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Integrated Policy Strategies and Regional Policy Coordination for Resilient, Green and Transformative Development: Supporting Selected Asian BRI Partner Countries to Achieve 2030 Sustainable Development Agenda

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Challenges and Prospects for Green Industrialisation in Malaysia

This paper explores the trajectory and future prospects of green industrialisation in Malaysia by situating current efforts within the broader context of the country's industrial policy evolution. It traces Malaysia's path from pre-independence strategies through successive waves of import substitution and export-oriented industrialisation, culminating in the emergence of green initiatives. The study applies an analytical framework that examines both structural and institutional dimensions, highlighting key green-related sectors such as the electrical and electronics industry, photovoltaic manufacturing, and resource-based industries. Despite progress, Malaysia faces significant challenges including climate adaptation gaps, dependence on foreign direct investment, institutional weaknesses, limited fiscal space, and talent shortages. The paper also scrutinises the marginalisation of indigenous populations in industrial strategies and the absence of strong local firms in green sectors. It concludes with policy recommendations aimed at fostering a more inclusive, resilient, and sustainable industrial future for Malaysia.

Contents

KEYWORDS: Industrial policy, Green transition, Decarbonisation, Malaysia

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Executive Summary

Green issues and industrialisation have been intertwined in Malaysia since the colonial era, when the British exploited the region for tin and rubber, introducing scientific forestry for resource management. Post-independence, Malaysia implemented environmental regulations in the 1970s and advocated for a balanced approach between environmental and development objectives in the 1990s. Over the past three decades, Malaysia's policies have increasingly aligned with international standards like ESG and net-zero emissions driven by its reliance on foreign direct investment (FDI) and participation in global value chains (GVCs), highlighting the strong influence of investment priorities on environmental policies.

Since Malaysia's independence in 1957, the country has experienced several industrialisation phases. Malaysia's industrialisation began with import substitution in the 1950s, followed by export-oriented industrialisation in the late 1960s. A second round of import substitution focused on heavy industries from 1981 to 1985, followed by another export-oriented phase in the mid-1980s.

Key green industrialisation and economy policies began in 2009. Key policies introduced included the National Green Technology Policy, National Renewable Energy Policy and National Climate Change Policy. Subsequent initiatives such as the Renewable Energy Act (2011), Net Energy Metering (2016) and the establishment of Green Technology Corporation supported green technology. Fiscal incentives like the Green Investment Tax Allowance (GITA) were also introduced. In 2023, the government launched the National Energy Transition Roadmap (NETR) and the New Industrial Master Plan (NIMP).

Key sectors driving Malaysia’s green industrialisation include Electrical and Electronics (E&E), solar photovoltaics and resource-based industries. Industrial policies have supported their growth making them significant contributors to Malaysia’s net exports. However, these industries face various challenges and implications.

Emissions-centric green industry policies could leave Malaysia’s industries vulnerable to climate change. If not properly balanced with local environmental conditions, such policies may divert resources from climate adaptation efforts that require context-based solutions. Southeast Asia is one of the most climate-vulnerable regions yet Malaysia’s historical contribution to global emissions is less than 0.4%.

Malaysia's industrialisation has marginalised the Orang Asli, who face poverty, poor education and displacement from their lands due to large-scale agriculture. Government plans like cash crop schemes lack consultation and fail to align with their needs. To prevent further exclusion, development must involve the Orang Asli, respect their rights and provide targeted education and job opportunities, particularly in green industries.

Malaysia has experienced premature deindustrialisation for the past two decades, threatening the development of green industries. Deindustrialisation is concerning as manufacturing drives innovation, technological progress and high-skill job creation. Without a strong industrial base, Malaysia risks losing these advantages, making it harder to develop green technologies.

Trade agreements and fiscal limitations constrain industrial policies. Malaysia's industrial policy space is constrained by WTO rules and free trade agreements that limit tools like tariffs and export incentives and impose stricter intellectual property and investment regulations. Additionally, Malaysia faces fiscal limitations due to the government's focus on reducing deficits and new laws that cap fiscal deficits and government debt. These factors reduce the government's ability to use industrial policies or fiscal expansion to support domestic industries.

Malaysia's high-tech industries face talent shortages and coordination problems. Malaysia faces a shortage of high-skilled talent to support the growth of high-tech industries. However**,** many STEM graduates are underemployed due to limited demand for skilled workers and declining R&D investment. The core issue is a coordination problem: even with more graduates, industries may not shift to higher value-added functions without substantial government support.

Malaysia's R&D efforts have been hindered by underutilisation of investments and weak collaboration between research institutions and industry. Unlike successful catch-up countries, institutions focus more on commercialising R&D outputs than addressing industrial technology needs. Initiatives like MIMOS have had limited success and the E&E sector remains in low-value-added segments. The lack of innovation-driven firms and strong corporate R&D policies has prevented industrial upgrading.

Political and structural challenges hinder the development of competitive local firms. The lack of domestic firms investing in technology development keeps many companies in low-value segments of global value chains. While business groups could drive innovation and market entry, political dynamics and early market liberalisation have weakened innovation and delayed industrial upgrading.

We conclude with the following policy recommendations:

Strengthening Industrial and Technological Foundations - Malaysia should combat deindustrialisation through targeted industrial policies, fostering competitive and innovative firms and promoting technological upgrades. Expanding state-owned enterprises and encouraging private-sector innovation can absorb skilled labour and drive knowledge-intensive growth. R&D efforts must align with industry needs and be supported by global technology transfers.

Addressing Fiscal Constraints and Building Resilience - Fiscal space can be expanded through tax reforms and carefully managed monetary financing, mitigating inflation and currency risks. Strong political coalitions and strategic governance are essential to

support industrial policy, drive innovation, and create competitive national champions. Climate adaptation must also feature prominently in green industrial strategies.

Promoting Social Equity and Inclusivity - Policies should address the socioeconomic challenges of vulnerable and disadvantaged groups, such as the Orang Asli, by improving access to education, healthcare, and economic opportunities while ensuring respect for their rights. Inclusive development is crucial for equitable participation in green industrialisation initiatives.

1. BACKGROUND

Green issues and industrialisation have been intertwined since the colonial period in Malaya. Under British colonial rule (1824-1957) Malaya was exploited as a mining and plantation colony focused on tin and rubber, and scientific forestry was introduced, along with the gazettement of forest lands. Scientific forestry did not equate to conservation as we now understand it; rather, it was for the 'rational' exploitation of timber and forest resources, as evidenced by the still extant category of 'production' forest . Much primary forest was felled to make way for rubber plantations.

In post-colonial Malaysia, environmental laws have been in place since 1974 to regulate emissions and require project proponents to conduct environmental impact assessments by qualified agents. This regulatory framework followed efforts to attract foreign manufacturing capital into free trade zones (FTZs) such as the offer of 'Pioneer Status' tax relief to foreign companies exporting their production.

Malaysia's industrial growth in the 1970s brought environmental concerns, leading to the rise of groups such as the Consumers Association of Penang (established 1969) and Sahabat Alam Malaysia (Friends of the Earth Malaysia) in 1977 who were among the organisations challenging pollution from FTZs in Penang. Radioactive pollutants from rare earth mineral processing have also given rise to tensions with investments like Asia Rare Earth in 1982 and Lynas more recently since 2012.

Global, rather than national or local, environmental issues gained international attention in the 1990s, leading to numerous United Nations treaties tackling sustainability, climate change, biodiversity, deforestation and desertification, and the ozone hole. Climate change has become the most prominent amongst its siblings. In a case of the global trumping the local, 'green' or 'environmental' issues in the present seemingly default to climate change, which cannot stand in for all environmental issues and sustainable development. This distinction appears to be lost in the mainstreaming of 'environmental, social and governance' (ESG) investing standards from developed countries since the orientation tends to be supply chain compliance for multinational corporations (MNCs).

Applying universal standards of climate action based on the particular situation of developed countries is an instance of the fallacy of composition, akin to that which has plagued international trade policy; that which is true of a part is held to be true for the whole. This is problematic because climate action is supposed to be highly differentiated based on each country's relative responsibility for climate change.

The climate treaties are based on a principle of 'common but differentiated responsibilities, and respective capabilities' in order to arrive at just burden sharing among the state parties. Countries such as the United States, responsible for over 25% of historical carbon dioxide emissions, have a correspondingly greater responsibility to

curb their emissions than Malaysia, responsible for only 0.37% of historical CO2 emissions (Yin Shao Loong 2022). The great differentials in wealth and technology between the US and Malaysia also mean that the US has greater capability to respond than a developing country such as Malaysia.

The situation is quite different for local or national environmental issues. A company operating both in Malaysia or the Australia should seek to reduce production of carcinogens, radioactive wastes or noxious emissions. Yet, while ore may be mined in Australia, processing and waste storage takes place in Malaysia.

When sustainable development gained international prominence at the 1992 Rio Earth Summit, Malaysia advocated for a balanced approach between environmental and development objectives. This contrasted with the Global North's push for conservation despite their own histories of deforestation, climate pollution, and industrialisation-induced extinction. (Today's debates between the European Union and its trading partners over the former's deforestation policy treads familiar ground).

Over the past three decades, Malaysia's environmental and industrial policies have increasingly reflected the Global North's priorities, such as the focus on ESG standards and achieving net-zero greenhouse gas emissions. This shift is partly due to Malaysia's dependence on foreign direct investment (FDI) for industrialisation and its efforts to rise in global value chains (GVCs).

Malaysia participates in GVCs dominated by lead firms from China and the United States, it's two largest trading partners and sources of FDI, along with Singapore, Japan, and Europe . Recent disruptions in GVCs due to the COVID pandemic and rising US-China tensions benefited Malaysia's manufacturing sector as firms relocated supply chains to closer or friendlier partners, as seen with semiconductors and solar panel production.

This dependence on FDI and GVCs led policies on green industrialisation to be framed in terms of energy transition towards 'net-zero' greenhouse gas emissions. Although broadly in line with its Paris Agreement commitments, it is pitched as part of a quest for relevance in the struggle to participate in GVCs and attract FDI flows.

1.1. Analytical Framework

This paper looks at Malaysia's green industrialisation journey primarily through the lens of industrialisation. The story of the rise of environmental concerns and policy has been told elsewhere[1].

This paper examines the innovation and production aspects of green structural transformation. The area of concern corresponds to Anzolin and Lebdioui's (2021) third dimension of green industrial policies (and its corollary, green industrialisation) – a productionist innovation-driven approach – that focuses on the development and innovation aspects of low-carbon industries. This is in contrast to the first two dimensions, which focus on changing consumer behaviour and improving production and supply-chain resource efficiency, respectively.

Our focus on the innovation and production aspect is motivated not only by the fact that innovation in green technology will play a key role in environmental sustainability but also by the fact that it opens "green windows of opportunity" (Lema, Fu, and Rabellotti 2020). It has become increasingly crucial for Malaysia to take advantage of such windows of opportunity, given that there has been growing concern that its economy has stagnated at the upper middle-income level and has not created enough high-quality jobs (Yusuf and Nabeshima 2009; Khazanah Research Institute 2020).

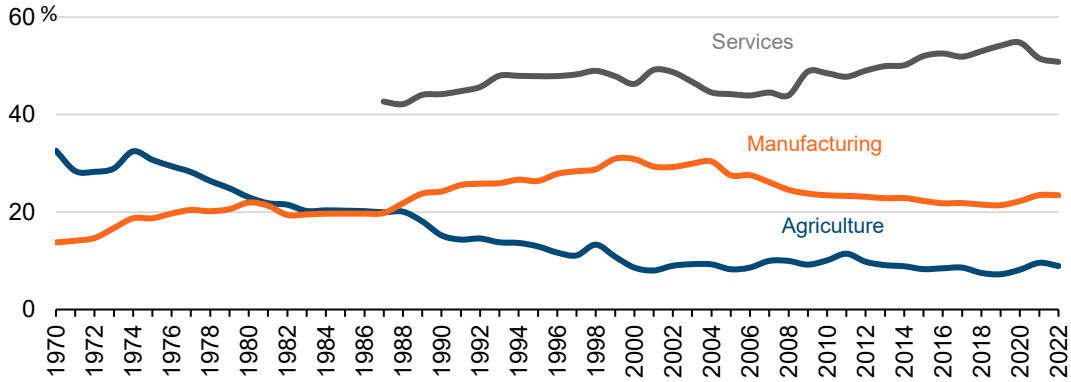
This paper is structured as follows. Following this introduction, the history of Malaysia's industrial policies is discussed in the next section with a view of how they have contributed to developing green-related industries. The subsequent section looks at the development of green-related industries over the years, namely, the electrical and electronics (E&E), photovoltaic and resource-based industries. The choice of photovoltaics is obvious given its strategic role in producing renewable energy. The E&E and resources-based industries are selected for their prominent role in Malaysia's economy and their potential to contribute towards energy efficiency and renewable energy. The E&E industry plays a role in developing information and communication technologies (ICT), which can increase productivity and resource-use efficiency (Kaplinsky 2021). Meanwhile, resource-based industries such as palm oil can be a source of sustainable biofuels. Challenges in developing green industries are discussed in the subsequent section. This section also looks at the issues faced by a marginalised group, the Orang Asli – indigenous peoples of Peninsular Malaysia – to participate in green industrialisation, seeing that technological change tends to disadvantage vulnerable groups. This paper then concludes with policy recommendations.

