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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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Electric Vehicle Transition in Malaysia: Policies, Performance and Prospects

This paper explores Malaysia's transition to electric vehicles (EVs) as a key component of its green structural transformation. It assesses the policies enabling this shift, the progress achieved, and the challenges faced, while offering recommendations to enhance the transition's effectiveness. The paper provides an overview of Malaysia's automotive sector, examines opportunities and barriers in the EV transition, and evaluates the country's role in the regional EV value chain. It also draws lessons from China's EV policy framework and reviews Malaysia's domestic policies and investment strategies, including the roles of both domestic and foreign direct investment. By critically analyzing current strategies and proposing policy improvements, the study aims to support a more sustainable and competitive EV sector in Malaysia.

Contents

KEYWORDS: Electric Vehicles, Green transition, Decarbonisation, Regional Value Chains, Malaysia

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Introduction

Malaysia shifted into manufacturing development when it opened up its first Free Trade Zone in Penang in 1972. Thereafter it liberalised inflows of foreign direct investments (FDI) in manufacturing leading an expansion of manufacturing activities. The share of manufacturing in the Gross Domestic Product (GDP) of the country increased progressively till it peaked at 31 percent in 2000. Manufacturing's share fell to about 23 percent in 2010, after which the share stagnated around 21-23 per cent, until the Covid years of 2020-21, when there was a slight increase in the share of manufacturing. But this was attributed to a greater contraction in services value added over 2019-2020 and its smaller expansion in 2021. In 2022, the share of manufacturing in GDP stood at 23.4 percent.

The drop in the share of manufacturing in GDP from 2000 onwards is often interpreted as premature deindustrialization as it occurred at a per capita income level that is lower than that experienced in advanced economies while the shift to services is a shift towards more labour-intensive services rather than knowledge-intensive services (Runchana and Wee 2023, Tham 2017). The causes of deindustrialization can be attributed to several key factors, including Malaysia's deteriorating competitiveness for FDI, leading to a slowing down of FDI inflows. At the same time, the country continued to depend on FDI for structural transformation instead of domestic innovation taking the lead. Domestic firms continued to be inward-looking while exports are mainly contributed by the multinationals (MNCs) operating in the country. This delayed the shift towards higher value-added manufacturing, leading to the stagnation in manufacturing development.

The on-going trade and technology disputes between the US and China opened up an opportunity for Malaysia to gain from the relocation of some of the FDI from the US, China as well as other advanced economies. Malaysia is also confronting new challenges such as climate change and its adverse impact on economic growth. Thus, Malaysia's new challenge is to strive for green structural transformation to overcome the twin problems of premature deindustrialisation and climate change. Industrial policies have targeted a shift towards electric vehicles manufacturing and use as one of the means to revitalise the manufacturing sector via renewed automotive development as well as to shift out of the use of fossil fuels in transportation.

This paper examines the policies used to enable this shift, the progress made and challenges encountered with policy suggestions for improving the prospects of this shift as part of the country's green structural transformation. The paper is organised as follows. An overview of the automotive sector is presented in section 2, after the introduction. This is followed by a discussion on the opportunities and challenges in EV transition in section 3. Section 4 examines Malaysia's participation in the emerging regional EV value chain. Since China is the world's leading producer of EV, the policies used to develop this sector is synthesised in Section 5. Section 6 summarises the key domestic policies used in Malaysia for fostering EV development while the use of domestic and foreign direct investments are analysed in section 7. Section 8 critically examines the strategies used for EV transition in Malaysia, followed by policy suggestions for improving the prospects of this transition in section 9. The conclusion in section 10 summarises the main findings of this paper.

Section 2: Overview of Malaysia's Automotive Sector

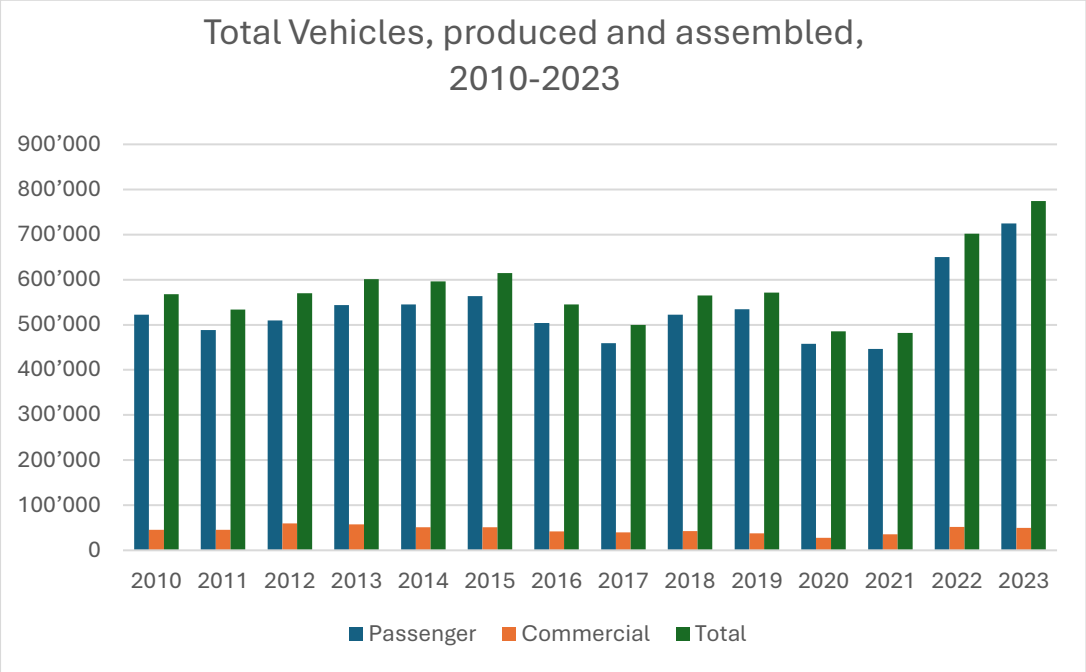
Malaysia's automotive industry was relatively small sector in 2006 with four passenger and commercial vehicle manufacturers, nine assemblers, and 343 motor vehicle components and parts manufacturers (MITI 2006). By 2015, based on the Economic Census 2016 for the manufacturing sector (DOSM 2016), there are 33 establishments in the manufacture of passenger cars. The manufacture of parts and accessories for motor vehicles have the largest number of establishments, totalling 525. In 2022, there are 38 manufacturers/assemblers and 641 parts and components manufacturers (MITI 2023a). Approximately 80.0 per cent of the parts and components manufacturers are Malaysian-owned companies. International component manufacturers, such as ZF, Delphi, Continental, Nippon Zayaku, PD Kawamura, Akashi Kikai, Denso, and Bosch are also active in Malaysia's automotive sector (Asian Insiders n.d.).

The automotive sector's value-added accounts respectively for 4.6 and 4.5 percent of total manufacturing value added in 2015 and 2021 (DOSM 2016, DOSM 2023). In terms of value added, the total for the manufacture of motor vehicles is bigger than that produced by the manufacture of parts and accessories for motor vehicles. The domestic orientation of these manufacturers can be clearly seen as only 22 percent of the establishments in the manufacture of motor vehicles are exporting with exports accounting for a mere 11.5 percent of their total sales value in 2015. In the case of parts and accessories for motor vehicles, 32 percent of the establishments are exporting with a share of export to total sales value of 28 percent (DOSM 2016).

Passenger vehicles dominate production, with only a small contribution from commercial vehicles (Figure 1). Production and assembly peaked in 2015 before trending downwards for four consecutive years, contracting further during the Covid pandemic years, 2020-2021. It recovered post pandemic and reached the highest in 2023 during the 13-year period shown.

Within ASEAN, Malaysia is the third largest producer for passenger vehicles, after Indonesia and Thailand (ASEAN Automotive Federation 2019). It is the fifth largest for the production of commercial vehicles, after Thailand, Indonesia, Vietnam, and the Philippines.

