several firms reporting full order books throughout 2021. Firms are also undertaking measures to expand production capacity to increase supply by investing in new plants and machinery, while introducing new products to cater to new and fast-growing segments such as electric vehicles, data centres and medical devices. The overall outlook for the sector is expected to remain positive, as domestic firms receive higher orders amid frontloading by clients in anticipation of future shortages of other products and components.

However, the effect of the shortages is uneven, as certain segments within the domestic E&E value chain require chips to produce other electronic goods, particularly consumer electronics. Some Original Equipment Manufacturer (OEM) and Electronics Manufacturing Services (EMS) that use chips as intermediate components have expressed concerns on how the low inventory levels and longer lead times to secure chip supplies are affecting their production.

Beyond the E&E sector, the automotive industry has been the most impacted industry globally due to the chip shortages. Nevertheless, Malaysia's automotive sector has been relatively less affected. Compared to the automotive industry in the US and Germany, Malaysia's production has improved since end-2020 (Chart 6). This is partly attributed to a lower chip intensity for motor vehicles produced in Malaysia, compared to the advanced economies, particularly in the production of mass-market and national makes. The improvement in motor vehicle production also coincides with the SST exemptions on purchases of passenger cars, as consumers leveraging on the tax savings increased their demand for vehicles.

C6 Motor Vehicles Industrial Production by Country



Note: June 2021 figures are excluded as automotive production in Malaysia was more impacted by the imposition of FMCO Phase 1 which restricted production

Source: Department of Statistics Malaysia, CEIC

Moving forward, longer term strategies are critical to build domestic capabilities

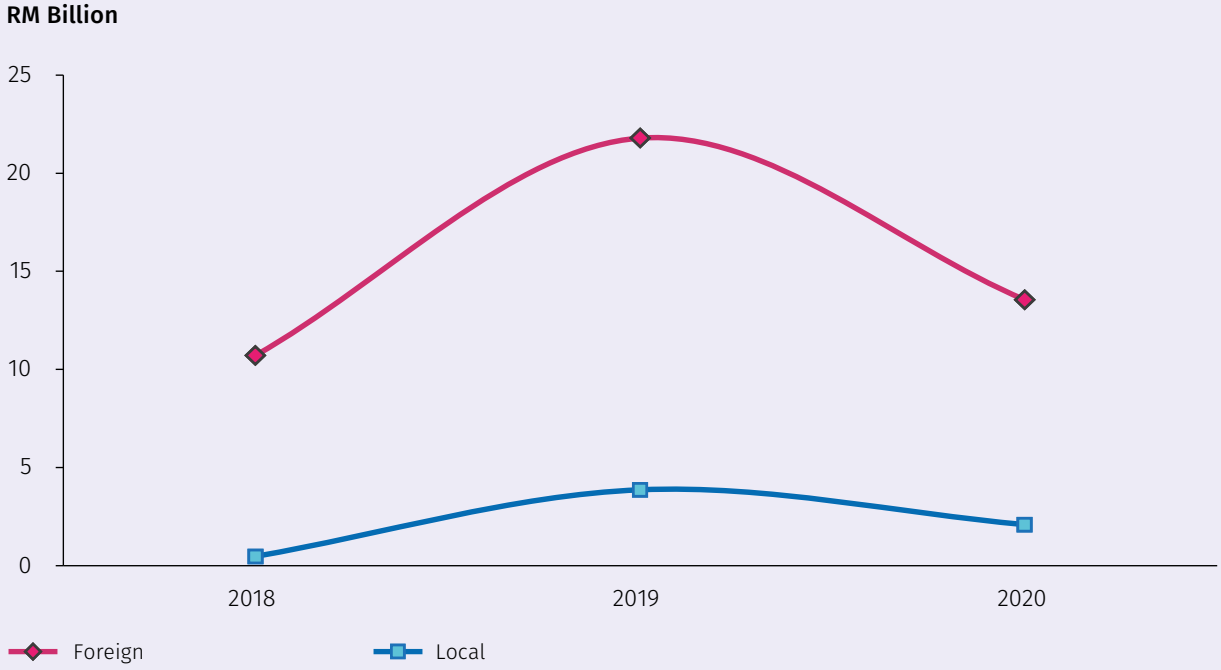
The longer-term outlook for the Malaysian E&E industry remains supported by strong order books, introduction of new products, and commencement of new plants, which will allow firms to benefit from the continued global demand. The ability of firms to capitalise on these opportunities remain contingent upon long-term strategies to build domestic capabilities to stay competitive.