(Guha 2000; Hezri and Nordin Hasan 2006)

2. A HISTORY OF MALAYSIA INDUSTRIAL POLICIES

The Federation of Malaya gained independence from Britain in 1957. Subsequently Malaysia was formed in 1963 with the unification of the Borneo states of Sabah and Sarawak, and for a time, Singapore. Malaysia's economy has undergone a tremendous structural transformation, from an agriculture-based economy, to being an economy driven primarily by the services and manufacturing sectors (Figure 1). The transition was not simply the result of market forces, as claimed by the World Bank's East Asian Miracle report (Birdsall et al. 1993), rather the government played a commanding role in implementing appropriate policies and reforms (Jomo KS and Wee Chong Hui 2013). Industrial policy, along with a controversial ethnic-based redistribution policy and an all-ethnic poverty reduction program under the New Economic Policy and its successors from 1970 onwards delivered reasonable success in driving economic growth and reducing overall poverty and inter-ethnic inequality. The recognition of these successes, however, must be tempered by the acknowledgement of higher vertical inequality compared to some regional peers. In 2022, Malaysia recorded a higher Gini coefficient of 0.40, compared to Indonesia at 0.38 and Thailand at 0.35 (2021 figure) (World Bank Group 2024). The government's involvement in steering industrial policy until the beginning of the 2020s can be distinguished by five distinct phases characterized by different policy priorities discussed below[2].

Figure 1: Gross domestic product, by sector share, 1970-2022 (percentage)



Source: DOS (2023)

[2] The material in this section draws mainly on Jomo KS (1990, 2007) and Rasiah (2011).

2.1. Pre-Independence

Before World War II, the British administration in Malaya focused on exploiting the peninsula's natural resources, centred on tin and rubber production and export, with low-paid local or imported workers (Lafaye De Micheaux 2022). Industrial promotion policies only emerged with the establishment of the Malayan Union in 1946, reflecting varying degrees of British rule from exploitation to indirect governance.

The Malayan Emergency, beginning in 1948 as a communist insurgency, redirected colonial priorities towards safeguarding British rubber plantation and mining interests. Malaya, as Britain's most profitable colony, significantly contributed to post-war reconstruction funding in Britain (Jomo KS 1990). Consequently, public development efforts concentrated on enhancing infrastructure to support the export-oriented primary commodity economy. Malaya's infrastructure, including railways, roads, ports, and utilities, was among the most advanced in British colonies, rivalling settler colonies (Jomo KS 2007).

Under colonial rule, local capitalists struggled to develop domestic manufacturing industries and instead found profit in commerce and usury. Malay elites barely participated in commerce and industry but were instead integrated into the colonial bureaucracy, while urban commerce was dominated by ethnic Chinese elites, who formed a comprador class linked to European capital (Puthucheary 1960). The ethnic stratification of the colonial economy would affect industrial and socio-economic policies for decades to come.

Colonial-era industries aimed to lower international trade costs through ventures like bottling plants, tin refineries and transport and capital equipment services, particularly during periods of weak British control like the Great Depression and Japanese occupation (Jomo KS 2007). British policies favoured imported goods to preserve duties and keep wages low, ensuring profitability for British-owned enterprises (Edwards 1975, as cited in Jomo KS 2007). Consequently, manufacturing had a minor role in colonial Malaya, dominated by tin mining and rubber plantations under colonial management.

The legislative framework from this period shaped post-independence rural development and affirmative action policies in Malaysia.

2.2. Post-Independence

Following Malayan independence in 1957, Malaysia’s economy diversified from colonial sectors like tin and rubber although primary commodities remained significant. New industries including palm oil and tropical hardwoods emerged alongside petroleum exports from the mid-1970s and cocoa production in the early 1980s. These industries have supported Malaysia’s export-orientation since the 1970s.

Post-independence industrialisation can be divided into five phases: initial import substitution, export-orientation, heavy industry-based import substitution, second round of export-orientation and most recently, a green industrial turn. This green shift aims to complement export-orientation and attract investment influenced by Western ESG standards.

2.3. Import Substitution Industrialisation, First Round

Compared to the colonial era post-independence governments actively pursued industrialisation. Initially haphazard, this approach shifted to import-substitution industrialisation in the late 1950s, relying on tax exemptions, tariff protection, infrastructure support, industrial credit facilities, directly and indirectly subsidising new factories, and other incentives. The goal was to attract foreign investors to establish local production, assembly and packaging facilities for goods previously imported, mostly through foreign subsidiaries. These industries aimed to process imported materials locally, substituting finished goods with semi-finished ones in a protected domestic market, albeit with limited employment benefits (Jomo KS 2007).

The government's support lacked targeted industry selection or performance monitoring, relying instead on ad-hoc tariff protection based on firms' applications. Industries included liquor, petroleum, tobacco and motor vehicles, expanding later to basic metals, electrical machinery, rubber and plastics. Additional policies emerged over time, including pioneer tax incentives from 1958 and protective measures such as tariffs and quotas by the Tariff Advisory Board from the early 1960s, which was more important to manufacturers than the former (Rasiah 2011).

The introduction of protection created opportunities for rent-seeking, with companies lobbying influential Malaysians, often by offering directorship positions. Rent-seeking though did not dissipate all rents (Edwards 1975, as cited in Jomo KS 2007). Still, profits did not reflect “social efficiency”, and high profits mainly went to foreign companies who repatriated them. State intervention, despite its distortive effects, was seen as necessary for industrialisation and development. However, rent-seeking, lack of export pressure, focus on final consumer goods, benefits mainly to foreign firms and regional industry concentration were issues associated with import substitution industrialisation (ISI) (Jomo KS 2007).

Malaysia's small domestic market and skewed income distribution hindered ISI's growth. This is reflected in the rapid peak and subsequent drop in output growth of firms with pioneer tax incentives (Jomo KS 2007). ISI's limited employment generation, due to poor economic linkages and its capital-intensive nature, further stifled success. By the mid-1960s, the limitations of ISI were acknowledged, leading to the establishment of the Federal Industrial Development Authority (FIDA, now Malaysian Investment Development Authority, MIDA) in 1967 and the 1968 Investment Incentives Act to promote manufacturing exports. This marked a strategic shift towards export-oriented industrialisation (EOI).

ISI coexisted with EOI after 1968 but declined in importance. Effective rates of protection (ERP) for ISI industries fell dramatically between 1969 and 1987. For instance, ERP for basic industrial chemicals dropped from 160% to 16% (Rokiah Alavi 1996). Over time, import-substituting industries became more locally owned, except for tobacco and beverages.

2.4. Export-oriented industrialisation, First Round

The shift to export orientation began with the Investment Incentives Act of 1968. Export-oriented policies were also associated with the New Economic Policy (NEP) in 1970. The NEP aimed to modernise the economy, eliminate poverty and achieve balanced inter-ethnic redistribution. It emphasized local ownership of productive assets and reducing foreign ownership which was believed to be compatible with stronger and more profitable integration into the global economy.

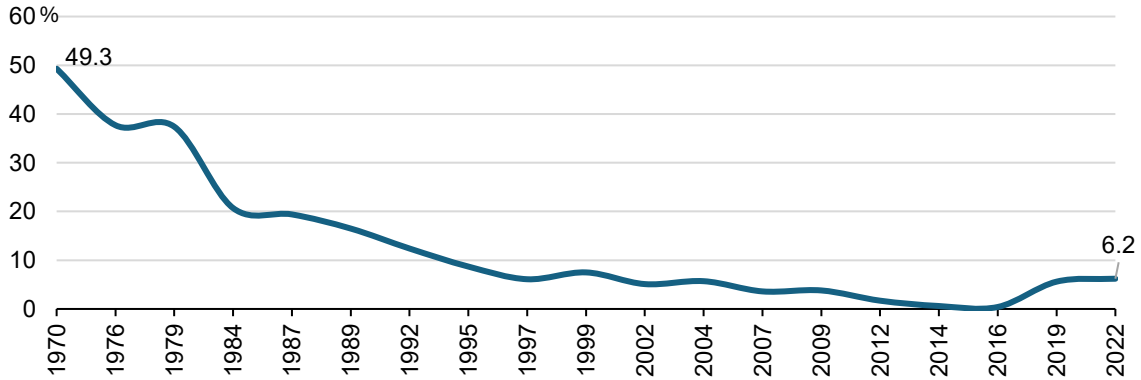
Box Article: The New Economic Policy

The NEP was a two-pronged redistribution program with the goals of disassociating the identification of ethnic groups from their traditional economic roles and eradicating poverty regardless of ethnicity. The policy was introduced as a response to ethnic riots in 1969, which the ruling Malay ethnic elite interpreted as arising from dissatisfaction with the persistent economic inequality between Malays and Malaysian Chinese. Effectively, the policy largely redistributed gains from growth favouring *Bumiputera* or "sons of the soil" - an umbrella term for native ethnicities including the Malays, the natives of Sabah and Sarawak, and indigenous peoples - through quotas in business permits, funds, privatisation contracts, shareholding in publicly listed companies, education placements and government jobs. As most of the poor belonged to the Bumiputera ethnic group in the wake of the country's founding, the ethnic-based redistribution program in their favour successfully contributed to poverty reduction. Job-creating economic growth also supported general poverty reduction (Figure 2). The NEP ostensibly expired in 1991. However, since similar redistributive considerations underpinned successive policies, the NEP moniker has been kept alive in the Malaysian public mind as a colloquial term to refer to such policies.

Although the policy has reduced poverty among Bumiputera and alleviated inter-ethnic inequality (Figure 3), it has not passed without severe criticism. Critics point out that the positive discriminatory policies towards Bumiputera alienate deserving yet underprivileged non-Bumiputera from opportunities, especially in tertiary education. The policy has also been blamed for fostering economic inefficiency as opportunities are not given primarily on merit. Furthermore, under the pretext of this redistribution policy, the government sought to create a "Bumiputera Commercial and Industrial Community"(BCIC) to ensure their inclusion in the commanding heights of Malaysia's economy. For this purpose, the government distributed rents to a class of

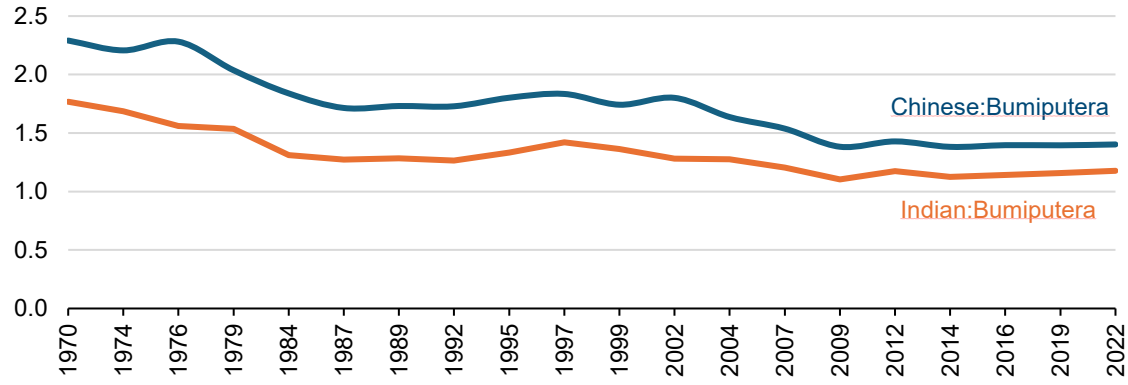
Bumiputera businessmen through several means, but most controversially through directly negotiated privatisation contracts. Thus, the beneficiaries tended to be a class of Malay businessmen who had connections with the leading ruling party politicians rather than the poor Bumiputera in general. As a result, the policy has been accused of being an excuse to further enrich the privileged sections of Bumiputeras rather than to address the plight of the poor Bumiputera appropriately[3]. A related criticism is that some ethnic groups within the Bumiputera, such as the Orang Asli, have not or have only marginally benefitted from this policy despite their supposed inclusion. A further discussion on the Orang Asli and their exclusion from development is discussed in a separate part of this paper.

Figure 2: Malaysian poverty rate, 1970-2022 (percentage)



Source: DOS (2023)

Figure 3: Interethnic Income Ratio, 1970-2022



Source: DOS(2023)

[3] (Kua Kia Soong 2020) and the edited work of (Gomez 2013) are some examples where these criticisms can be found.

Both resource-based and non-resource-based sectors expanded under export-oriented policies. Primary commodities like tin, rubber, timber and palm oil were processed for export, but non-resource-based sectors, particularly electrical and electronic components, along with textiles and garments, contributed more to economic growth and job creation since the 1970s.