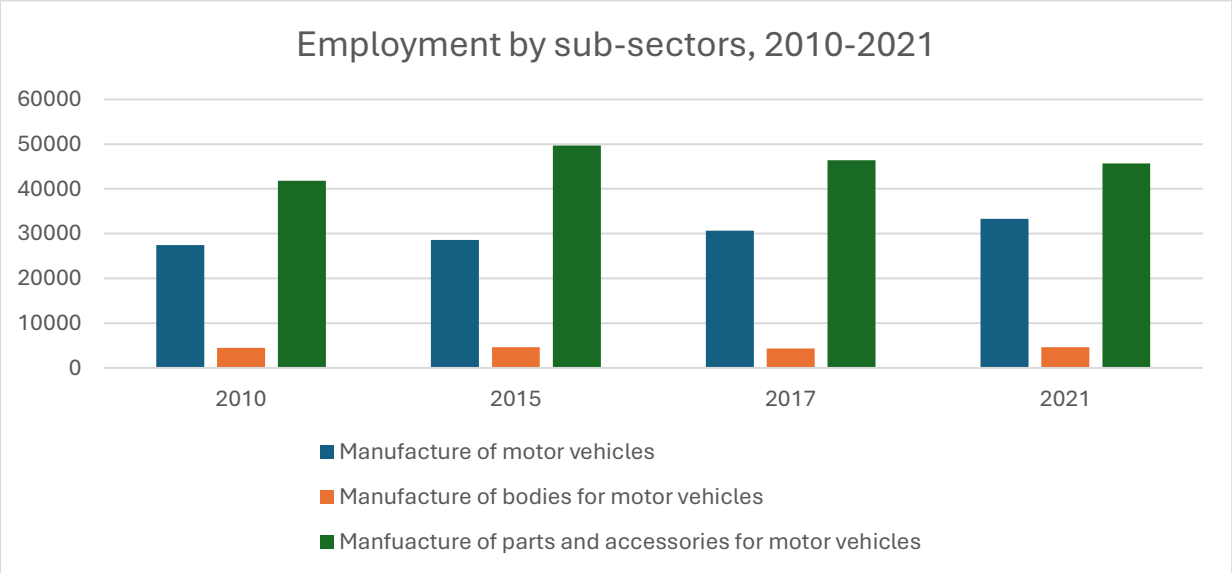
Figure 1. Total Vehicles Produced and Assembled in Malaysia, 2010-2023



Source: Malaysian Automotive Association (http://www.maa.org.my/statistics.html)

Total employment is highest in the manufacture of parts and accessories for motor vehicles, followed by the manufacture of motor vehicles, and the manufacture of bodies for motor vehicles; manufacture of trailers and semi-trailers (Figure 2). Although total employment in the entire automotive sector grew from 2010 to 2015, it fell from 2017-2021. Total automotive employment contributed to about 2.3 percent of total manufacturing employment in 2021. It should be noted that the data does not capture the services component of this sector such as the employment in car sales, etc, which is not available. In 2022, there are 62,387 after sales business companies (MITI 2023a).

Figure 2. Total Employment by Sub-Sectors, 2010-2017



Source: Department of Statistics, Annual Economics Statistics, Manufacturing 2018 and 2023.

The automotive sector is a strategic sector, with specific policies drawn up to foster its development. Since 1980, the government has used different industrial policy instruments to develop the auto sector, especially for the production of national cars, Proton and Perodua (Tham 2004). This included, among others, the introduction of tariff and non-tariff barriers such as the use of Approved Permits (AP) to limit the import of Completely-Built-Up (CBU) models, manufacturing licenses, and discriminatory allocation of incentives (Suffian 2018). Similarly, industrial policies were used to encourage the development of supporting industries in the bid to create industrial linkages between the national car and small and medium enterprises (SMEs). Specifically, vendor development and local content strategies were harnessed for this purpose.

National Cars

Proton

Proton was started in 1983 as part of the heavy industry program under former Prime Minister Mahathir, with the twin objectives of deepening industrialisation and creating Bumiputera entrepreneurship. Established by government funding and protected by high tariffs, with technology provided by Mitsubishi, Proton was able to capture 73 percent of the domestic market by 1988 (Tham 2015).

Several of the privileges enjoyed by Proton were removed over time. The establishment of a second national car in 1993 created competition for the domestic market. Tariff protection was later removed in 2005 under the ASEAN Free Trade Agreement (AFTA) for ASEAN member countries. Mitsubishi also divested their stake in Proton to a government-linked investment company, Khazanah, in 2005.

Proton first lost its dominant position in the local market to Perodua in 2006. Subsequently, it continued to lose market share to Perodua as Proton did not manage to engineer a technology turn around despite several partnerships with different technology providers after parting ways with Mitsubishi.

In 2012, after a protracted search for a technology partner, Proton was fully acquired by DRB-Hicom, a local listed conglomerate involved with automotive, services (postal) and property development. But this sale did not stop Proton's progressive loss in market share as its sales continued to plunge downwards. Its share in the domestic market dropped from 23 percent in 2013 to a mere 13.8 percent in 2017 (KiniBiz Online 2015, Paultan.org 2019) as DRB-Hicom was unwilling to invest in R&D for Proton to develop new car models.

Proton's losses affected DRB-Hicom's total performance negatively, leading to the decision to sell Proton. In May 2017, DRB-Hicom sold a 49.9 per cent stake in Proton for USD 106 million (RM460 million) and a 51 per cent stake in Lotus, the British sports car marque (which was acquired by Proton in 1996), for USD 77 million (£100 million) to China's Zhejiang Geely. Lotus, ceased to be a part of Proton, after the acquisition. Geely paid USD 39 million (RM170.3) million in cash while the remainder was paid by

the rights of Proton for the Boyue SUV model platform, which had an implied value of USD 67 million (RM290 million) (Gomez et al. 2020).

The sale breathed new life into Proton's flagging sales performance as Geely rapidly brought in their SUV Boyue, which is renamed as Proton X-70 into the Malaysian market in 2019. It also introduced some cosmetic changes in the bodies of some Proton models as well as cost-cutting and re-investment requirements for the vendors and distributors. Proton's total sales increased, while its market share increased to 16.7 percent. This upward trend continued to the latest year available for data, which is 2023, with its market share inching up to 20.1 percent (Proton 2023).

Perodua

The second national car, Perusahaan Otomobil Sdn. Bhd. (Perodua) was established in 1993, also with government funding from PNB Equity Resource Corp Sdn. Bhd. (10 percent) and Med-Bumikar Mara (MBM) Sdn. Bhd. (10 percent) (Rosli 2006). UMW, a government-linked company (GLC), is the majority shareholder, with Daihastu, the technology partner holding a minority stake. Subsequent equity restructuring in 2001 led to a change in the ownership structure in its manufacturing arm, Perodua Auto Corporation Sdn. Bhd. The Malaysian portion of Perodua is then left controlling only sales, marketing, and after-sales, while the manufacturing operations is majority-controlled by Daihatsu (and the trading company Mitsui) (UMW 2017). Daihatsu, which is a subsidiary of Toyota, focused on the compact car segment to differentiate itself from Proton. By leveraging on the technology of its parent company, Toyota, and therefore lower investment costs in R&D, Perodua was able to overtake Proton to hold the largest market share since 2006 (UMW 2017).

Other Major Assemblers

Besides the two national cars, numerous foreign marques such as Toyota, Honda, Volvo, Mercedes Benz, Hino, Isuzu, Hyundai, BMW, Madza, Mini, Citroen, Kia and Peugeot are locally assembled, in partnership with local companies (MAA n.d.).

However, in terms of market share, national cars take the lion's share with Proton and Perodua capturing 66.9 percent of auto sales in 2023 (Tan 2024), leaving 33.1 percent of total market share for non-national cars. National cars are cheaper, making them more affordable for the mass market due to lower excise duties paid as local content in these cars is much higher than non-national makes (Carlist 2023).

Section 3: Opportunities and Challenges in EV Transition

Malaysia includes all types of electrified vehicles (or xEV) rather than just battery electric vehicle (BEV) alone in its EV transition. Hybrid electric vehicle (HEV), plug-in hybrid electric vehicle (PHEV), battery electric vehicle (BEV), and fuel cell electric vehicle (FCEV) are all part of the transition.

Malaysia's total automotive industry volume is expected to reach 1.22 million units in 2030 (MITI 2023a). This is expected to be driven primarily by an increasing demand for EVs as the country strives to meet its climate action goal of halving carbon emissions by 2030. A drastic change in its transportation sector is necessary as automobiles contribute significantly to Malaysia's carbon emissions. Within the transport sector, road transport accounts for more than 90.0 per cent of energy consumption, with cars accounting for 58.0 per cent, goods vehicles at 23.0 per cent and motorcycles at 12.0 per cent. Malaysia also has the highest car ownership ratio of 82 per cent in ASEAN as it offers subsidised fuel. The International Energy Agency (IEA) estimated that an equivalent battery EV would produce 54 per cent less carbon emissions over its lifetime than a conventional internal combustion vehicle and 32 per cent less than an equivalent plug-in hybrid EV (IEA 2024). The drive towards EV is therefore needed to facilitate Malaysia's transition towards its goal of net-zero GHG emissions by 2050.

Significantly, Malaysia is also seeking to revive its manufacturing sector and to reverse its premature deindustrialization. In particular, Malaysia aspires to leverage on the strength of its electronics sector to have in-depth cooperation between the electronics and automotive sector to advance economic complexity in manufacturing development, which is also one of the goals in the New Industrial Master Plan 2030 (NIMP 2030) (MITI 2023b).

The automotive sector is also vital in the manufacturing revitalization process as it has multiple linkages with various other sectors within and outside manufacturing as shown in Figure 3. A rejuvenated automotive sector can have numerous spillover effects on other sectors due to these linkages.

Figure 3. Value Chain of Automotive Industry

Value Chain	**Resource Sector**	**Primary Sector**	**Support Sector**	**Manufacturing Sector**	**Aftermarket Sector**
Services within automotive industry	Natural Resources	Large foundries	Engineering & Product Design	Assemblers	Parts & Components Centre
	Iron Smelter	Large forgers	Machine makers	Tier 1 Module manufacturing activity, sub-assembly	AATF Centre
	Steel Refiners		Tool, die and mould	Tier 2 Components manufacturing activity	Remanufacturing Centre
	Rolling Mills		Gigs & Fixtures	Markets	Vehicle Inspection Centre
	Refineries		Surface treatment and coatings		Workshops
	Petrochemicals		Automotive Fasteners		

	Non-ferrous metals				New/Used Vehicle Dealership
	R&D and Technology Development				

Note: AATF: Authorised Automotive Treatment Facility
Source: MITI 2023a

There are however several challenges in the aspired EV transition.