While the current environment is positive for Malaysia, the E&E sector is confronted by challenges, both in the near- and medium-term. First, the near-term performance of the E&E industry in Malaysia is expected to be weighed down by the recent implementation of FMCO (full movement control order) and restrictions on labour capacity due to the resurgence in COVID-19 cases. Nevertheless, firms were able to minimise the impact given the highly automated nature of many large semiconductor firms. Meanwhile, some firms also extended the number of working days in order to catch up on production. Moving forward, firms that are currently focused on labour-intensive activities are most at risk of production disruptions resulting from labour restrictions. As such, embarking on automation would not only mitigate the impact of containment measures as firms become more capital intensive, but also help to ensure that Malaysia's E&E sector is better able to capture the strong demand for E&E products. While automation is prevalent amongst larger E&E manufacturers, tier 2 and tier 3 suppliers, which comprise mainly SMEs, have room to automate further. Impediments to automation include an aversion to change involving new production methods, as well as high costs, including for maintenance and staff training when operating machinery[3]. In this regard, SMEs are encouraged to automate processes and digitalise operations by leveraging on capacity building resources, as well as grants and financing facilities like the MIDA Domestic Investment Strategic Fund and High Impact Fund, and the SME Automation and Digitalisation Facility[4] by Bank Negara Malaysia.

[3] Findings from E&E Productivity Nexus "Study on Productivity and Contribution of the Malaysian E&E Industry"
[4] For more information, please refer to https://www.bnm.gov.my/documents/20124/2294076/ADF_Eng.pdf

Second, the push towards the reshoring of chip manufacturing activities by major economies could impact the significance of Malaysia as an E&E producer in the semiconductor global value chain (GVC). As major economies prioritise strengthening their own domestic capabilities, they may reduce investments in other parts of the GVC. Thus far, Malaysia's E&E sector has been highly dependent on foreign direct investments (FDI), accounting for more than 80% of total approved investments in the past 3 years (Chart 7). A cutback in FDI could translate into slower capital accumulation, production capacity expansion and output growth. As the E&E sector is highly technology intensive, lower technology-driven FDI could also impact domestic technology development and adoption, high-skilled job creation and access to global markets for local suppliers through the MNC network.

C7 Foreign and Local Approved Investment in E&E Industry in Malaysia



Source: Malaysian Investment Development Authority

As such, there is an urgent need to grow investments by domestic firms while increasing Malaysia's capability in attracting quality FDI amid global reshoring efforts. The implementation of the "National Investment Aspirations" (NIAs) can stimulate investments in segments of the value chain that are of high economic complexity, create high-value jobs, and have extensive domestic linkages. Examples would be Integrated Circuit (IC) design and design automation, which are strongly aligned with the NIAs given its high dependency on innovation. To date, there are only a few active local design houses in Malaysia as IC design activities are undertaken mostly by MNCs. In order to venture into these segments, local players, especially the new entrants, can form partnerships with MNCs by setting up offshore design centres to bring these activities to Malaysia in the medium term. Trade promotion agencies could also enhance the branding of the domestic E&E sector as an IC design hub, which will increase the exposure and create opportunities for local IC design firms.

The E&E industry in Malaysia can further scale up its capabilities and competitiveness by expanding into research and development (R&D), product innovation and design activities that can add value beyond just the manufacturing front (Malaysia is ranked 70 out of 131 countries in knowledge creation, and 53 out of 131 countries in knowledge workers recorded in the Global Innovation Index 2020). These transitions can be complemented by government policies to attract R&D investment activities that encourages inflows of know-how and new technology innovations via industry-academia collaboration. For example, Chinese Taipei's Industrial Technology Research Institute (ITRI) is a successful model of industrial technology upgrading and innovation policy that not only drove innovation among firms and incubated some of the Chinese Taipei's top home-grown companies but also bridged the gap between the industry and academia research. The ability to entice MNCs to bring R&D activities also depends on the availability of the right talent pool to undertake these higher-value tasks. This can be partly addressed by the continuous and cohesive collaboration between industry and the universities in developing industry-relevant curriculum to keep pace with the ever-evolving skills demand. To strengthen the eco-system for R&D to be undertaken locally, Malaysia's Intellectual Property (IP) frameworks should also be updated to widen the recognition of domestic patents across key international jurisdictions, which will offer more comprehensive protection for IPs patented in Malaysia. There is also a need to strengthen and align IP arbitration to global standards to facilitate effective resolution of disputes.

Conclusion

Malaysia has been able to withstand the impact of chip shortages considerably well, given its established footprint in the global semiconductor supply chains. With higher E&E industrial production during the pandemic period compared to 2019, as well as full order books among chip manufacturers and future product diversification plans, Malaysia's E&E industry has thus far benefitted from this unanticipated global chip shortage.

However, there is the risk that intensifying reshoring of semiconductor manufacturing activities may impact future investments into Malaysia. As such, it is timely for Malaysia to strengthen domestic capabilities by increasing productivity via automation and digitalisation, leveraging on forward-looking investment policy tools such as the NIAs, and enhancing R&D capabilities by developing the right talent pool, while improving collaboration between industry and academia.

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