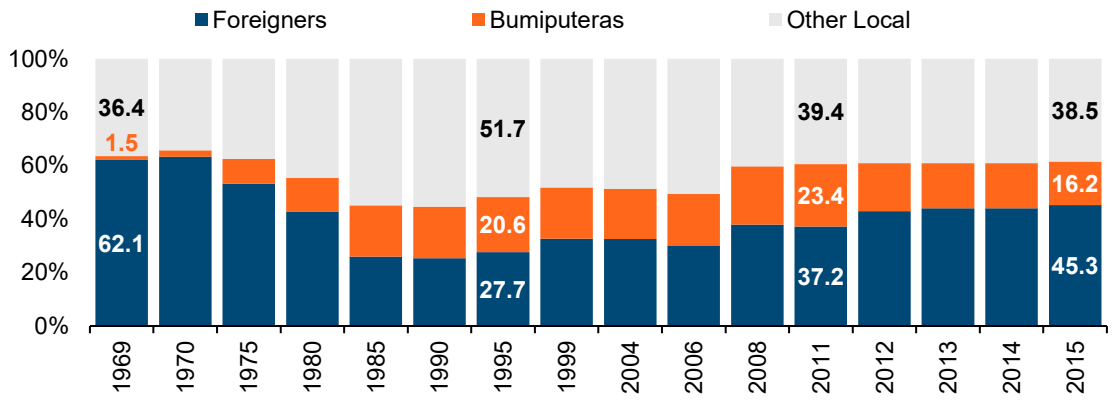
Foreign investment surged after the establishment of FTZs in 1972 and licensed manufacturing warehouses (LMWs) (Rasiah 2011). Government officials' visits to potential investors also played a crucial role. Incentives included accelerated depreciation allowance, labour utilisation relief, infrastructural support and tax deductions and exemptions like investment credits, tariff exemption on raw materials and export tax exemption. Despite the gains in international competitiveness, these were often artificial, as multinational firms were incentivised to operate in enclaves.

To maintain cost-competitiveness in labour-intensive industries, the government kept labour cheap and amended labour regulations to favour transnational corporations, banning unionisation in electronics and allowing women to work night shifts. This unionisation ban was partially lifted in 1989.

Protectionist policies for import substitution industries continued but did not hinder export-oriented industries, as tax holidays and tariff exemptions in export-processing zones allowed them to bypass regulations. However, poor integration between export-oriented and import-substitution sectors led to limited domestic market engagement (Rasiah 1995).

Malaysia’s openness to foreign investment to drive industrialisation raised the share of foreign ownership in manufacturing industries and in gross fixed capital formation (GFCF) (Figure 4). The enclave nature of export-oriented firms was reflected in the structure of domestic demand in the 1970s by growing imports, which was partly a result of the firms’ limited buying and selling in the domestic market. By the late 1970s, the government recognized the need to address weak linkages and dependency on a narrow range of export products, leading to plans for aggressive development of heavy industries.

Figure 4: Ownership of Share Capital of Malaysian Limited Companies, 1969-2015 (percentage)



Source: Government of Malaysia (various years) as compiled by ET Gomez (2013), and Government of Malaysia (2019).

2.5. Second Round of Import Substitution

The shift to heavy industries during the Fourth Malaysia Plan (1981-1985) marked a return to import substitution industrialisation with increased government backing. Inspired by South Korea and Japan, and strained relations with Britain leading to a 'Look East' policy, Malaysia aimed not only to develop heavy industries but also to emulate cultural aspects contributing to the success of East Asia's newly industrialized economies, as emphasized by Prime Minister Mahathir Mohamad in 1983.

Before the 1980s, import substitution sectors faced limits due to a small domestic market, low local technology levels, inadequate protection, lack of linkages and little encouragement for international competitiveness. The dominance of ethnic Chinese in business further complicated matters as the government prioritized developing a Malay entrepreneur class.

The introduction of the heavy industries policy aimed to build domestic linkages, especially Malay enterprises, rectify trade imbalances and promote indigenous technology through initiatives led by the Heavy Industries Corporation of Malaysia (HICOM) from 1981(Jomo KS 2007). Key ventures included PERWAJA Steel, PROTON and later PERODUA for automotive manufacturing, and petrochemical and cement plants. These industries benefited from import restrictions, price controls, duty exemptions, pioneer status tax benefits, subsidised capital, vendor development programs, controlled domestic competition, quotas, tariffs and other protective measures, with intermediate and capital goods seeing significant protection (Rokiah Alavi 1996).

Despite these efforts, heavy industries faced challenges such as high costs, small market size and weak linkages with other sectors, exacerbated by economic downturns in the mid-1980s. Furthermore, even though the automotive sector required high initial protection rates due to high technical entry barriers, it was not paired with effective

monitoring and appraisal like in South Korea and Japan (Amsden 1989). Nevertheless, sectors like automotive and cement showed profitability by the late 1980s under strong protection, while PERWAJA Steel continued to struggle into the 1990s.

Economic pressures partly due to high heavy industry-related imports prompted a re-evaluation, leading the government to shift focus towards foreign investment and export orientation by the late 1980s, amidst declining foreign investment and a global electronics downturn. Policy gradually moved away from emphasising heavy industries towards supporting export-oriented sectors, acknowledging the need for efficiency and competitiveness.

2.6. Second Round of Export Orientation

The first Industrial Master Plan of 1986 (IMP1) and external factors spurred manufactured exports growth from the mid-1980s onwards. The appreciation of currencies in Singapore and Northeast Asian industrialized economies following the Plaza Accord and increasing tariff costs following their withdrawal from the US Generalized System of Preferences (GSP) (Rasiah 1998).

IMP1 prioritised 12 subsectors—seven resource-based and five non-resource-based—for development through strategic planning, policy measures and targeted emphasis. Resource-based industries included rubber, oil palm, food processing, wood-based, chemical and petrochemical, non-ferrous metal products and non-metallic mineral products. Non-resource-based industries encompassed apparel, ferrous metals, machinery and engineering products, transport equipment, and electrical machinery. IMP1's recommendations enhanced fiscal incentives, reinvestment inducements, improving domestic linkages and training initiatives significantly, with heightened support for research and development (R&D) (Rasiah 2011).

Infrastructure development and incentives were pivotal in promoting export-oriented industries, alongside streamlined investment approval processes. New incentives encompassed double deductions for export credit refinancing, training, and R&D expenses. Companies already operational received extended tax relief for five years, proving effective (Rasiah 2011). Additionally, the scope of double deductions widened to cover advertising in media and trade fair exhibits, benefiting manufacturing firms meeting ministry criteria.

By the early 1990s, the manufacturing sector grappled with labour shortages, escalating wages, and stagnant technological advancements due to limited local firm opportunities to upgrade into original design manufacturing (ODM) and original brand manufacturing (OBM) as MNCs engaged them for simpler tasks. In response, the government intensified domestic content regulations, introduced new policies and institutions to foster technological advancement, and encouraged higher value-added activities.

Initiatives such as the Action Plan for Industrial Technology Development (APITD) in 1990, the Human Resource Development Act in 1992, the second Industrial Master Plan

in 1992 emphasizing cluster development, and the establishment of entities like the Malaysian Technological Development Corporation (MTDC) in 1992 and the Malaysian Industry-Government Group for High Technology (MIGHT) in 1993 were pivotal. However, these efforts primarily supported local firms not yet prepared for technological innovation, which Rasiah believes slowed down structural advancement. Challenges, including rising costs, overheating, declining FDI due to emerging low-cost competitors like China and the Philippines, and pressures from World Trade Organisation (WTO) and trade agreements to liberalise trade further compounded issues, prompting firms to internationalis (Rasiah 2011).

2.7. Green Initiatives

While early industrial policies in Malaysia did not focus on green initiatives, a shift occurred in 2009 with the launch of several key, albeit unintegrated, policies. These are the National Green Technology Policy, the National Renewable Energy Policy and Action Plans, and the National Climate Change Policy.

The 2009 National Renewable Energy Policy and Action Plan, introduced under the 9th Malaysia Plan, aimed to develop the renewable energy industry and boost renewable energy's share in the energy mix through regulatory frameworks, business-friendly environments, human capital development, research and development, and outreach programs. However, initial targets were unmet due to financial constraints. **The Renewable Energy Act of 2011** established the Feed-in Tariff (FiT) system, increasing renewable energy capacity from 52MW in 2009 to 243MW in 2014, with biomass as the primary source. Despite these gains, the 2015 target of 985MW was not achieved (Chandran Govindaraju 2016).

In 2016, new measures like **Net Energy Metering (NEM)** and the Large-Scale Solar Program were introduced. The NEM, which replaced the FiT scheme, allowed solar panel users to export excess electricity to the grid, while the Large-Scale Solar Program awarded contracts to build substantial solar power plants. Additional programs in 2019, such as peer-to-peer energy trading and **the Supply Agreement for Renewable Energy (SARE)**, further supported the sector. SARE allows households to lease solar panels through a monthly fee, eliminating the need for upfront installation costs.

The 2009 **National Green Technology Policy** was also a significant step towards green industrialisation. It aimed to minimize energy consumption, develop the green technology industry, build innovation capacity, educate the public, conserve the environment, and promote sustainable development. The policy targeted four sectors: energy, water and waste management, building and transportation.

The government established the **Green Technology Corporation** under the **Ministry of Energy, Green Technology and Water**, which implemented projects like the National Green Technology and Climate Change Council (MTHPI), Green Technology Financing Scheme (GTFS), ASEAN Energy Manager Accreditation Scheme, and Green Township

and Green Labelling. The GTFS provided both demand- and supply-side assistance, offering a 1.5% interest rate rebate and a 60% guarantee of the financing amount for companies investing in green technology (“Features of GTFS 4.0,” n.d.).

Fiscal incentives, such as tax exemptions and allowances, also supported the green industry. Between 2016 and 2019, 301 projects received the **Green Investment Tax Allowance (GITA)**, and 28 services were given the Green Income Tax Exemption (GITE)(Chandran, Baskaran, and Selvarajan 2022). Foreign companies could retain full ownership of Malaysian operations. For the solar industry, the government removed tariffs for solar panel trade and operators within Export Processing Zones (EPZs) enjoyed import duty exemptions.

Despite these efforts, financing remains a significant challenge for green industry due to financial institutions' lack of expertise in assessing green technologies and their low awareness on green technologies, resulting in uncertain financing availability (Chandran, Baskaran, and Selvarajan 2022).

Prior to the Paris Agreement of 2015 developing countries did not face mandatory greenhouse gas emission reduction targets. The absence of an overarching green policy direction contributed to a lack of urgency to mainstream these policies which were better seen as tentative steps. The energy policy in 2010 was still focused on fossil fuels for supply and cost reasons with an energy mix of 53% natural gas and 40% coal with hydro contributing the bulk of ”renewable” energies at 4.9% (“National Energy Balance 2010” 2010).

In 2023, the government launched the **National Energy Transition Roadmap (NETR) and the New Industrial Master Plan (NIMP)**. Reflecting a post-Paris direction the NETR aims to transition Malaysia's energy system to a lower-carbon model by 2050, with renewable energy usage increasing to 23%, electrification of the transport fleet to 80%, and public transport modal share to 60%. It also proposed incentives to develop hydrogen, bioenergy, and power storage facilities. The NIMP includes a mission to push for net zero alongside three other missions to advance economic complexity, enhance digital vibrancy, and ensure economic security and inclusivity. It targets 21 sectors, with six related to green industry: electric vehicles (EV), renewable energy (RE), palm oil products, E&E, digital and ICT, and machinery. The NIMP also emphasizes building climate adaptation measures, such as safeguarding Port Klang against rising sea levels.

Publishing these policies promises to significantly shape the development of key Malaysian industries, including those related to the green sector. The next section examines the development of selected key green-related sectors and their challenges.

3. KEY GREEN-RELATED SECTORS IN MALAYSIA

3.1. The Electrical and Electronics Industry

The E&E industry has played a significant role in Malaysia's economic growth and transformation since independence, becoming the leading manufacturing industry since the 1980s[4]. It expanded rapidly since the opening of the first Free Trade Zone (FTZ) in 1972 (Lim 1978; Rasiah 1988) and saw substantial growth after the 1984-1985 downturn, aided by the relaxation of upgrading requirements introduced in the first Industrial Master Plan (IMP1) of 1986 (Rasiah 2017). Value-addition and exports peaked in 2000 but began to decline due to increased competition from China and Vietnam , dropping significantly by 2013.

The industry's development in Malaysia can be divided into three phases: industrial promotion, first-round export orientation and second-round export orientation. The first phase, starting in 1958, focused on import-substitution manufacturing but was limited by a small domestic market. The second phase began in 1971, promoting export-oriented manufacturing through the Second Malaysia Plan (1971-1975), which introduced several tax incentives that attracted MNCs. However, it struggled to transition to high-value-added activities due to insufficient technological focus.

The third phase began with Industrial Master Plan 1 (IMP1) in 1986, which initially demanded local linkages from foreign firms but relaxed these requirements amid economic downturns. The government supported the sector through currency devaluation and tax credits, spurring foreign investment. Efforts to enhance high-value-added operations began in 1991 with the Action Plan for Technology Development (APITD). This led to the establishment of the local foundry, Silterra, in 2000 and the extension of grants to foreign firms beginning in 2005.