Charging infrastructure

To allay range anxieties, Malaysia has targeted to have 10,000 EV charging stations by 2025 under the Low Carbon Mobility Blueprint (LCMB): 2021-2030 (Ministry of Environment and Water (KASA), 2021). This initiative is left to the private sector as it is supposed to be industry-driven. By April 2024, there are only 2,288 charging points which are distributed across 824 locations across the country (Plan Malaysia n.d.). The slower than expected roll-out of charging stations is attributed in part to the lengthy approval process, bureaucratic delays, and red tape as it reportedly takes approximately eight to nine months to construct charging points (Lim 2023a). Private investors are also slow to invest as capital costs are high, estimated at RM1.5-RM2 million for installing 10 rapid charging stations while demand is held back by the lack of affordable EVs. The high initial costs and slow EV adoption rate implies an extended cost recovery period, thereby reducing private investment interest (TnGlobal 2023).

Affordable EVs

EVs can penetrate the Malaysian market at a meaningful rate only if they enter the mass instead of premium market. Incentives were given to hasten EV adoption, such as exemptions from all import duties and excise taxes, but although such incentives reduce the price of imported/locally assembled EVs, they remain unaffordable for the average Malaysian. Currently, EVs range from just over RM100,000 (USD21,000) to almost RM700,000 (USD 146,000) for individual buyers.

According to MITI, the import of completely built-up (CBU) EVs is capped at RM100,000 (USD 21,000) to prevent dumping and to provide time for local car manufacturers, primarily Proton and Perodua, to develop their EVs for the local market. The benchmark of RM100,000 is still arbitrary since the most popular cars in Malaysia are sold by Perodua. Perodua's top selling car is Myvi, which costs about RM46,500 (USD9,700) to RM59,900 (USD12,500), or less than half the price of the cheapest EV. Proton and Perodua are scheduled to unveil their EVs by the end of 2025.

Fossil Fuel Subsidies

The petrol price at the pump in Malaysia is subsidised based on an Automatic Pricing Mechanism (APM), which is a managed float system, leading the low fuel prices for RON 95 petrol and diesel (Carsome 2023). In 2022, the fuel subsidy bill alone reportedly came up to RM28 billion, or seven per cent of total government expenditure (Tham and Zhang 2023).

The removal of fuel subsidies which is supposed to take place in 2024 is facing challenges due to lower-than-expected registration at the Central Database Hub

(PADU), which is supposed to provide the information on who will be receiving the targeted subsidies (Business Today 2024). And if indeed the subsidies are given back as cash transfers to the targeted groups, it may not facilitate any shift towards the use of electric vehicles since the subsidised group can still choose to use ICE, especially in view of the slow development of charging infrastructure and affordable EVs (Lim 2024).

Skills Shortages

Generally, the manufacturing sector in Malaysia is dependent on foreign workers for low-skilled and semi-skilled work. In 2023, the number of foreign workers in the country is estimated at 1.8 million, with the share in manufacturing being the highest at 35.1 percent (MOF 2023). There are 15 source countries which are allowed to supply foreign workers. These are Indonesia, Nepal, Myanmar, India, Viet Nam, Philippines (men), Pakistan, Thailand, Cambodia, Sri Lanka, Lao PDR, Turkmenistan, Uzbekistan and Kazakhstan. Nevertheless, the hiring of low-skilled foreign workers was kept within the threshold of below 15 percent of total employment so as to reduce the country's continued dependence on foreign workers. The media reported that the automotive sector faced a shortage of workers, including foreign workers in 2022, but the magnitude of this shortage is not known (New Stratis Times (NST) 2022). Although skilled foreign talents (or expatriates) are also hired, they are found mostly in the services (51.3 percent), information technology (37.1 percent), and construction (7.6 percent).

For skilled workers, the Malaysia Critical Occupations List (MyCOL) is a set of occupations in demand that is ascertained, based on the skills imbalance across 18 economic sectors, including the automotive (EV) sector. This list is compiled to provide information to policy-makers for the development of critical human resources, in terms of education and training as well as target admissions for immigration. My COL has identified eight occupations that have consistently appeared in every MyCOL since it was initiated in 2015. These are finance managers, business services managers industrial and production engineers, mechanical engineers, manufacturing professionals, software developers, information technology system administrators and mechanical engineering technicians (Sofiah 2023).

Grid

While EVs will reduce tail pipe emissions, it is the energy mix in the electricity generation of a country that will determine the emission expanded by EVs. Malaysia's electricity generation in 2020 was contributed primarily from coal (50.9 percent) and gas (30.8 percent), while hydropower and other renewable energy (RE) only contributed 17.8 percent (MIDA 2023a).

The installed capacity of energy sources in 2020 had a higher share of RE (including hydropower) at 23% (8,450MW), according to the Malaysia Renewable Energy Roadmap (MyRER). Most of it comes from large hydro while the share of solar, biogas

and biomass installed capacity was 2,251MW.[1] Malaysia targets to have a share of renewables of 21 percent by 2025, 40 percent by 2035 and 70 percent by 2050. It is therefore still a long way to go for EVs to be truly a vehicle for green transition.

Section 4: Malaysia's participation in the emerging regional EV value chain

It should be noted at the outset that the EV industry is an emerging industry in the Association of Southeast Asian Nations (ASEAN) member countries, including Malaysia. The industry is still at its infancy in the region, despite having many advantages such as mineral resources, a potentially large consumer market and capabilities in ICE manufacturing as well as components that can support the development of EVs. There is instead, a broad array of other elements that are still being developed such as charging infrastructure, new components needed for EV manufacturing and assembly, such as EV batteries, standards, and regulations, as well as renewable energy sources in countries that are still dependent on fossil fuels (US-ABC 2023).

Based on UNCTAD (2023), the EV supply chain covers raw minerals, processed minerals, battery materials, battery packs, and electric vehicles. Malaysia's exports and imports in these five categories are shown in Tables 1- 4. In terms of exports, the main destination countries are not the immediate ASEAN neighbours, with the exception of EV exports, where Thailand and Vietnam alone accounts for 92 percent of total exports of Malaysia's EVs. This can be attributed to Volvo Malaysia's positioning its assembled cars for the region. The major export destinations for the other parts of the EV supply chain are countries outside the ASEAN region. Likewise, the major import sources are from outside the region, with Indonesia providing some battery materials, and raw minerals. Indonesia, though rich in mineral resources such as nickel has banned the export of nickel in order to develop the mineral processing industry domestically and to use the battery supply chain to build the country's EV industry.

See the Appendix for Tables 1-4

Tables 2 and 4 show that trade in these products as a share of Malaysia's total exports and imports are really tiny since this is a nascent industry in the country. Hence, it can be concluded that Malaysia's participation in the emerging value chain in ASEAN is still quite small in 2022.

Box story: Volvo Malaysia

[1] Installed capacity refers to the maximum possible capacity that can be provided by the power plant. However, these plants do not run at maximum capacity all the time due to several factors. Therefore, the number differs from the electricity generation mix.

Volvo Malaysia entered Malaysia in partnership with Federal Auto Holdings Bhd in 1966. It is the first foreign car maker in the country (Volvo 2023). The factory in Shah Alam Malaysia is one of six worldwide and the only one outside of either Europe or China. In 2016, it became the first luxury car brand in Malaysia to locally assemble EVs as part of its electrification plan. Volvo Malaysia started assembling plugin hybrid (PHEV), (or the Volvo XC90 Recharge) in line with the EEV vision of Malaysia (MIDA 2022a). It is also the only country outside Sweden that is assembling this model. It reportedly invested RM20 million to expand its annual production capacity in Shah Alam from 1,500 to 5,000 units by 2020. The company expects to export 75 percent of its volume of production.

By 2021, the company had a full range of plug-in hybrid electric vehicles (PHEVs) for all the models assembled in Malaysia. In 2022, Volvo Malaysia embarked on local assembly of fully electric cars, with the launch of the Volvo XC40 Recharge Pure Electric.

Volvo is aiming to assemble for Malaysia and the ASEAN market. It has been exporting ICE and PHEV to Thailand, since 2013 and it is also targeting other export markets such as Indonesia, Vietnam, the Philippines, and Taiwan (Carlist.my 2019, DNA 2023). Volvo's ambitions is the basis of Malaysia's plan be an export hub of luxury cars, including EVs in ASEAN (MIDA 2024a).

Section 5: Policy Lessons from China: Technology Transfer and Transition to Higher Value-Added Manufacturing

China, like Malaysia, also utilised FDI to acquire foreign technology when it opened up to foreign direct investments (FDI) in the late 1970s. It made technology transfer mandatory as a condition of FDI approval, or renewal of registration (Jefferson 2021).[2] This did not deter FDI inflows as they were drawn by the sizeable domestic market and relatively low labour costs at that time. The main policy instruments used were investment incentives, investment requirements and administrative approval (Huang 2006).

Joint research initiatives involving Chinese and foreign nationals were used to facilitate the transfer of new R&D capabilities and specific technologies (Jefferson 2021). Other factors that expedited technology transfer included the choice of joint-venture (JV) partners, imitation, and learning by exporting. Jiang et.al. (2019) found that the Chinese firms that are most likely to be chosen as JV partners, are the larger and more productive firms that possess the needed absorptive capacity to benefit from the technology transfer. Chinese firms were then quick to use backward design strategies to produce "imitation" goods at a cheaper cost, based on scale and speed, for the local markets, thereby crowding out foreign suppliers (Howell 2018). Chinese exporting

[2] Or what is known as "Technology Transfer in Exchange of Domestic Market."

firms were also able to garner technical and managerial expertise from their foreign contacts, such as competitors, suppliers, or scientific agents.

After 1995, policies were also designed to speed up the development of indigenous science and technology. These included introducing incentives to firms to set up R&D units as well as improving the public infrastructure for indigenous innovation, increasing domestic R&D expenditure, and supporting mega projects in science and technology (Fu et al. 2016, Baark 2019). China also used public procurement for key industries to encourage Chinese firms to develop their own intellectual property (Baark 2019). For public procurement, conditions for products in the indigenous innovation procurement required the product to be produced by an enterprise with full ownership of the intellectual property in China; have a trademark that is owned by a Chinese company and is registered China; feature a “high degree” of innovation; and be of dependable quality. China also provided subsidies for applications and grants to encourage patent development, besides developing indigenous standards to facilitate it’s to shift from a standard taker to a standard maker.

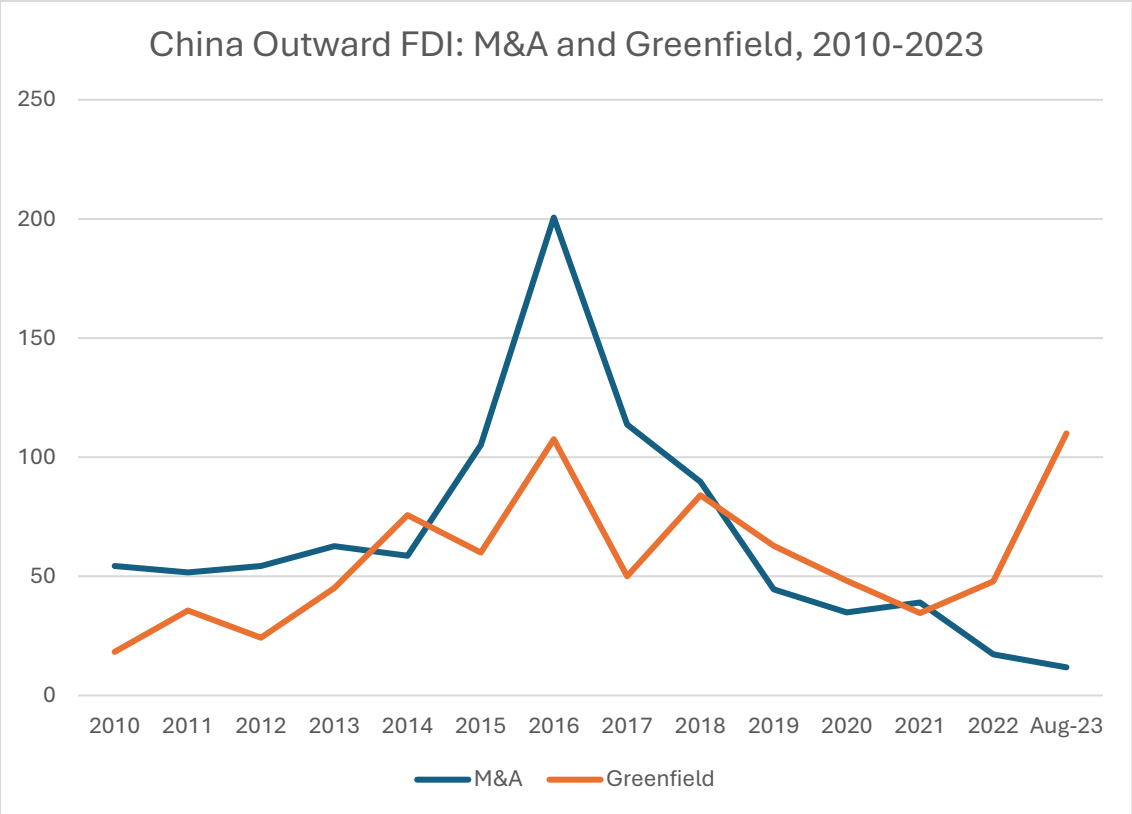
Therefore, there are concurrent efforts to absorb foreign technology as well as to build up indigenous innovation (Fu et al. 2016). It is important to note that the numerous well-funded programs helped to build up the innovation infrastructure, which further increased the absorptive capacity of Chinese firms, so that foreign technology did not stay as mere static technology embedded in imported machines. Chinese firms also learned from using imported machines to make their own, evolving from imitation to making their own and improving due to intense domestic competition (McKern 2016). Absorbing foreign technology in turn, strengthened indigenous technological capability. This enabled China to climb up the technology ladder and to catch up by the early 2000 (Jefferson 2021).

The ‘Go Global’ policy launched in 1999 encouraged outward investments through preferential policies such as direct grants, tax benefits, low or no interest loans and access to foreign exchange (Guo and Clougherty 2022). The aim of these policies is to encourage Chinese multinationals to learn from international experiences and acquire the advanced technologies, knowledge and management skills that can improve domestic productivity. A notable example is Geely’s acquisition of Volvo in 2010. Geely was the first private Chinese company approved by the central government to produce automobiles in 2001 (Geely n.d.). The acquisition helped to internationalise Geely’s operations, expand sales for Volvo and Geely as well as co-development of technology (Chen et al., 2015; Volvo, 2017).

According to FDI Intelligence (2023), mergers and acquisitions (M&A) was the more common mode of entry from 2010 till it peaked in 2016 USD200.6 billion, before subsequently trending downwards (Figure 4). Increasing investment screening from the developed world to safeguard critical industries has made Chinese M&A activities more difficult. Concurrently, excess capacity in home market and slowing economic growth since the emergence of the Covid-19 pandemic have pressed Chinese companies to go abroad in search of new markets rather than technology, especially in sectors where Chinese companies are leading in terms of innovation such as EVs and renewable energy. Greenfield investments are deemed to be lower risks of entry and can facilitate Chinese companies operating in for example Europe to export to the

US, thereby allowing China market entry in the midst of the US-China technology conflicts.

Figure 4. Outward FDI from China: M&A and Greenfield, 2010-2023 (USD billion)



Source: FDI Intelligence (https://www.fdiintelligence.com/content/data-trends/chinese-outbound-fdi-boom-signals-new-phase-83013)

Although China has also lost talents, it was able to engineer a "reverse brain drain" just like the economies of South Korea and Taiwan did in the late 1980s (Fu et al. 2016). The change in the nature of Chinese brain drain is seen in that ratio of returnees

to ‘‘departees’’ was 28 percent in 1995 and 31 percent in 2006 but rose to 79 percent in 2014. The return of these talents was attributed to push and pull factors, with the Global Financial Crisis (GFC) and reportedly glass ceiling encountered in the developed world to be the key contributory factors while China’s rapid pace of development and specific talent programs offering high salaries and research funding were important pull factors.

These returnees contributed towards the development of some high-technology industries and strategic emerging industries such as renewable energy, electrical cars, and biotechnology (Fu et al. 2016). For example, Chinese solar panel companies such as Suntech Power and Trina Solar, were founded by returnee scientists and engineers. These firms have subsequently become global leaders.

The 2015 launch of *Made in China 2025* (MIC 2025) marks an important watershed in China’s industrial policy as the country aims to shift up the value-added chain within ten years, from low-cost “factory of the world” to be a global powerhouse at par with the likes of technologically advanced OECD economies, South Korea, Japan, and Germany (Jefferson, 2021). MIC 2025 is the first phase of a three-step development strategy, which aims to have China join the ranks of major manufacturing countries by 2025 (Ono 2023). China then targets to rise to the middle of this group by 2035. In the last step, China intends to emerge as the world’s preeminent manufacturing powerhouse by 2049, which is also the 100th anniversary of the establishment of the People’s Republic of China.

The plan highlights 10 key prioritized industries[3] including robotics, new energy, and green vehicles. For the latter, targets include domestic products with IP rights to supply 50 per cent of domestic market. Fuel consumption of passenger vehicles will not exceed 4L/100km, self-sufficiency rate for key parts to exceed 60 per cent. China aims to export 20 per cent of all commercial vehicles and have three companies that are ranked in the top five for sales internationally.

Key Policies for EV development

EV technology was introduced in 2001, as a priority science research project in China’s Five-Year Plan, the country’s highest-level economic blueprint. China identified EV development as an innovative new technology that could enable the country to break away from the dominance of the developed countries in ICE technologies (Yang 2023). At that time, EV development was at the experimental phase by a few car companies like General Motors and Toyota and EVs have not taken off yet. EV development was envisaged to open new pathways for China to transit to high value-added manufacturing and to dominate world production. It would also concurrently facilitate green transition, which is also prioritized by China.