Despite IMP2 (1996) and IMP3 (2006) aiming to promote high-value activities, they did not significantly change the government's hitherto largely regulatory role to becoming increasingly developmental. The industry has undergone limited functional and horizontal upgrading[5] since its establishment, with global competition prompting automation and the introduction of just-in-time practices rather than government initiatives. All semiconductor firms in Malaysia have incorporated *kaizen* (continuous improvement) practices (Rasiah 2017).

Rasiah (2017) (Table 1) showed that no firms in Malaysia operate at the frontier of human resource (HR) competencies, process capabilities and product capabilities—key

[4] This section mainly draws on (Rasiah 2017)

[5] Functional upgrading refers to the movement to, or incorporation of, higher-value-added back-end or front-end processes in the value chain while horizontal upgrading refers to the deepening of existing functional capabilities

technology pillars of R&D. None of these firms conduct frontier R&D in-house or engage with frontier R&D facilities in local universities. Among the firms with mature R&D capabilities, all seven are foreign. While 20 of the 21 foreign firms reported conducting early R&D activities, only one of the four local firms did so.

Table 1: Technological Competency and Capability, Semiconductor Firms, Malaysia, 2015

Level	Type	HR		Process		Product	
		National	Foreign	National	Foreign	National	Foreign
4	Engineering	4	21	4	21	4	21
5	Early R&D	1	20	1	20	1	20
6	Mature R&D	0	7	0	7	0	7
7	Lead Technology	0	0	0	0	0	0
	N	4	21	4	21	4	21

Source: Rasiah (2017)

Following the introduction of capital grants in 2005, the number of firms engaged in wafer fabrication and chip design rose, increasing from none in 1999 to 10 in 2014, but local firms still lacked cutting-edge R&D capabilities. Four foreign firms and one local firm are involved in chip design, while five foreign firms are involved in wafer fabrication.

Challenges in the E&E industry

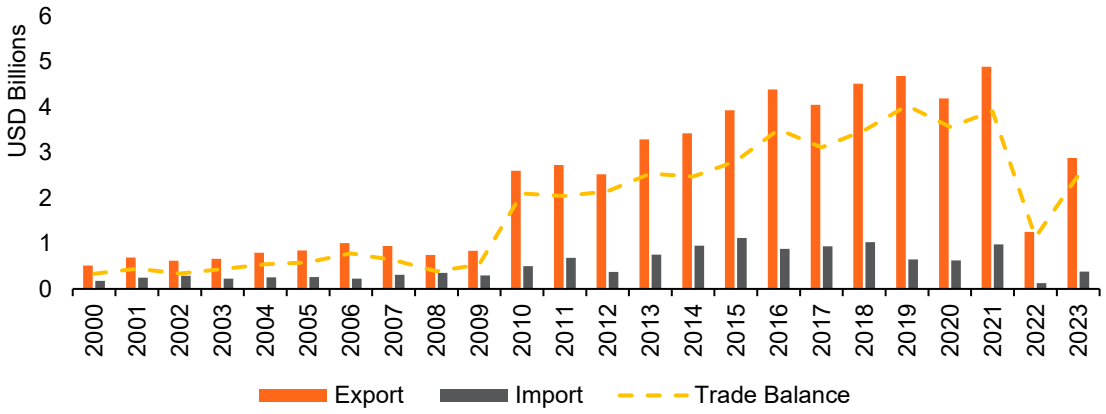
Despite some functional upgrading since the mid-2000s, no firms are involved in key areas of semiconductor R&D such as those related to the enlargement of wafer diameter and miniaturisation, and no local wafer fabricators operate at the frontier. This has been attributed to a shortage of research scientists and engineers and a lack of frontier research at Malaysian universities even with available R&D grants (Rasiah 2017). Furthermore, policy institutions related to the sector such as MIMOS and the Malaysian Technological Development Corporation (MTDC) are disconnected from the industry and their leaders lack technological foresight. These gaps have hindered Malaysian firms' ability to catch up in the manner achieved in South Korea and Taiwan. Additionally, ineffective monitoring has limited resource allocation efficiency.

3.2 The Malaysian Photovoltaic Industry

More central to green industrialisation is the semiconductor-associated solar photovoltaic (PV) industry. Malaysia, the world's third largest exporter of solar panels after China and Vietnam, has strong technological capabilities in manufacturing solar PV, benefiting from its established electronics industry, however, there is negligible domestic presence in this sector. The industrial base and existing skills in regions like Penang and Kulim attract MNCs to establish production facilities. Over 250 companies are involved in the entire value chain (J. Lee 2017), from upstream processes like poly-silicon to mid-stream production of wafers, cells, and modules, and downstream activities such as inverters and system integration (Chandran Govindaraju 2016).

Malaysia has a competitive position in solar PV, as seen by its positive trade balance (Figure 5). Leading manufacturers such as Jinko Solar, First Solar, JA Solar, Flextronics, SunPower, and Hanhwa Q-Cells have plants in Malaysia, linking the country to the global environmental goods supply chain. However, with the exit of Malaysian Solar Resources (MSR) and TSR Solar Tech as of 2022, innovation-intensive upstream and mid-stream segments are now entirely foreign-owned, predominantly Chinese firms (Chandran, Baskaran, and Selvarajan 2022).

Figure 5: Malaysia – Trade Flows of Renewable Energy, 2000-2023, USD billion



Source: UNComtrade, authors' elaboration

National green initiatives, as mentioned above, and to a greater extent investment and trade policies have been crucial in developing the industry. Recently, international political and economic developments have also played a significant role in shaping the mid-stream section of the value chain. While Chinese solar firms already take advantage of low costs in Malaysia, the US-China trade war further encouraged Chinese solar firms to relocate production to Malaysia and other Southeast Asian economies to evade rising US tariffs. This has not gone unnoticed, as Malaysia, along with Cambodia, Thailand, and Vietnam, have been accused by the US Department of Commerce of participating

in circumventing US anti-dumping measures on solar cells and modules from China (Bond et al. 2023).

Despite direct impact from US safeguard tariffs since 2018, Malaysian solar PV exports continued to grow until 2021. The temporary continued improvement in exports is likely due to exclusions of certain products from tariffs, like thin-film modules, exemptions for the first 2.5GW of imported solar cells, exemptions given to developing countries if US imports are less than 3% of the total import basket, and trade diversion to China (Tham Siew Yean, Kam Jia Yi, and Tee Beng Ann 2019). However, in 2022 the trade balance of the product declined, likely reflecting the impact of the tariffs. Although in 2023 there has been a slight rebound, the future of this Chinese-firm-dominated industry remains uncertain as following a two-year waiver the US imposed countervailing duties and anti-dumping rates in late 2024. While three firms that did not respond to the US Department of Commerce investigations were slapped with an adverse inference rate of 124.78% the majority of solar firms assessed in Malaysia were levied a subsidy rate of 12.32%. One Chinese firm received a subsidy rate of only 9.92% whilst a Korean affiliate was levied at 14.72% ("Crystalline Silicon Photovoltaic Cells, Whether or Not Assembled Into Modules, From Malaysia: Amended Preliminary Determination of Countervailing Duty Investigation" 2024). Signs indicate Chinese firms might use other nations such as India to circumvent these restrictions (Prasso 2024).

Challenges in the Photovoltaic Industry

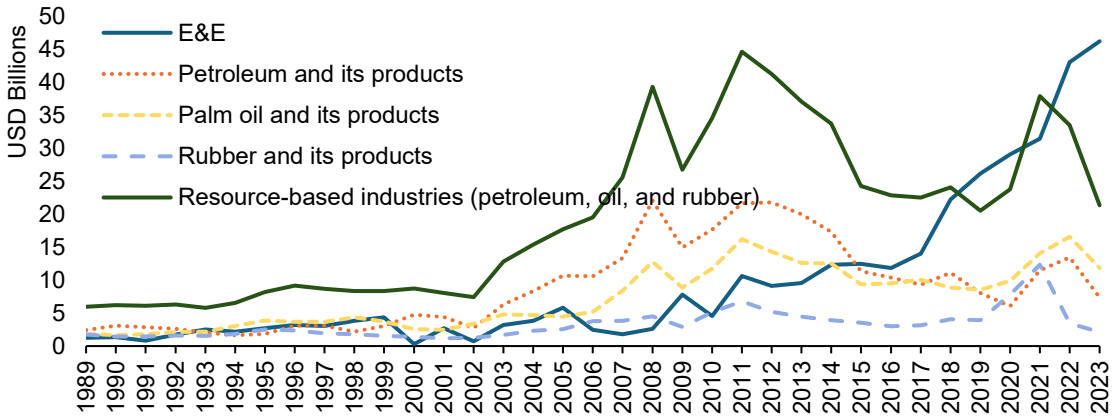
Despite Malaysia's complete value chain for modules, Chinese firms operating there prefer importing cheaper inputs from China. This preference has led to a significant rise in Malaysia's PV industry imports from China, increasing from USD35 million in 2010 to USD522 million in 2021. Chinese lead firms in the solar panel industry are generally vertically integrated and continue sourcing inputs cheaply from China even after setting up operations in Malaysia. The domestic sourcing of inputs by these firms in Malaysia ranges from none to 60% (Chandran et al. 2023).

This global value chain (GVC) structure limits the potential for Malaysian firms to upgrade their capabilities. While MNCs dominating upstream and midstream segments of the value chain can move into downstream activities, local downstream players struggle to move into upstream and midstream segments. For example, local producers of innovative solar modules in the downstream segment cannot source components locally, even if MNCs produce them in EPZs. As MNCs in EPZs are not allowed to sell to the local market, local solar PV module makers must import costlier inputs from abroad, making their products less price-competitive.

3.3 Resource-based Industries

In addition to E&E, resource-based industries like palm oil, rubber and petroleum are crucial to Malaysia's economy and the energy transition[6]. Collectively, these sectors contribute significantly to the country's trade balance, surpassing the contribution of the E&E sector for most of the period between 1989 to 2023 (Figure 6).

Figure 6: Malaysia's Trade Balance by Sector, 1989-2023

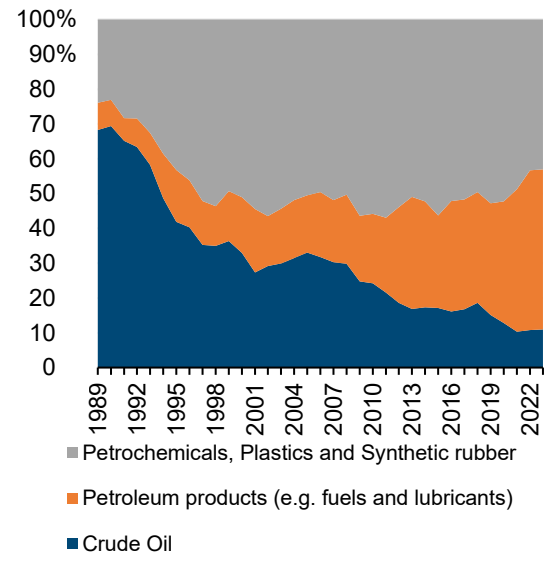


Source: UNComtrade data, authors calculations

Malaysia not only exports raw commodities but also increasingly engages in value-addition processes (Figure 7 and Figure 8). In the 2000s, value-added commodity-based manufacturing accounted for 12% of GDP, compared to 18% for raw commodities. About half of the commodity exports were processed (World Bank 2013).