China therefore used a suite of policies that addressed both supply and demand. Supply-side strategies started from way back in 2001, in the form of production subsidies such as support for model development, manufacturing prizes and monetary

[3] These are robotics, new generation information technology, aviation and aerospace equipment, marine equipment and hi-tech ships, railway transport, new energy and energy-saving vehicles, energy equipment, agricultural equipment, new materials, biopharma, and hi-tech medical devices.

rewards for achieving a certain quantity of sales (Zhang et al., 2024). Production subsidies were provided for domestic and foreign car manufacturers (Yang 2023). Reportedly, Tesla is the most heavily subsidised vehicle maker in China in 2020 despite being wholly foreign-owned (Alvarez 2021). Subsidies also included land, loans, and grants (The Business Times 2023), as well as the provision of infrastructure. For the latter, there were guidance, guidelines, standards, targets for the number of charging posts to be built, as well as incentives provided. At the provincial and local level, where policies are implemented, additional support came in the form of incentives, requirements for construction and utility rate design (FutureBridge 2021).

Subsequently, to stimulate demand, incentives were given in the form of purchase subsidies, Demand-side policies focus on consumers and include purchase subsidies, purchase tax exemptions and exemptions from purchase restrictions (Zhang et.al., 2024). Central government purchase subsidies were progressively reduced from 2009 and eliminated by end of 2022.

In 2018, China started the dual credit system in preparation for the eventual elimination of subsidies. The system allows car companies that fail to meet fuel consumption control requirements to offset these negative credits with positive credits generated or purchased from other companies. These credit revenues are the main financial benefits for New Energy Vehicle (NEV) producers after the subsidies were ended in 2022 (Chen and He 2022).

Empirical findings on the effectiveness of China's policies in EV development have mixed findings, with some concluding that the subsidies are effective as for example shown in Chen and He (2022), while others show that these subsidies did not affect EV sales as in the case of Qiu et al. (2019). These contradictory findings reflect the difficulties in capturing impact when numerous policy instruments are used to stimulate supply and demand, with varying degrees of implementation capacity at the local level, and where many enabling factors interact (Gomes et. al. 2023). Gomes et.al. (2023) in particular emphasized the interrelatedness of policies governing supply and demand which require constant effective coordination and alignment for these policies to work. Hence it is quite difficult to unpack which policies worked and which did not.

Section 6: Key Domestic Policies for fostering EV industry

The two key policy documents guiding the development of EV in Malaysia are the National Automotive Policy 2020 and the New Industrial Master Plan 2030 (MARii n.d., MITI 2023b). The former plan is broad in its scope covering Next-Generation Vehicles which includes BEV as one type of vehicle, Industrial Revolution 4.0, and Mobility-as-a-Service. Its ambitions are equally wide-ranging, aiming to make Malaysia a regional leader in manufacturing, engineering, and technology.

The NIMP 2030 is the most recent industrial master plan, launched in 2023, that covers manufacturing development and manufacturing-related services. The vision of the

plan are aligned with the National Investment Aspirations (NIA) (MITI n.d.), that was launched in October 2022 to guide the new investment policy of the country. Investments are harnessed to develop: (i) competitive industries with high economic complexity, (ii) high income and skilled workforce, (iii) strong domestic linkages, (iv) well developed new and existing industrial clusters, (v) balanced and inclusive participation and (v) sustainable development. The goal is to facilitate high-impact growth for Malaysia.

Shifting from the traditional sectoral approach used for guiding industrial development, the plan adopts a mission approach, patterned after Mariana Mazzucato's "Mission Economy" (Mazzucato 2021). This approach uses visionary missions to create knock-on effects for triggering change. NIMP 2030 identified four missions or cross-cutting challenges that need to be addressed for rejuvenating manufacturing development in the country. These are: advancing economic complexity, using tech up for a digitally vibrant nation, pushing for net zero and safeguarding economic security and inclusivity. Each mission is accompanied with specific strategies and action plans as well as mission-based projects (MBPs) or catalytic projects which are used to ignite the change process, which is then expected to crowd in other projects during the duration of the plan.

To complement the broad strokes of the NAP and the NIA ambitions, NIMP 2030 focuses specifically on developing the EV value chain, lending greater substance for EV development (MITI 2023b). However, the plan did not have any details and the action plan is only detailed in a subsequent sectoral document focusing on the automotive sector (MITI 2023a). For BEV, the automotive sectoral document focuses on Malaysia building its presence in the full spectrum of the value chain, with the aim to make Malaysia an assembly hub for ASEAN and Asian markets, as well as develop the export market for BEVs assembled in Malaysia (MITI 2023a). The sectoral document also targets Malaysia to be the manufacturing and design centre for right-hand drive BEVs and a leading country in manufacturing BEV two-wheelers. The last objective is for Malaysia to be the market leader in ASEAN, as well as a test bed for new mobility ideas, including autonomous vehicles.

An important contribution of the NIMP is the use of Mission-based-Projects (MBPs) to generate change in the desired direction. Affordable EVs remain a question as the EV cars assembled locally or imported are all above RM100,000. The cap is seen as a move to protect Proton and Perodua, as the two national cars manufacture mainly cars that are below RM100,000. Thus, it is not surprising that the MBP for this action plan, which is to catalyse EV as a key growth driver, has Perodua committing towards the local assembly of affordable EV models. It is reportedly working with three local universities to develop the power bench for the EV while the power conversion technology is a collaborative effort with an Australian company (Low 2024). Presumably, this will address the affordability issue that is needed to stimulate local demand via the mass market. Perodua has an estimated 41.3 percent of the car market share in Malaysia in 2023.

The automotive sectoral document (MITI 2023b) has put together several action plans for the automotive sector that includes EVs. The ten action plans listed are culled from the NAP (AP1, AP2, AP 3, AP4, AP5, AP6, AP11 and AP12) and the Low Carbon Mobility Plan (AP7, AP8, AP9 and AP 10) (Table 5).

Table 5. Action Plans for Automotive Industry

AP1	Enhance component testing activities by improving existing facilities and establish new facilities
AP2	Conduct a study to promote local development activity and reduce imports
AP3	Development of Centre of Excellence for Future Industry (COEIF) – Electric Vehicle Interoperability Centre (EVIC)
AP4	Tighten cybersecurity for automotive
AP5	Establish training programs for parts and components suppliers towards smart manufacturing
AP6	Promote development of new system integrator companies and enhance existing companies
AP7	Apply well-to-wheel concept in the calculation of emission of mission from EV
AP8	Introduce Corporate Average Fuel Economy Standards to improve the average fuel economy of vehicles produced for sale
AP9	Decarbonise the sector drive by Zero Emission Vehicles (ZEV)
AP10	Promote remanufacturing activities
AP11	Improve existing automotive related education program in line with current trend and industry needs
AP12	Uniformise, review and promote new TVET programmes

Source: MITI (2023a)

However, as in other countries, the demand for EVs has been held back by concerns over the travel range of battery electric vehicles (BEVs) based on a single charge as the charging infrastructure in Malaysia is still underdeveloped. Hence, budget 2022 and 2023 introduced specific incentives to stimulate the demand for EVs as well as the development of charging infrastructure (Table 6).

Malaysia's EV tax incentives apply to three categories: imports, local assembly, and individual owners. They only apply to full EV vehicles and exclude hybrid vehicles. Imported (CBU) EVs have full import and excise duty exemptions until the end of 2025. Locally assembled (CKD) have full import and excise duty exemptions, and a sales and service tax (SST) waiver until the end of 2027. EV owners are exempted from road tax and can claim a personal tax exemption of up to 2,500 ringgit (US$571) for costs relating to EV charging hardware and services, including the purchase, installation, rental, and subscription fees of EV charging facilities, until the end of 2023. Companies contributing to building EV infrastructure in Malaysia will benefit from government incentives, such as tax breaks to support the government's target to install 10,000 charging stations by 2025 under the Low Carbon Mobility Blueprint (MGTC n.d.).

Table 6. Incentive packages for EVs, in Budget 2022 and 2023

Incentives	**Budget 2022 End-date**	**Budget 2023 End date**

Full exemption of import duty and excise duty for imported Completely-Built-Up (CBU) EVs	2023	Extended to 2025
100% Road tax exemption of EVs	2025	2025
Full exemption of import duty and excise duty and sales tax on locally assembled EVs or Completely Knocked-Down (CKD)	2025	Extended to 2027
Tax exemption for the import of EV components	2025	2027
100% road tax exemption	2023	2025
Full tax exemption for EV charging equipment manufacturers as well as a complete Investment Tax Allowance for them	None	2023-2032. Five years
Individual income tax relief of up to RM2,500 for the installation, rental, and purchase costs of EV charging facility	For year of assessment (YA) 2022-2023	For year of assessment (YA) 2024
Companies are entitled to a tax deduction for rented EVs with a maximum qualified amount limited to no more than RM300,000.	None	2023-2025

Source: Compiled by author

These incentives stirred the interests of foreign manufacturers to bring their EV models to Malaysia, thereby creating more choices, especially in terms of pricing, despite the import price being capped at RM100,000. For example, Sime Darby brought in China's BYD EVs into Malaysia in 2022, with the cheapest model priced just slightly above RM100,000 (Lye 2022). BYD is China's largest EV manufacturer.