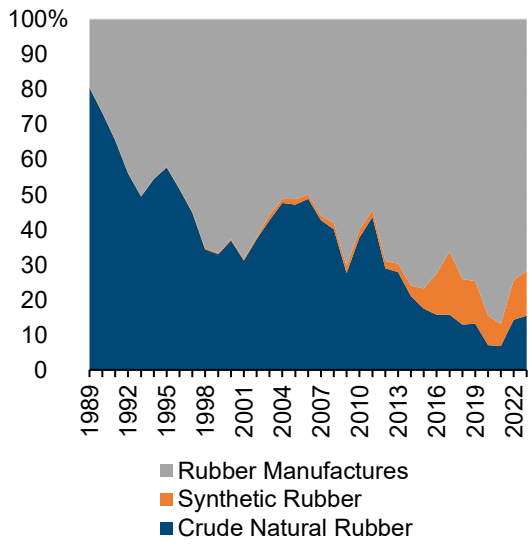
[6] This section draws mainly on (Lebdioui 2022)

Figure 7: Composition of Petroleum Industry Exports (1989-2023)



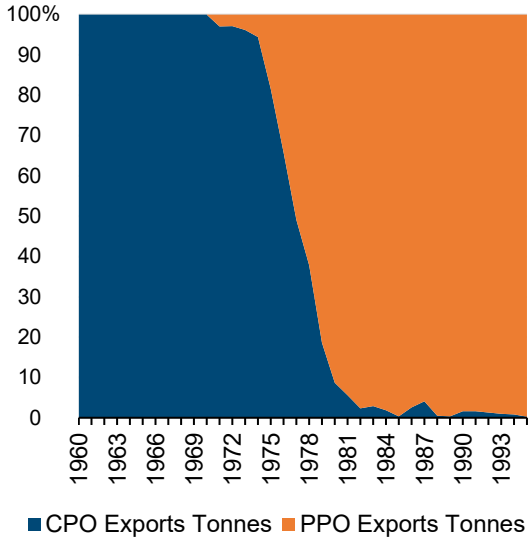
Source: UNComtrade, authors' elaboration

Figure 8: Composition of Rubber Industry Exports (1964-2018)



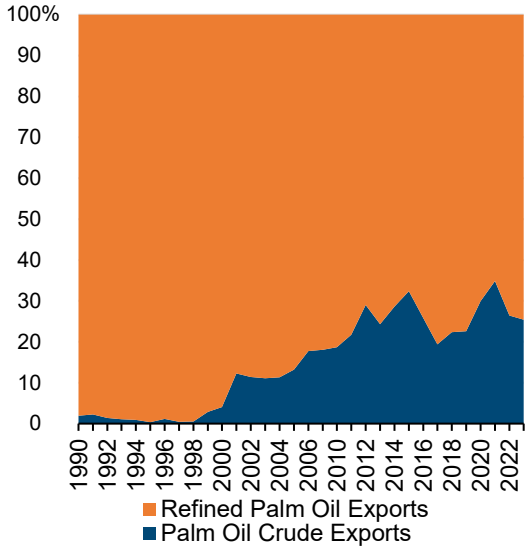
Source: UNComtrade, authors' elaboration

Figure 9: Composition of Malaysia's Palm Oil Exports, based on volume, tons, (1960-1994)



Source: Gopal (2001), authors' elaboration

Figure 10: Composition of Malaysia's Palm Oil Exports, based on Value, USD, (199*0-2023)*



Source: UNComtrade data, authors' elaboration

Malaysia transformed from an insignificant palm oil producer to a leading exporter of processed palm oil, with its share of total oil palm exports growing from 0% in 1974 to 99% in 1994 (Figure 9 and Figure 10). From the 1970s to 1980s, Malaysian palm oil processing grew 34% annually, which was three times faster than the growth of other domestic industries and the global average (Jaya Gopal 2001). The oil palm industry

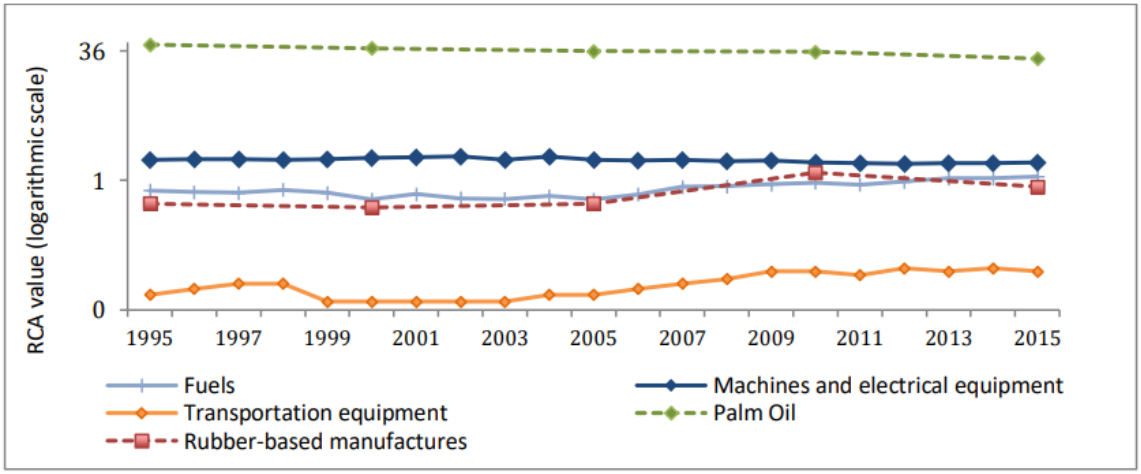
emerged as the second-largest contributor to exports, the fourth-largest contributor to gross national income and directly employs about 600,000 individuals (Azhar AA 2009).

The rubber industry has also evolved from raw rubber production to a nearly fully integrated sector. Since 2012, the value of manufactured rubber goods exports has more than doubled that of raw rubber exports.

The petroleum sector has integrated value-addition processes in both upstream and downstream activities since the 1990s. Domestic firms have accumulated capabilities in downstream production related to refined oil, petrochemicals and lubricants, reducing the share of crude oil exports from over 95% to 20% in the last 50 years (Lebdioui 2020). The products of these industries also feed into the domestic synthetic rubber and plastic producers.

Malaysia's resource-based sectors are globally competitive. Palm oil consistently shows a high revealed comparative advantage (RCA) (Figure 11), while petroleum products and rubber-based manufactures have recorded an RCA of above 1 since 2007.

Figure 11: Malaysia's Revealed Comparative Advantage by Sector (1995-2015)



Source: Lebdioui, Lee and Pietrobelli (2020)

Several policies were important in developing these industries. These policies comprised fiscal incentives, trade protection and promotion, R&D support, as well as human capital promotion as listed in the table below (

Table *2*).

Table 2: Key policies towards value addition in commodity sectors in Malaysia

	Petroleum		Palm Oil		Rubber	
	Upstream	**Downstream**	**Upstream**	**Downstream**	**Upstream**	**Downstream**
Fiscal Incentives	Fiscal incentives for re-investment in resource-based industries The promotion of Investments Act (1986) offers tax breaks to petroleum firms if they contribute to industrial local linkages and knowledge transfers		Fiscal incentives for re-investment in resource-based industries Replanting subsidies	Preferential export duties between crude and refined palm oil Tax credits for downstream processing 7 years tax breaks for pioneer status refineries	Fiscal incentives for re-investment in resource-based industries, which include Pioneer Status (with income exemption) and Investment Tax Allowance Incentives for priority sectors (which include the rubber sector)	
Trade Promotion and Protection	Local content requirements for staff and the supply of goods and services Petronas Vendor Development Programme (1993)	Export taxes on crude oil (1993)	Malaysian Palm Oil Council for promotional efforts (since the 1980s) Barter trade and POPCA credit (since the 1990s) The sustainable palm oil certification scheme (MSPO) since 2015		The Malaysian Rubber Export Promotion Council promotes local products and identifies new export opportunities since 2000 The Malaysia Rubber Board (1998) offers product quality testing and compliant services for local firms to match changing international standards	Tariff protection on tires imports (1960s)
R&D Support	The Petronas Research Cess, an annual research contribution paid by partner companies to promote R&D		Oil Palm Genetics Laboratory (1960s) Malaysian Palm Oil Board (2000) (a merger of the Palm Oil Research Institute, 1997) and the Palm Oil Registration & Licensing Authority (1979)		The MRB (created from a merger the rubber R&D Board; Rubber Research Institute; Rubber Exchange & Licensing Board; Malaysian Rubber Producers Research Association; Tun Abdul Razak Research Centre)	
Human Capital	Institut Teknologi Petroleum of Petronas (1983) Universiti Teknologi PETRONAS (1997)		Universiti Putra Malaysia to train agro-industrial engineers and agro-business graduates			

Source: Lebdioui (2022)

Challenges in Resource-based Industries

Malaysia's resource-based industries have progressed, but still struggle to move into high-value segments dominated by firms from high-income countries that control key assets like brands, technologies, and IP. These segments have become increasingly oligopolistic due to global mergers and acquisitions, limiting opportunities for developing-country firms to grow into globally competitive national champions. Advanced-economy firms hold entrenched global positions, while those from the Global South lack comparable assets and revenues, highlighting the steep barriers to entering high-value, tech-driven markets .

The challenges faced by Malaysia's resource-based industries mirror those encountered by the E&E and solar PV sectors in their efforts to achieve functional upgrading within global value chains which remain dominated by firms from advanced economies. While there are opportunities for capability building and progression within these industries significant obstacles hinder their advancement to higher-value functions.

The continued growth and transformation of these sectors are essential for Malaysia's economic development and green industrialisation goals. A comprehensive understanding of the barriers these industries face, including their effects on vulnerable minority groups, is critical for charting a path forward. These issues and their implications will be explored in greater detail in the next section.

4. CHALLENGES AND BINDING CONSTRAINTS TO GREEN INDUSTRIALISATION

4.1. Climate Adaptation Gaps and the Risks of FDI-Centric Policies

Climate adaptation is a critical pillar of climate action because considerable anthropogenic warming has already taken place. The 12 months of 2023 saw the world hit 1.5°C warming over pre-industrial levels, which is the principal limit targeted by the Paris Agreement. Expectations are growing that the world will overshoot 1.5°C before any tapering or stabilisation is achieved via coordinated global action. The Intergovernmental Panel on Climate Change (IPCC) has documented extensively the dangers courted by 1.5°C warming in its special report. Failure of collective global action would invite runaway warming and significant economic impacts.

Responses to climate change therefore must include both efforts to prevent further warming (mitigation via emissions reduction) and measures to tackle existing and incoming physical risks (adaptation). Additional areas of action include mobilisation of the ‘means of implementation’ (finance, technology transfer and capacity building) and claims of losses and damages.

Ironically, one of the binding constraints on climate adaptation in developing countries can be a green industrialisation policy that is mitigation-centric. In a situation of scarce political and bureaucratic resources adaptation measures may appear less economically salient than greenhouse gas mitigation to meet the biases and expectations of developed country investment demands (such as ESG metrics).

In the Malaysian case, policy development from 2021 to 2023 saw a tremendous emphasis on climate and green industrialisation – framed as "Net-Zero" ambition – with the following measures:

1. Revision of Malaysia's Nationally Determined Contribution (NDC) to the Paris Agreement in 2021 at COP26 to drop conditionality on the receipt of finance, technology transfer and capacity building towards achieving its target of a 45% reduction in the greenhouse gas emissions intensity of GDP by 2030 relative to a 2005 baseline;
2. The 12th Malaysia Plan (2021-2025) which articulated a national carbon neutral target as early as 2050, called on the corporate sector to achieve carbon neutrality by 2050, and was launched in Parliament with an aspiration for 'net-zero' GHG emissions as early as 2050;
3. The National Energy Policy 2022-2040 which placed emphasis on energy transition in light of climate imperatives;
4. The National Energy Transition Roadmap (2023, NETR) which charted out transition to 'net-zero' GHG emissions as early as 2050;
5. The New Industrial Master Plan (2023-2030, NIMP)

These headline national policies have been complemented by the mandatory adoption of G20 reporting standards for the financial sector, namely the Taskforce on Climate-related Financial Disclosures (TCFD).

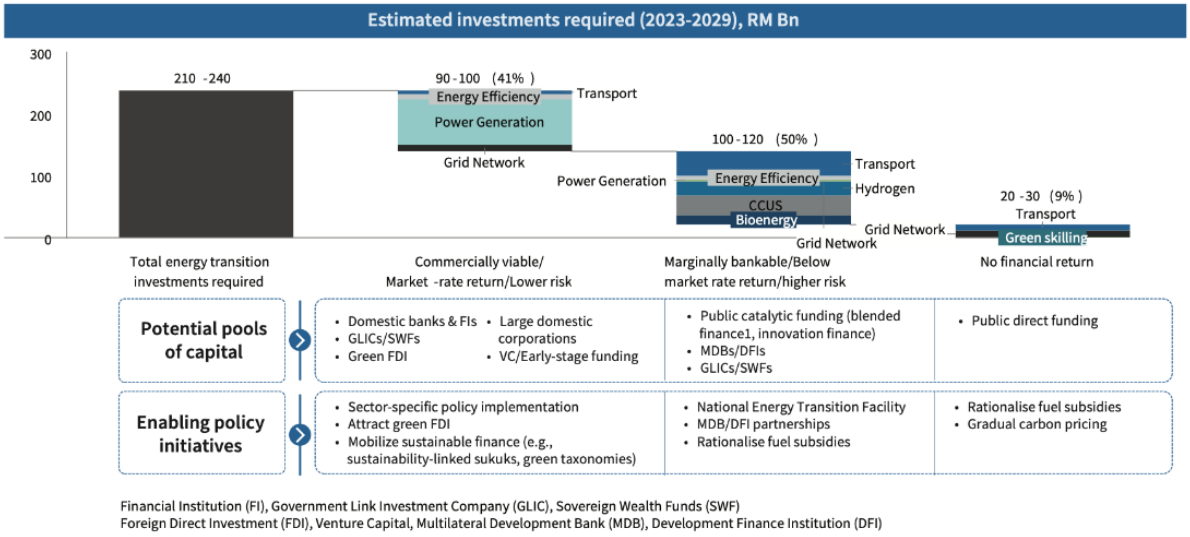
Work on a National Adaptation Plan (NAP) was delayed until late 2024 and is expected to take 2-3 years to complete. As of end 2024, 16 out of 55 countries (29%) in the Asia-Pacific region have filed NAPs with the UNFCCC. This populous and economically critical region as a whole is formally underprepared to respond to the physical risks of climate change.