An import permit (or Approved Permit (AP)) is needed to import automobiles in Malaysia. This import license is issued by MITI. In 2023, MITI introduced the Battery Electric Vehicle Global Leaders Initiative (BEV GLI) which allows foreign companies to sell cars in Malaysia, with 100% foreign equity ownership. Tesla was brought into Malaysia under this program in the same year. Tesla is required to contribute towards the charging infrastructure as it is required to install at least 50 units of DC fast chargers within three years, and open at least 30 percent of these for public use (Khaw 2023).

Investment incentives such as pioneer status, investment tax allowance, reinvestment allowance and import duty exemption are used to attract investments in the EV ecosystem.[4] Investments of more than RM500 million at the planned Automotive Hi-Tech Valley (AHTV) project in Tanjung Malim can have tax exemption of up to 15 years compared to the conventional five to ten-year duration. The AHTV is a joint-venture between DRB Hicom and Geely to develop a smart city in Tanjung Malim for the development of advanced automotive manufacturing, research and development and supportive services such as logistics and training. The project aims to promote

[4] Income tax exemption for pioneer status ranges from 70–100 percent for a period of five to ten years. Investment tax allowance apply for 60-100 percent on qualifying capita expenditure for five years. Reinvestment allowance apply to 60 percent of qualifying capital for 15 consecutive years. Import duty exemption cover raw materials, components and machinery and equipment.

Malaysia as a prominent hub for next-generation vehicles within an integrated automotive and mobility ecosystem (Geely 2023).

For charging infrastructure, Malaysian Green Technology and Climate Change Corporation (MGTC) is currently developing a strategic framework for the development and planning of Electric Vehicle (EV) infrastructure across Malaysia (MGTC 2023). The Energy Commission as the national regulator for the energy sector has issued a guide for the development of EVs which provides the requirements and specifications for the installation, operation, maintenance, safety, power quality and licensing for EVs for Peninsular Malaysia, Sabah, and Labuan. A guideline for electric vehicle charging bay (EVCB) was also published by the Local Government Development Ministry through the Town and Planning Department (PlanMalaysia), in 2023. The guideline provides guidance on the planning and design of EVCBs, which is required to comply with the Fire Safety Guidelines for On-premises EVCBs issued by the Malaysian Fire and Rescue Department.

In 2023, a National EV Steering Committee (NEVSC), helmed by the Minister of Investment, Trade, and Industry, was formed to oversee the National EV Taskforce (NEVTF) to coordinate and facilitate communication between the multiple ministries and agencies that are involved in EV development (Table 7).

Table 7. Governance of EV Development, 2024

NEVSC: Minister of MITI (Chair) (Secretariat: MIDA/MITI)								
NEVTF: Secretary General, MITI (Chair) (Secretariat: MIDA)								
KPKT/Plan Malaysia: EVSC Installation Procedure	JSM/MARii: Standards	MOSTI/Nano Malaysia: ICE to EV conversion	NRECC/MGTC: Infrastructure Planning	MARii: Vendors & Skills	MOF: Government Fleet	MITI: Import License	ST/TNB: Charging Point Operator Operations	KPT/UTM: Research and Local Talent

Notes: KPKT: Ministry of Housing and Local Government

JSM: Department of Standards Malaysia
MARii: Malaysia Automotive, Robotics & IoT Institute
MOSTI/Nano Malaysia: Ministry of Science, Technology, and Innovation
MOF: Ministry of Finance
NRECC/MGTC: Natural Resources, Environment and Climate Change Ministry (NRECC)/ Malaysian Green Technology and Climate Change Corporation (MGTC)
ST: Energy Commission
TNB: Tenaga Nasional Malaysia (National Electricity Malaysia)
KPT/UTM: Ministry of Higher Education/Universiti Teknologi Malaysia

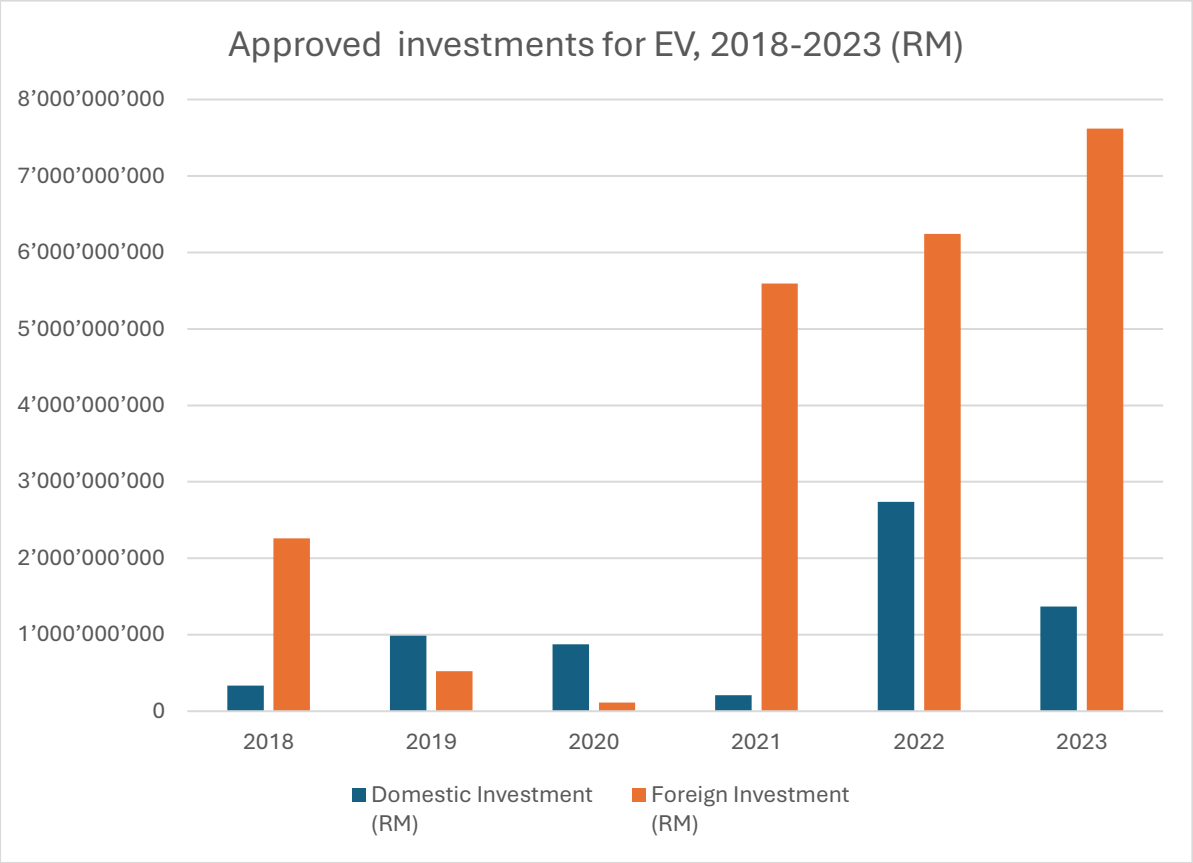
Source: Lim 2023b. https://paultan.org/2023/10/04/malaysian-national-ev-steering-committee-nevsc-and-ev-task-force-governance-structure-detailed/

Section 7: Role of Domestic and Foreign Direct Investments

Overall, domestic investments have dominated the auto sector in Malaysia from 2006-2020 (MITI 2023a). Although the government has been progressively liberalizing FDI[5] in the auto sector, foreign investors still perceive an unfair advantage offered to national car makers, due to their higher local content and hence, bigger exemptions from excise duties, which can range from 60-105 percent, thereby allowing national cars a lower price advantage over foreign assemblers (Tham 2021).

However, the incentives offered for EV adoption in Malaysia increased investors' interests in this sector. According to MIDA, 70 projects with a total value of RM28.9 billion were approved for the manufacturing sector for EV assembly, EV components and EV charging from 2018 to 2023. Figure 5 shows that foreign investments dominated from 2018-2023, excluding the Covid pandemic years from 2019-2020.

Figure 5. Approved investments for EV, 2018-2023, (RM)



Source: MIDA, unpublished data.

[5] In 2009, the Government began allowing FDI for vehicles of 1,800 engine size (cc). Subsequently, in 2014, the automotive industry opened up investment for all cc for Energy Efficient Vehicles (EEV).