The overall stance of the recent climate and energy policies above has been to showcase Malaysia's attractiveness as a destination for ESG-sensitive foreign investment, or "green FDI". The transition costs for the energy sector are considerable, with an estimated RM1.2 - 1.3 trillion for investment alone under the NETR, not including the cost of capital. This makes energy transition the largest single expense item currently in government plans. By comparison, the 2024 federal budget amounted to RM393.8 billion out of which the allocation for the then climate and energy ministry was a mere 1.7% of the total.

Low rates of return are a problem that haunts renewable energy transitions around the globe. The NETR indicates that out of the energy transition items for 2023-2029, only

41% are considered to be commercially viable or offer market rates of return (see below). 50% of investments are considered marginally bankable, below market rate, or higher risk, implying the need for public catalytic funding. 9% of investments with no financial return would require direct public funding ("National Energy Transition Roadmap" 2023).

Figure 12: Estimated investment needs under the NETR, 2023-2029



Source: NETR 2023

The need for the state to make financial interventions in up to 59% of medium-term energy transition investments represents a form of de-risking for private capital and FDI in particular[7]. This shifts investment and borrowing costs from private sector to the state. An additional industrial policy risk presents itself whereby the Malaysian state could undertake expensive energy transition measures as a form of 'powershoring' service for transnational capital to decarbonise its GVCs. It does not necessarily follow that if such infrastructure is built, capital will come given the secular decline in global FDI flows, centripetal 'friendshoring'[8] dynamics, and multiple sites of decarbonisation efforts in the region, led by China.

The risk of such powershoring is that it does not represent a qualitative jump in production capabilities or greater value addition on the part of the host country. Rather, it is a more sophisticated form of providing a new level of 'basic' infrastructure for a climate-constrained age. Absent more sophisticated industrial upgrading measures, Malaysia could end up being a low-skill, labour-intensive global production site with a variety of green energy offerings. Notably, if such emissions-focused measures are not also paired with adaptation measures as part of a holistic climate policy, then physical

[7] cf. (Gabor 2020)

[8] Friendshoring refers to the act of moving manufacturing facilities or sourcing from countries that are geopolitical allies.

climate disruptions such as floods, heat stress and sea-level rise can disrupt production in the near and long term.

Conversely, the primary risk which policymakers appear to be responding to is that of divestment risk or investment diversion to third parties. Unless one ignores Malaysia's empirical emissions data – with only 0.37% of historical carbon dioxide emissions – there is no robust way in which Malaysia's achievement of 'net-zero' GHGs will have a decisive impact on reaching global Paris Agreement goals due to its small emissions footprint.

Attraction and domestication of clean energy industries such as batteries and electric vehicles would still require Malaysia to overcome the pre-existing challenges it faces in absorbing and indigenising technologies to generate spillovers.

In either case of responding to divestment risk or de-risking 'green FDI', the risk taken on by the state is a fiscal risk.

It is important to note that while at present climate-friendly (read: low emissions) growth is associated with green growth, it should not be taken as synonymous. While it is possible to deliver environmental health benefits through the phase-out or phase-down of coal (cutting down noxious emissions such as nitrous oxides and sulphur dioxide), there are still industrial processes without significant GHG emissions that also present environmental risks. For example, the processing of rare earths can produce radioactive waste, as does nuclear power generation. Furthermore, climate resilient development that emphasises climate adaptation and resilience has yet to achieve mainstream recognition as green growth or green industrialisation though it is one of the more consequential forms for developing countries.

4.2. Industrialisation and Indigenous Peoples

Even though Malaysia's growth and industrialisation has been recognised to have successfully incorporated redistribution, some groups and communities have been left behind, namely the Orang Asli. The term Orang Asli translates to 'original people'. They are categorised as Bumiputera, along with the Malays, the natives of Sabah and Sarawak, the Malaysian Siamese, and the Portuguese-Eurasians. Orang Asli is an umbrella term introduced by the government in the 1960s to group three broad indigenous ethnic groups in Peninsular Malaysia, the Senoi, Semang and Melayu Asli (Andaya 2002). They, in turn, are made up of 18 subethnic groups in total. The Orang Asli number around 207,000, comprising about 0.6% of Malaysia's population dispersed around the peninsula states except for Perlis and Penang. They have fallen through the cracks despite the NEP's target to uplift the Bumiputera in general.

Social indicators such as poverty rate, educational attainment, health status, access to amenities, and access to economic opportunities are significantly worse for the Orang Asli than Malaysia's average. According to the Department of Orang Asli Affairs, in 2008,

50% of Orang Asli were poor, while 33% were hardcore poor[9], earning incomes below what is required to purchase the minimum caloric intake of food for each household member. In contrast, only 5.4% of Bumiputera in general were poor, and 1.1% were hardcore poor, according to data reported in 2009. The available data, though dated, still likely describes their present situation. Their poor health outcomes are exacerbated by displacement from forests, their traditional source of food and natural resources (Khor Geok Lin 1994; Nurfaizah Saibul et al. 2009).

Educationally, Orang Asli remain disadvantaged. In 2000, only 4.2% of Orang Asli were enrolled in upper secondary education, and recent data from a parliamentary session showed that only 42.29% of Orang Asli completed the final year of secondary school (Kurniawati Kamarudin and Sakini Mohd Said 2022). The number of Orang Asli in tertiary education is even lower. In 2000, only 0.8% were enrolled in tertiary institutions, and between 2000 to 2008, only 497 Orang Asli graduated at the tertiary level (Rusaslina Idrus 2011). This poor education performance is mainly due to poverty and inadequate delivery of educational assistance and subsidies.

Modern economic development has largely been detrimental to the Orang Asli's welfare. Large-scale industrial agriculture has encroached upon the Orang Asli's traditional territory, displacing them and reducing their access to communal forests vital for their sustenance. The establishment of rubber estates and oil palm plantations not only displaced them, but also led to environmental degradation through pollution and forest fragmentation, threatening wildlife and traditional ways of life (Rusaslina Idrus 2011).

Government development plans intended to assist the Orang Asli have sometimes had the opposite effect. In 2010, the government proposed cash crop planting schemes modelled after past rural income-raising programs. Under this scheme, the Department of Orang Asli Affairs would be converted into a statutory body responsible for developing Orang Asli reserve lands. However, the proposal was met with resistance because it did not adequately consult the community. Although the Orang Asli would receive land titles, they could not freely transact them without permission from the Department of Orang Asli Affairs. Furthermore, their communal forests, essential for their livelihood, would be converted into monocultural crops vulnerable to global market swings. This would force a drastic lifestyle change and threaten cultural practices and traditional knowledge.

The Orang Asli objected to the proposal but this was dismissed by the Department of Orang Asli Affairs, which accused them of rejecting modernity and being misled by outsiders. The clash highlights the value-laden nature of development policies, often

[9] Poverty is officially defined by the Department of Statistics Malaysia (2019) as household earning less than the monthly poverty line income (PLI), which is divided into two categories, food PLI and non-food PLI. A household is considered hardcore poor if its monthly income is less than the value of food PLI. Based on the 2005 definition, which was used until 2019, food PLI was determined according to the minimum caloric intake needed for each household member, taking into account the food pyramid and international best practices.

based on a Eurocentric version of economic rationality (Mehmet 2002), and what may be deemed good by planners might not be perceived so by the intended beneficiaries. Industrial capitalist agriculture prioritises profit maximisation, which risks viewing the environment merely as an economic resource for exploitation, in contrast to Orang Asli's values of environmental harmony.

Such conflicts underscore the need for inclusive decision-making when introducing development plans for the Orang Asli, including opportunities related to green industrialisation. A sustainable palm oil industry producing biofuel, for example, can create job opportunities, but imposing such project on the Orang Asli infringes upon their rights and may not align with their concept of well-being. Participation should be voluntary, and states must obtain their free and informed consent prior to the approval of any project affecting their lands or territories (Nicholas 2000). Any development proposals should adhere to the United Nations Declaration of the Rights of Indigenous Peoples, to which Malaysia is a signatory, affirming that "[i]ndigenous people have the right to determine and develop priorities and strategies for the development and use of their lands or territories and other resources".

The need to obtain prior informed consent notwithstanding, should Orang Asli choose to participate in modern development plans including in green industries, opportunities should be adequately provided to develop their capabilities. Part of the rationale for industrialisation is to provide high-income jobs for highly skilled workers who are expected to benefit more by virtue of their skills. The Orang Asli's generally low education level could see them fall further through the cracks in the coming sweep of green industrialisation if nothing is done to improve their educational outcomes.

Opportunities in education and jobs can be allocated through affirmative action policies targeting the group specifically. The problem with current affirmative action policies is that they target the Bumiputera in general without distinguishing the constituent ethnicities. Most government statistics also present the Bumiputera as one consolidated group, masking the true economic position of constituent ethnicities. As such, indicators showing the progress of the Bumiputera's position, in general, may not mean any progress for the Orang Asli at all since it is possible that only particular subgroups are beneficiaries of that progress. Furthermore, Orang Asli households are typically excluded as statistical outliers in the household amenities surveys conducted by the government. Therefore, their socioeconomic deprivation in matters such as access to electricity, piped water and schools can be statistically invisible unless dedicated surveys are carried out.

4.3. Deindustrialisation

Concerns about Malaysia's deindustrialisation have grown in recent years. While definitions vary, we adopt Tregenna's (2009; 2013) view that deindustrialisation refers to a sustained decline in manufacturing's share of both GDP and total employment. Crucially, not all declines in manufacturing employment qualify—only when accompanied by a drop in value-added share does it count as deindustrialisation.

By this measure, Malaysia is indeed deindustrialising. Between 2000 and 2018, manufacturing's share of GDP fell by 7.8% and employment by 6.1%. This has been accompanied by deteriorating trade performance, slowing productivity, and a failure to upgrade into high-value-added activities (Rasiah 2011b). The rise of lower-cost production sites such as Vietnam and China has further accelerated this trend.

Manufacturing holds unique advantages over other sectors—chief among them its role in driving growth, productivity, and technological upgrading. It offers more learning opportunities and generates both embodied and disembodied knowledge with strong spillover effects across sectors. Capabilities developed in manufacturing, such as internal combustion engines or wafer technologies, often serve multiple industries, including emerging green sectors.

Innovation frequently emerges from combining complementary existing technologies (Arthur 2009; Andreoni, Chang, and Labrunie 2021), making a robust industrial base crucial for green transition. China's leadership in solar PV and EVs, for instance, drew on its pre-existing industrial strengths. A deindustrialising economy, by contrast, faces shrinking talent pools and eroding technological capabilities, making such transitions far harder to achieve.

4.4. Constrained Industrial Policy Space

Building competitive indigenous industries in developing countries requires strong government support through industrial policies to close capability gaps with advanced economies. As Chang (2003) and Reinert (2008) highlight, early industrialisers like the US and UK relied heavily on state intervention, despite later criticising such approaches. Similarly, newly industrialised countries like South Korea and Taiwan used industrial policies to strengthen global competitiveness.

These countries employed tools such as tariff sequencing, import licensing, duty drawbacks, subsidies (for exports, production, R&D), local content requirements, tech transfer mandates, trade balancing, selective patenting, compulsory licensing, skills development, and state-owned enterprises. However, most of these tools became non-compliant under WTO rules after it replaced GATT in 1994.

During the GATT era, Malaysia used instruments like local content requirements, import controls, export incentives, and export performance requirements. DiCaprio and Gallagher (2006) noted that under the WTO regime, Malaysia ceased using all but import

controls. The WTO's dispute mechanism discourages the introduction of non-compliant policies, effectively constraining national policy space.

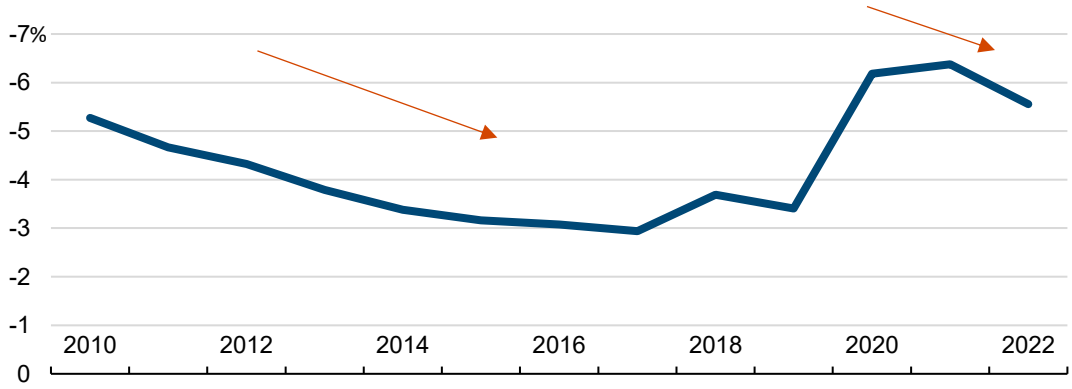
These WTO rules represent only the baseline. Malaysia is also party to seven bilateral and nine regional FTAs, which impose stricter intellectual property rules and investor-state dispute settlement (ISDS) clauses. These WTO+ commitments allow MNCs to sue governments for policies that allegedly reduce profits (Jomo KS 2024), further limiting policy space .

Beyond trade agreements, dominant Global North MNCs indirectly restrict policy space by erecting barriers to entry for firms from developing countries (Andreoni, Chang, and Estevez 2019). They also influence global rule-making by lobbying national governments and international bodies to adopt regulations that favour their interests. Key mechanisms used include intellectual property rights, international standards, and liberalisation of trade and capital flows.

4.5. Constrained Fiscal Space

Malaysia's ability to implement industrial policy has been further limited by constrained fiscal space. Since the 2008 Global Financial Crisis, successive governments have focused on reducing the fiscal deficit, with only brief exceptions during the COVID-19 crisis in 2020–2021 (Figure 13). As a developing country, Malaysia's sovereign debt is less attractive to international investors compared to safe-haven economies like the US, Germany, Japan, and the UK (De Paula, Fritz, and Prates 2017). This limits its ability to run high deficits or accumulate debt without risking balance of payments pressures, especially given its reliance on imported capital and intermediate goods.

Figure 13: Malaysian Government's Fiscal Balance, 2010-2022 (percentage)

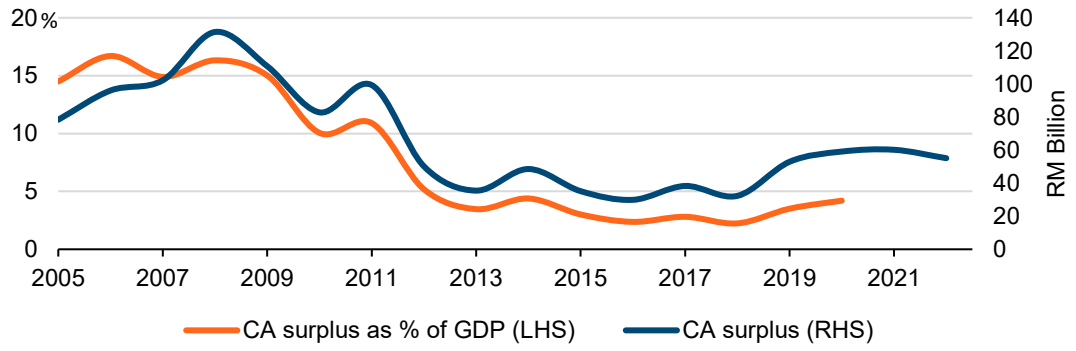


Source: Bank Negara Malaysia

This challenge is compounded by a weakening current account surplus, Malaysia's traditional source of foreign currency (Figure 14). To bridge the external financing gap, Malaysia has increasingly relied on foreign purchases of government bonds and other

capital inflows. Without this, the ringgit faces depreciation pressures, raising the risk of currency mismatches for firms reliant on imported inputs but earning mostly in local currency.

Figure 14: Malaysia's Current Account Surplus, 2005-2022 (percentage of GDP and RM Billion)



Source: Bank Negara Malaysia and the International Monetary Fund

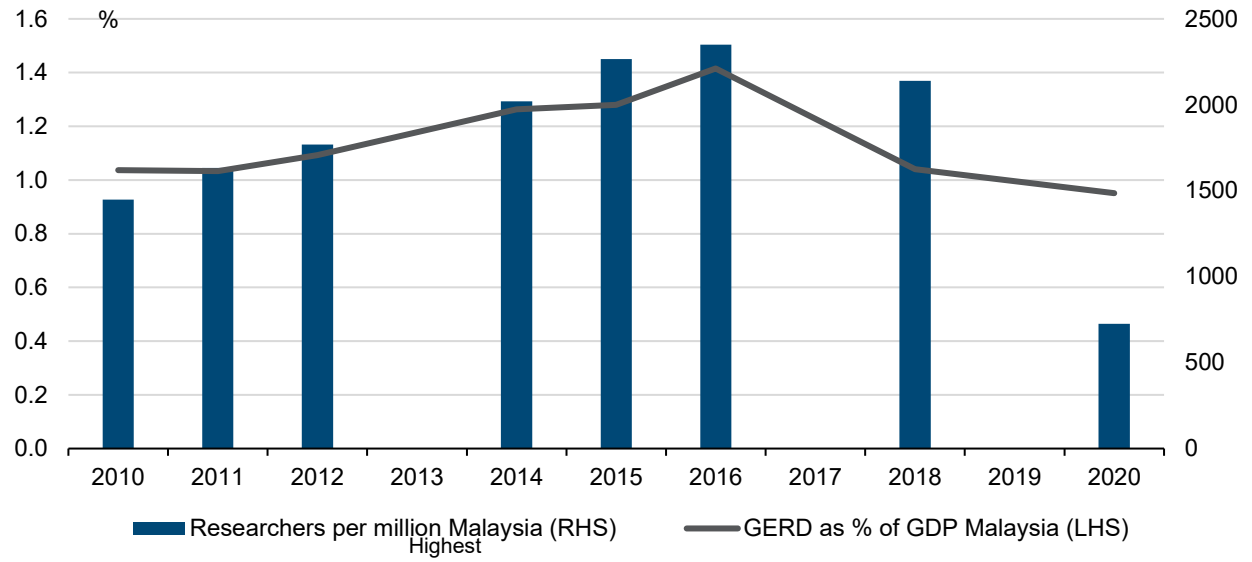
In November 2023, further constraints were introduced via the Public Finance and Fiscal Responsibility Act, which caps the fiscal deficit at 3% of GDP, government debt at 60%, and financial guarantees at 25%. Exceeding these limits requires cabinet and parliamentary approval under exceptional circumstances. These legal limits reduce the scope for using fiscal expansion to support industrial policy.

4.6. Talent Issues

A shortage of high-skilled talent is often blamed for Malaysia's difficulty in upgrading to high-tech, high-value-added industries, particularly in the E&E sector (Rasiah 2017). Unlike Taiwan's TSMC, where visionary leadership and strong R&D networks drove success, Malaysia lacks similarly capable executives, though some talent exists among MNC alumni. Foreign E&E firms cite the lack of engineers and R&D scientists as a key reason for not investing in advanced wafer fabs, despite available grants. The Minister of Investment, Trade and Industry noted a demand for 50,000 engineers, while only 5,000 graduate annually (Izzul Ikram 2024).

Malaysia's number of researchers has fallen—from 2,349 per million in 2016 to 726 in 2020—alongside a decline in R&D spending (from 1.4% to 0.95% of GDP) (Figure 15), suggesting the issue is more demand-side than supply-side. Skill underemployment data supports this: in 2021, over 40% of STEM graduates were overqualified or employed outside their fields (Table 3 and 4)Tq. For example, 20% of E&E graduates did not secure jobs in their field in 2021, despite supposed talent shortages (Department of Statistics Malaysia 2023). Between 2018–2022, high-skilled jobs in the industry remained stagnant (~140,000), and new job creation fell, indicating limited absorption of skilled talent (Figure 16).

Figure 15: Gross Expenditure on R&D and Researcher Headcount, Malaysia, 2010-2020 (percentage and per million people)



Source: UNESCO (2024)

Table 3: Prevalence of Overqualified Graduates, by Study Field, 2010-2021

Field of Study	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Average
Science, Mathematics & Computing	47.4	47.1	50.2	49.1	50.5	51.7	53.4	55.5	57.3	38.7	36.0	37.3	47.8
Engineering, Manufacturing & Construction	32.4	32.0	36.0	41.4	39.5	43.7	45.5	47.5	52.4	38.1	42.6	44.5	41.3
Health & Welfare	15.7	19.5	31.6	31.3	26.1	27.5	37.2	36.4	33.8	24.7	29.9	30.2	28.7
Agriculture & Veterinary	64.7	64.7	67.2	68.7	68.9	66.8	72.3	75.4	81.7	65.1	65.8	70.2	69.3
Social Science, Business & Law	55.8	54.0	56.6	57.6	60.0	61.8	60.9	61.8	61.6	50.9	51.6	54.9	57.3
Education	17.0	29.4	33.4	25.5	32.4	29.0	30.0	34.4	37.9	28.8	30.6	34.5	30.2
Arts & Humanities	45.5	45.5	49.4	46.8	47.0	51.0	51.6	53.8	58.8	41.7	45.9	47.6	48.7
Services & Others	70.5	67.7	67.2	67.1	68.9	73.9	73.4	76.1	77.5	70.3	70.9	70.9	71.2
Overall	42.3	43.2	46.6	48.0	50.0	51.9	54.0	54.0	55.4	44.3	46.2	48.6	**48.7**

Lowest

Note: Study fields shaded in grey indicate the three fields with the lowest overqualification rates across the years, while those shaded in blue represent the three fields with the highest overqualification rates. Similarly, in the "Overall" category, years with the three lowest overqualification rates and the three highest overqualification rates are shaded in grey and blue, respectively.

Source: KRI (2024), based on KRI calculations of MOHE, n.d., data

Table 4: Prevalence of Horizontal Mismatch (perceived by graduates), by Study Field, 2018-2021

Field of Study	2018	2019	2020	2021	Average
Science, Mathematics & Computing	47.7	48.3	47.3	44.3	46.9
Engineering, Manufacturing & Construction	38.6	39.5	42.7	41.2	40.5
Health & Welfare	25.8	24.4	26.2	18.0	23.4
Agriculture & Veterinary	56.5	60.2	57.1	56.6	57.8
Social Science, Business & Law	39.2	41.3	43.8	42.8	41.7
Education	26.6	28.5	31.6	31.3	29.6
Arts & Humanities	45.5	48.6	54.0	54.5	50.7
Services & Others	36.8	37.0	44.4	49.2	41.7
Overall	**39.1**	**40.4**	**43.3**	**42.0**	**41.2**

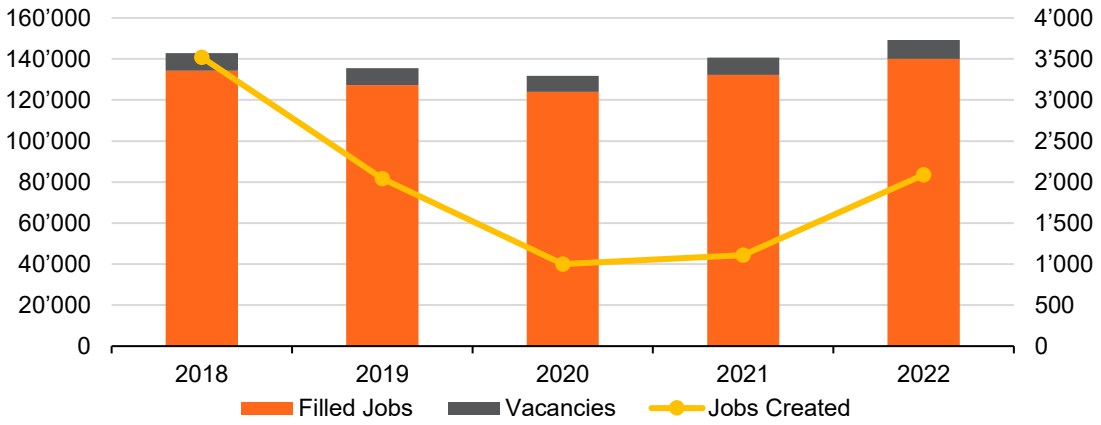
Lowest  Highest

Note: Study fields shaded in grey indicate the three fields with the lowest overqualification rates across the years, while those shaded in blue represent the three fields with the highest overqualification rates. Similarly, in the "Overall" category, years with the three lowest overqualification rates and the three highest overqualification rates are shaded in grey and blue, respectively.

Source: KRI (2024), based on KRI calculations of MOHE, n.d., data

Thus, the perceived talent shortfall may reflect industry aspirations for future growth or anticipated FDI, rather than actual shortages. The real issue is a coordination failure: firms may not move into high-value segments even if talent is available, due to competitiveness, market access, and strategic factors. The government lacks leverage to compel MNCs to invest in frontier R&D or fabs, and local firms may not be profitable enough to move up the value chain.