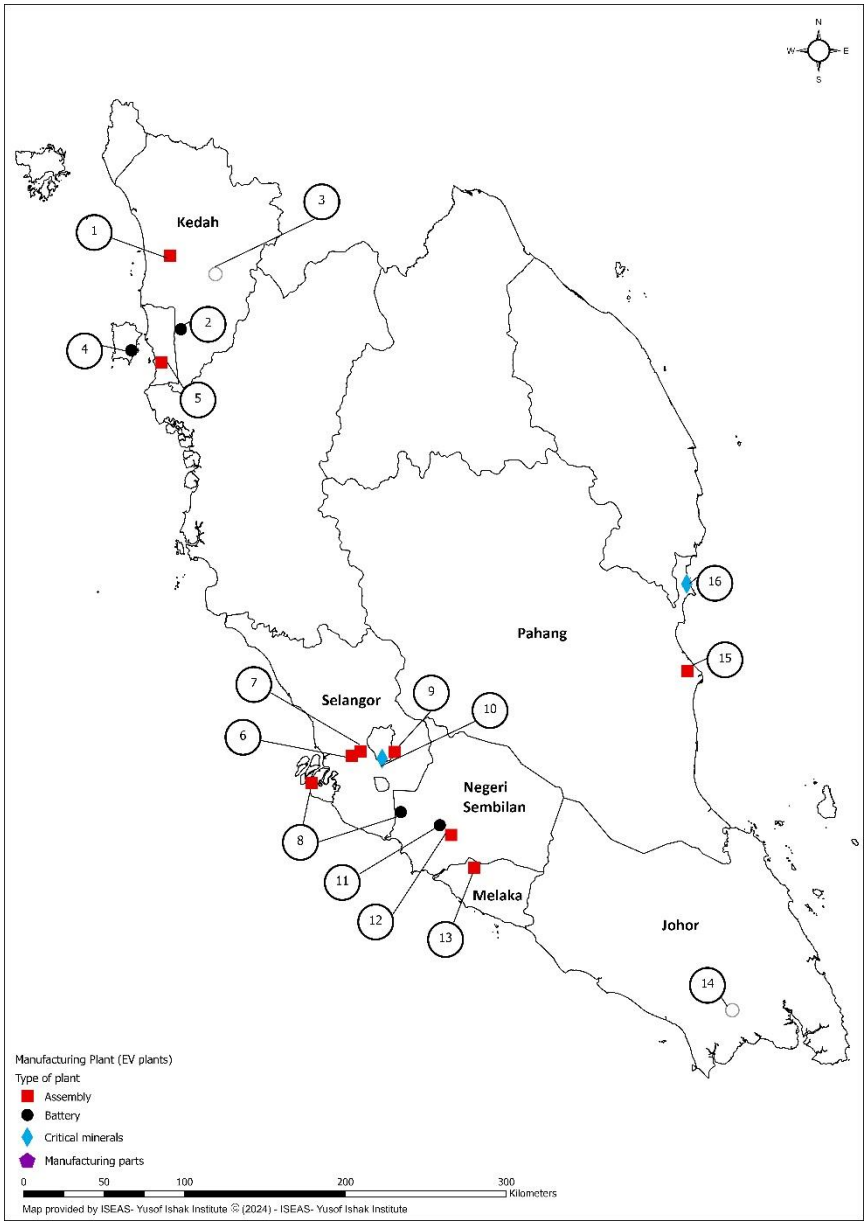
Domestic and Foreign Investments in the emerging EV Supply Chain

The EV supply chain comprises of several key components, starting with the sourcing and transportation of raw materials, followed by battery manufacturing, vehicle design and assembly, EV sales and dealership, and lastly EV's end-of-life management such as battery recycling (Jagani et. al., 2024). This differs from the supply chain of ICE, as it has fewer mechanical parts, with the EV battery being a key differential component. The EV battery depends on several critical minerals to power it such as graphite, aluminium, nickel, copper, steel, manganese, cobalt, lithium, and iron (Buthada and Alexander 2022).

Since firm level data on the investments in the EV supply chain in Malaysia is not available, the data in this section is constructed from an internet search and cross checked with MIDA and company level announcements.[6] Investments in Malaysia over the last few years show a diverse and diffused pattern. There are investments across all segments of the supply chain, from minerals to battery and vehicle assembly and these are distributed across various states in the country (Figures 6 and 7).

Figure 6. Manufacturing Plants for EV supply chain in Peninsula Malaysia

[6] This section is extracted from Tham and Neo (2024).

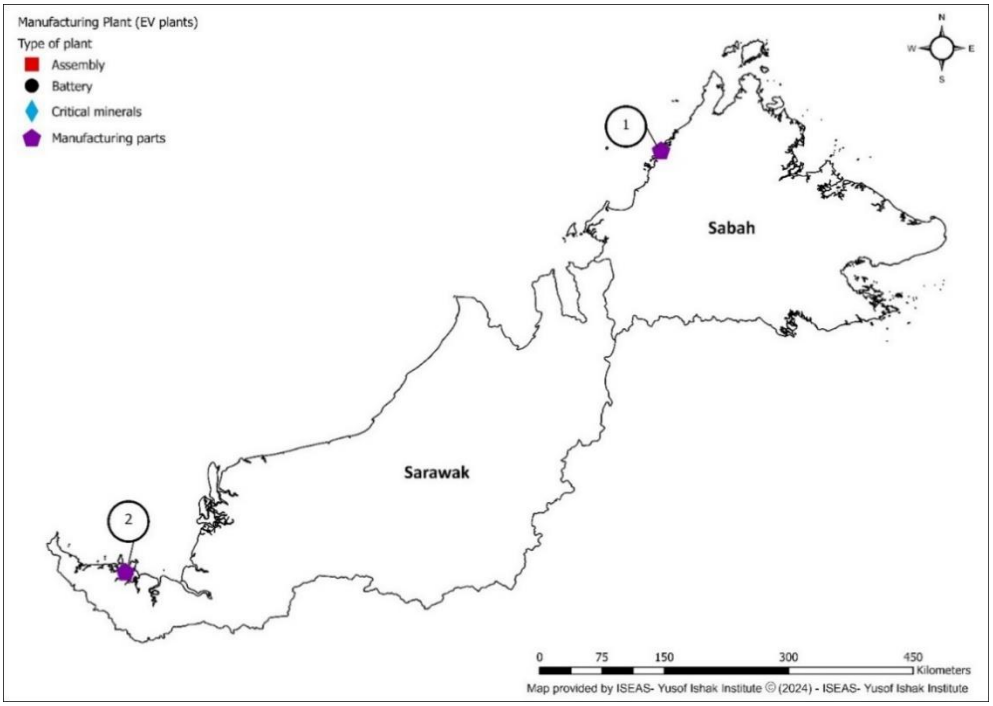


No.	Technology Partner(s)	Local partner/company	Name of company	Products/Service
States in Malaysia: Kedah				
1	Stellantis (US)	None	Stellantis (US)	ICE, hybrids and EV Assembly plant
2	Infineon and Siemen (Germany)	None	Infineon Technologies AG	EV electronic chips
3	Eve Energy (China) **Unconfirmed site*	None	Eve Energy Malaysia Sdn Bhd	Battery assembly
Penang				
4	Shenzhen Serious Technology Material Co. (China)	n.a.	INV New Material Technology (M) Sdn. Bhd	Battery separators
	Enovix (US)	None	Enovix	Battery for four-wheelers

5	United E-motor (Indonesia)	Antroniq (Malaysia)	Antroniq Bhd.	E-motorbikes
Selangor				
6	Volvo (Germany)	Federal Auto	Volvo Malaysia	Assembly of EVs
7	China's Sharkgulf Technologies Group Ltd, Blueshark (China)	EP Manufacturing Berhad	EP Manufacturing Berhad	Electric motorcycles
8	Tron Bradbury Energy (Taiwan)	None	Tron Bradbury Energy (Malaysia) Sdn Bhd	Commercial EVs and energy storage systems (including Battery R&D)
9	Thamlev (USA-based)	None	Kulim Thamlev Mobility Sdn. Bhd (Malaysia)	Electric motorbikes
10	Graphene Synergy (Malaysia)	Graphene Synergy R&D Berhad (Malaysia)	Graphene Synergy R&D Berhad	Graphene-based raw materials
Negeri Sembilan				
11	Samsung SDI Co Ltd (Korea)	None	Samsung SDI Energy Malaysia Sdn Bhd (SDIEM)	Lithium-ion battery by 2025
12	Chinese companies like Higer and Yu Tong and Hozon Auto	Joint venture between Careplus Group Bhd and GoAuto Group Sdn Bhd with Chinese companies like Higer and Yu Tong and Hozon Auto	NexV Manufacturing Sdn Bhd (NMSB)	Assembly of Neta brand and other completely-knocked-down (CKD) operations
Melaka				
13	BAIC and Great Wall (China)	EP Manufacturing Bhd (EPMB)	EP Manufacturing Bhd (EPMB)	Manufacture and assembly of four-wheel EEVs, EVs, and electric commercial vehicles
Johor				
14	United E-motor (Indonesia) **Unconfirmed site*	Antroniq (Malaysia)	Antroniq Bhd.	E-motorbikes
Pahang				
15	Mercedes Benz (Germany)	DRB Hicom	Mercedes Benz Malaysia	Assembly of EVs
16	Graphjet Technology Sdn Bhd (Malaysia)	Graphjet Technology Sdn Bhd (Malaysia)	Graphjet Technology Sdn Bhd (Malaysia)	Transform palm industry waste materials, palm kernels, into graphite and single-layer graphene.

Notes: n.a.: Not available
Source: Tham and Neo (2024)

Figure 7. Manufacturing Plants for Mineral and Batteries in Sabah and Sarawak



No.	Technology Partner(s)	Local company	Products/Service
1	SK Nexilis (South Korea)	KKIP (Kota Kinabalu Industrial Park) Sdn Bhd (Malaysia)	Copper foil manufacturing for EV batteries
2	Gallois New Energy (HK)	SEDC Energy (Sarawak), Gallois New Energy Materials (M) Sd Bhd	Graphite plant

Source: Tham and Neo 2024

Emerging EV supply chain from domestic and foreign investments

Minerals

Although Malaysia has some critical minerals such as rare earth elements (REE) (Tham and Neo 2023), policies regarding its extraction, processing and usage are still being formulated. Malaysia also has domestic sources of nickel, cobalt, manganese, and graphite, making it ideal for the country to develop its own EV supply chain.