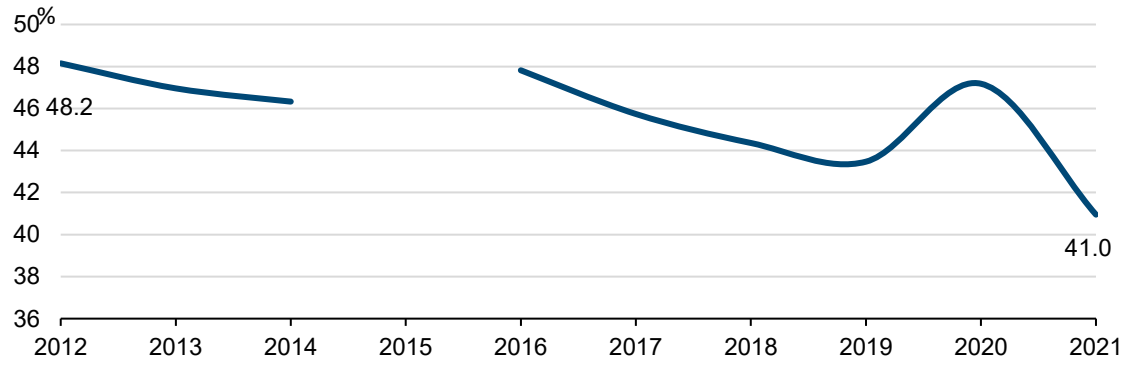
Figure 16: Breakdown of high-skilled jobs in the E&E sector, 2018-2022



Source: Mohd Amirul Rafiq Abu Rahim and Laventhen Sivashanmugam (2024), based on calculations of DOS (2023) data

One solution is for the government to directly invest in state-owned or supported firms that can absorb skilled talent—an approach used by South Korea and Taiwan (Amsden 2012). Malaysia's own attempt, Silterra, fell short due to financial and strategic limitations. Without such intervention, Malaysia risks losing interest in STEM careers altogether, as shown by the declining number of STEM graduates (Figure 17). These talent coordination issues could similarly affect green industries, which also require high-tech skills.

Figure 17: STEM enrolment in Malaysian Universities, 2012-2021 (percentage)



Source: Ministry of Education (2023)

4.7. Weaknesses in Supporting Institutions

Malaysia's R&D weaknesses stem not only from low spending and talent shortages but also from ineffective utilisation. Although the government invested in higher education and research institutions, policy did not emulate best practices from successful catch-up countries. In Taiwan, Japan, and Korea, government research institutions acted as 'collective entrepreneurs'—engaging in applied R&D, reverse engineering, and technology substitution to serve industrial needs, often in collaboration with firms (Danaraj 2011).

Unlike these countries, Malaysia focused more on commercialising R&D outputs from government institutions than on solving industry-specific technological problems or promoting corporate R&D (Danaraj 2011). Institutions like MIMOS and SIRIM have had limited success in internal R&D and technology transfer, and their outputs were largely unused by local firms. MIMOS initially aimed to stimulate the E&E sector but later shifted away from frontier R&D following leadership changes (Rasiah 2017).

Malaysia also lacks institutional support in sectors with strong export potential, such as rubber gloves, palm oil, and furniture. R&D policy has prioritised scientific research over practical industrial application, despite evidence that firm-level R&D is more crucial for economic success (Kim and Lee 2015). Efforts to promote collaboration, such as the Collaborative Research in Engineering, Science and Technology (CREST) initiative, have shown early promise. Firms' co-funding in CREST rose from 50% to 64%, indicating private sector buy-in (Chin et al. 2018). However, with MNCs dominating participation, there are concerns that benefits accrue more to them than to the domestic economy (Rikap and Flacher 2020; Rasiah and Yap 2019).

Earlier initiatives—like the Action Plan for Industrial Technology Development (APITD), Malaysian Technology Development Corporation (MTDC), and the establishment of Silterra—also failed to upgrade Malaysia's E&E industry into high-value functions such as chip design and frontier fabrication. Reasons cited include talent gaps (Best 2007; Rasiah 2017) and reliance on foreign firms performing low-value activities, a pattern possibly reinforced by access to cheap labour (Raj-Reichert 2020). Ultimately, the persistent absence of large, innovation-driven domestic firms reflects a deeper lack of strong industrial policy focused on fostering indigenous technological advancement.

4.8. Lack of Big Indigenous Firms in Green Industries

Malaysia's limited presence in high-value segments of green product markets is partly due to the lack of large domestic firms investing in technology development. While Malaysian firms may join global value chains (GVCs) as suppliers, they are often confined to low-value-added roles, such as packaging and testing in the E&E sector. This is due to structural asymmetries in GVCs, where lead firms restrict value capture by intensifying supplier competition (Milberg and Winkler 2013; Tan 2014). Such lock-in is a key reason Malaysia remains a middle-income country.

To avoid similar outcomes in green industries, local firms must develop innovative capabilities. In successful economies like Japan, Korea, and China, large business groups, critically supported by industrial policies, played a crucial role in technological upgrading. These groups leveraged internal resources—such as R&D units and brand power—which are indivisible and tacit, giving them an advantage over standalone firms (K. Lee 2019). They also facilitated access to funding and helped absorb initial losses in high-risk sectors, as seen with Samsung's entry into memory chips (Shin 2017).

Business groups thrive by sharing resources and spreading risk across affiliates, especially in countries with weak external capital markets. Although Malaysia's capital market is relatively advanced, financing for new technologies remains limited, especially in green sectors (Chandran, Baskaran, and Selvarajan 2022). Business groups can "socialise" early-stage losses and fund long-term innovation.

However, firms in developing countries usually lack the capabilities to enter high-barrier markets. Building these capabilities requires time and effort. Korean firms succeeded by developing "dynamic capabilities"—skills for adapting to changing environments—through project execution experience and strong government support. They progressed through stages: rent-seeking, diversification, integration, and finally, innovation (K. Lee 2019).

Malaysia, by contrast, has not followed this path. Although large Bumiputera conglomerates emerged in the 1980s through state support, they failed to become innovators. The state provided accumulation rents through contracts and licenses, aiming to create dynamic entrepreneurs. Rents for learning were also allocated, such as in the automotive sector via Proton. However, political patronage and factionalism in the ruling party, UMNO, blurred the lines between productive and unproductive rents, and firms like DRB, Proton's owner, failed to sustain R&D investments, opting instead for safer, rent-heavy sectors (Tan 2014; 2018).

The 1998 Asian Financial Crisis exposed the fragility of these conglomerates, leading to bailouts and renationalisation, and highlighting the failure of Malaysia's firms to graduate from the rent-seeking stage. External liberalisation pressures from the WTO and regional trade agreements during the 1990s further reduced Malaysia's policy space, forcing many firms into protected, low-productivity sectors such as real estate and construction (Tan 2014).

South Korea succeeded partly because its firms built capabilities before the era of "compressed development," when global trade rules began shrinking state policy space (Whittaker et al. 2020). Samsung, for instance, had already developed innovation capacity by the 1990s. In contrast, Malaysian firms were still in early capability-building stages during that time and lacked state support to break into high-tech markets.

Today, both Bumiputera and non-Bumiputera business groups in Malaysia remain constrained by weak capabilities and limited policy support. Without strong domestic firms investing in innovation and with diminished government leverage to support capability-building, Malaysia's move into higher-value-added green industries remains a challenge.

5. CONCLUSION AND POLICY RECOMMENDATIONS

Malaysia has built several green-related industries over time—such as E&E, solar PV, and resource-based sectors like palm oil and rubber—through phases of industrial policy. However, these industries continue to face challenges in moving up the value chain, owing to issues like deindustrialisation, constrained fiscal and industrial policy space, talent issues, weak innovation ecosystems, and the absence of strong indigenous firms. The over-reliance on mitigation-focused FDI policies, without sufficient attention to adaptation, adds further vulnerabilities, especially in green infrastructure. Meanwhile, marginalised groups, particularly the Orang Asli, risk being excluded from the benefits of green industrialisation due to persistent socio-economic disparities. Addressing these multi-dimensional barriers is critical for making Malaysia's green transition both innovative and inclusive.

This paper closes with several policy suggestions.

1. **Industrial policies to address deindustrialisation -** Industrial and innovation policies that address gaps in current industrial capabilities can mitigate Malaysia's deindustrialisation. Malaysia's deindustrialisation occurred due to strong competition from lower-cost countries and from being technologically inferior to firms in advanced countries. Where the industry is not yet sunsetting, or capabilities within the industry could be useful for future industries, the government can use available policy tools under current international agreements to help firms upgrade technologically. Additionally, policy space may have been freed with the US Appellate Body blockage in WTO rendering WTO rulings not legally enforceable(Hopewell 2024). Given possible fiscal constraints, fiscally light tools such as trade protection should be considered. However, the fiscal constraint may not be as limiting as assumed, as discussed below. Tools such as local content requirements can be implemented indirectly and not trigger WTO prohibitions as the case of Proton shows. However, competition policies should be introduced to prevent firms from being uncompetitive, such as export targets and making subsidies conditional on competitive performance. It is beyond the scope of this paper to discuss the appropriate combination of policy tools to be deployed in respective industries.

2. **Expand and upgrade technology-related state-owned enterprises or implement policies to encourage firms to move into technology-centric industries to absorb skilled labour -** Reconciling the problem of talent undersupply to enter knowledge-intensive high-value-added activities with presently high rates of skill-related underemployment requires establishing firms that absorb currently produced graduates in STEM. If current prospects for employment are dim, students will avoid studying STEM in university, shrinking the talent supply. This can be addressed through state-owned firms, which have been tried before in the E&E industry (Silterra). However, it failed to expand and upgrade due to a lack of capital and ambition and thus could not continuously absorb talent. Any future attempts at such a venture require a greater willingness

by the state to take risks. At the same time, if the problem of lack of competition arises, it can be mitigated by imposing conditionalities on the firm and adhering to meritocratic standards in hiring and firing, especially the leading executives. Another way to increase firm creation is by encouraging private local firms to enter the business through trade and industrial policies such as subsidies, procurement and managed competition, especially those already operating in a related business and might already have relevant capabilities. This method encourages multiple entries in the sector and avoids problems of a lack of competition, a common problem when relying on a single state-owned enterprise to drive the industry.

3. **Expand taxes or consider intelligent use of monetary financing to overcome fiscal constraints -** To address shrinking fiscal space, new taxes may be imposed, but fiscal constraints might be less severe than perceived. Modern Monetary Theory (MMT)(Wray 2024; Kelton 2020) suggests countries with monetary sovereignty—those issuing their own currency—can finance deficits by printing money, with inflation being the key risk rather than a lack of funds. However, this approach must be adapted cautiously for developing countries, where monetary sovereignty is limited by foreign demand for local currency assets(De Paula, Fritz, and Prates 2017).
   Developing countries face risks of currency crashes from foreign sell-offs of local assets. Mitigation strategies include managing foreign exchange reserves and maintaining a current account surplus. Long-term resilience requires reducing reliance on foreign investors for local currency financing.
   Inflation risks in developing countries are more pronounced due to capacity constraints and import reliance. Increased government spending may strain resource limits, leading to inflation or currency devaluation if higher demand is met by imports. Thus, monetary financing policies must be strategic, prioritising trade balance, currency stability, and inflation control by strengthening export-oriented industries and developing self-sufficient industrial capacity. Development banks may be a useful tool to support these objectives.

4. **Reorient R&D policy to encourage firm innovation with universities as support and change the role of government research institutions to assist global technology transfer to firms -** University research institutions' weaknesses in supporting the creation of innovative industries can be addressed by orienting research policies towards industries' needs rather than solely focusing on mainstream science. However, this requires the establishment of local firms that are interested in entering technology-based segments first. Only then can university research be guided by industry to assist them in their innovation needs. Additionally, in the case of government research institutions, their role could be changed to scouting and assessing available technologies and know-how globally and facilitating their dispersion amongst local firms. Developing countries can leverage existing technologies without reinventing the wheel to establish capabilities in their local firms. These technologies, and more

importantly, the know-how learned from foreigners, can act as important foundations for firms to begin innovating(Mathews and Cho 2000; Chung and Lee 2015).

5. **Industrial policy to encourage the emergence of large firms that can innovate** - The industrial, trade and competition policy to prevent deindustrialisation discussed above may also facilitate the creation of big local firms with innovation capabilities. However, there is no easy solution to rein in powerful social groups to use allocated rents productively when ruling coalitions are vulnerable. A ruling coalition conducive to development requires a ruling party that is not easily threatened by competing political forces and has strong implementation capabilities that powerful social groups cannot easily dismiss. Influential political parties and powerful social groups must agree to pursue developmental goals. Overarching industrial policies and policymakers must understand the qualitative differences in development outcomes from an FDI-focused manufacturing policy and one focused on raising innovative large local firms.

6. **Greater inclusion of climate adaptation policies in future climate policies** - Future iterations of green industrial policies must not only focus on climate mitigation to attract foreign investment but must also substantially focus on climate adaptation policies since an unavoidable minimum 1.5°C degree of global warming is locked in, likely higher given disappointing outcomes in climate finance following the COP29 climate summit in November 2024(Yin Shao Loong and Nurul Farhana Abdul Shukor 2024).

7. **Resolve the basic needs of Orang Asli and marginalised groups and implement specific affirmative actions so that they can benefit from job opportunities related to green industrialisation** - To provide opportunities for Orang Asli and structurally marginalised groups to benefit from green industrialisation, the state must resolve their longstanding issues related to poverty, low education levels and poor health. These three conditions likely cyclically interact with each other, with poor outcomes in one condition reinforcing poor outcomes in others and themselves. Without proper education, Orang Asli will continue to be excluded from modern development. State and federal governments must improve their access to education and healthcare by improving infrastructure, locating it nearer to Orang Asli settlements, and increasing the funding and staff that provide these services to the Orang Asli. Economic programs to raise their incomes must also respect their rights, especially rights to their land and way of life. It should also be done with their prior informed consent and without coercion.

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