Nevertheless, foreign investments in synthetic minerals have emerged in Malaysia (Figure 7). Sarawak in East Malaysia is venturing into graphite manufacturing in Bintulu, under a Memorandum of Understanding (MOU) between Sarawak Economic Development Corporation (SEDC), and Gallois New Energy Materials (M) Sdn Bhd (MIDA 2024b). The latter is a subsidiary company of an established Madagascar graphite miner, Gallios (LinkedIn n.d.). Although graphite is used for EV batteries, Sarawak has announced that it also intends to use it for the development of hydrogen fuel cells as it is championing the development and use of hydrogen in public transportation (Dayak Daily 2024).

Peninsula Malaysia is also pursuing the development of alternative mineral resources, namely graphene. There is in fact a National Graphene Action Plan that was launched in 2014, which focuses on the commercialisation of graphene, including for the use of lithium-ion battery anodes (NanoMalaysia n.d.). The most important development is the emergence of an initially private local company, Graphjet Sdn. Bhd, in 2019. Graphjet has patented technology to produce graphene from recycled palm kernel shells, which can then be used for EV batteries, medical devices, and home appliances (Graphjet Technology n.d.). The company was also identified as one of NIMP's national mission-based projects or catalytic projects, at the launch of the plan in 2023 (MIDA 2023c). It is building a factory at Malaysia-Kuantan Industrial Park (MCKIP) in Kuantan, Pahang, where it is expected to produce 10,000 tonnes of graphite and 60 tonnes of single-layer graphene annually (The Star 2022a). In March 2024, the company went public as it was listed on Nasdaq Global Market (Graphjet Technology 2024). It also aims to be the leading source of graphite and graphene in the US market, thereby offering an alternative to China, which is the largest synthetic graphite manufacturer in the world.

Another local R&D company, Graphene Synergy R&D Sdn. Bhd, is also producing graphene and graphene-based materials at Teknologi Park Malaysia, in Selangor. It is exploring partnerships with producers and manufacturers.

EV Batteries

There are also investments in EV battery assembly for two and four wheelers as well as the manufacture of key components for EV batteries. The sources of investments are diversified, including China, the US, Taiwan, and South Korea (Table 8). These new manufacturing plants are primarily concentrated within Kedah, Negeri Sembilan, Penang and Sabah.

Table 8. List of Investors for EV batteries and its components

State	Name of Investor(s)	Details of investment
Kedah	Eve Energy	Manufacture lithium-ion batteries at a new factory in Kulim.[7]
Penang	Joint-venture between Enovix Corporation (lithium-ion manufacturer listed in Nasdaq), and YBS International of Malaysia	Manufacture silicon battery at Penang Science Park.[8]
	INV New Material Technology (M) Sdn Bhd, which is a subsidiary of Shenzhen Senior Technology Material Co. Ltd	Manufacture of wet process and coated separators for lithium batteries, key components in ensuring battery safety
Negeri Sembilan	Tron Energy Technology Corporation, in partnership with Bradbury Asset Management (Hong Kong) Ltd	Planning to build a battery research and development facility at Malaysia Vision Valley
	Samsung SDI	Building a battery factory
Sabah	South Korea with SK Nexilis	Producing copper foil for EV battery materials manufacturer SKC

Source: Tham and Neo 2024.

EV Electronics

Germany's Infineon Technologies and Siemen will expand its facility in Malaysia's Kulim Hi-Tech Park to manufacture chips for different uses including in EVs. These chips are crucial components in EVs and can affect the optimal and efficient performance of EVs.

Vehicle Assembly

Luxury cars with plants in Malaysia have already started assembling EV models locally. For example, Mercedes Benz in Pahang has launched locally assembled CKDs in early 2023 (King 2023). Volvo is also assembling EVs at its plant in Shah Alam and it is exporting locally assembled EVs to other countries in ASEAN (MIDA 2022a).

There are also new vehicle players coming from new source countries. Stellantis from the US has acquired Naza Automotive Manufacturing Sdn. Bhd. and the latter's manufacturing plant in Gurun, Kedah (The Edge 2021). Stellantis assembles various marques such as Peugeot, Alpha Romeo, and Citreon. It is reportedly planning to assemble ICEs, hybrids and BEVs for Malaysia and the regional market, using Malaysia as its ASEAN hub (Paultan.org 2023a). The targeted plan is to assemble the first EV in

[7] Jalil, A. https://www.nst.com.my/business/esg/2023/08/939838/eve-energy-breaks-ground-rm19-billion-factory-kedah%C2%A0

[8] MIDA 2023d. https://www.mida.gov.my/media-release/enovix-joins-forces-with-ybs-international-berhad-to-unveil-its-next-generation-battery-manufacturing-facility-in-penang-science-park/

Malaysia by second half of 2024, followed by producing its BEV series (STLA medium vehicle) in 2025 (Aman 2023). Tron Bradbury Energy (Taiwan) and Bradbury Asset Management (Hong Kong) Ltd, is also planning to assemble commercial vehicles at Port Klang (The Star 2024).

Locally assembled electric motorcycles are also emerging. The first is a partnership between Malaysia's Antroniq, an investment holding company and Indonesia's United E-motor to assemble e-motorbikes at Batu Kawan, Penang, and Johor (The Star 2024). US-based Thamlev, which was started by a Malaysian, is assembling at Balakong in Kuala Lumpur (Paultan.org 2023b). A local parts and components manufacturer, EP Manufacturing Berhad is partnering with China's Sharkgulf Technologies Group Ltd, to assemble, manufacture and distribute the latter's Blueshark two-wheeler at Glenmarie in Shah Alam, Selangor (The Star 2022b).

Two local companies are given the license to assemble EVs, with technology partners from China, in respectively Melaka and Negeri Sembilan. One of them, EPMB, plans to launch the locally assembled Neta EV by the first quarter of 2025 (King 2024), which would be earlier than the planned end 2025 launch date of Proton and Perodua.

While the emerging supply chain sees the entry of new players in the automotive market in different states, it also shows that the main foreign brands assembling in Malaysia, namely Toyota, Honda, and Mitsubishi, have yet to introduce BEVs as they are still assembling at the EEV segments, including hybrids. According to Toyota, their stand remains at providing a broad range of engine options to their consumers which includes petrol, diesel, hybrid, plug-in hybrid, and hydrogen. As much as electric cars can be a solution to carbon neutrality, Toyota believes that there is still value in investing with other fuel types such as hydrogen fuel cell, synthetic fuel etc (Dowling 2023). This could account for their slow entry toward the BEV markets, including in Malaysia.

Section 8: Assessing Planned Strategies for green structural transformation in the EV sector

Malaysia's planning documents for the automotive sector state clearly targets and ambitions. The targets are aspirational and the ambition is to lead or be the leader or auto hub in the ASEAN auto market. It does not mean that the stated targets and ambitions are new. For example, Malaysia has also aspired to be an automotive hub in the earlier National Automotive Plan (NAP), or NAP 2014. This has not been achieved since Thailand is the "Detroit of the East," while Indonesia is an emerging EV contender (Guild 2021, Tham 2022). Neither did Malaysia achieve the export targets and more importantly exports were contributed mainly by non-national cars such as Mazda, Volvo, Mercedes, and BMW, rather than by Proton, which is supposed to champion exports for Malaysia (Tham 2021). The only difference is the hub vision is currently specified in terms of BEVs.

The ambitions are also extremely broad as it goes beyond BEV and includes fuel cell vehicles, in line with Malaysia's hydrogen aspirations and Autonomous, Automated and Connected Vehicles (AACV), without any sequencing (MITI 2023a, MITI 2006).

How the targets and ambitions are to be achieved are not documented. This is especially difficult when the list of action plans (APs) in the NIMP sectoral document (MITI 2023a) is also a list of intentions and objectives, which are compiled from NAP 2020 (AP1- 6, 11-12) and Low Carbon Mobility Blueprint (AP7-10) as the list also does not indicate how each of the APs are to be achieved (Table 5). Moreover, some of the APs are couched in vague terms such as enhance, promote, and improve, without a list of tasks to do, performance measures, and resources, including finance for its implementation. Unsurprisingly, policy implementation in Malaysia is deemed weak (World Bank 2021). Without a roadmap for policy implementation, monitoring implementation is equally difficult. This often leads to grand plans but minimal meaningful outcomes.

The main NIMP document does include a National NIMP 2030 Council, which includes sectoral working groups, for overseeing the overall implementation of the plan. The establishment of a National EV Steering Committee (NEVSC) underscore the need for better policy coordination across the different ministries and agencies that are engaged in the development of the EV ecosystem.

Significantly, there is no AP for the deployment of charging infrastructure even though the main NIMP 2030 document has highlighted the need to collaborate with selected players for the development of charging infrastructure and improve demand for EV by lowering the cost of these vehicles (MITI 2023b, page 105). The AP in the sectoral document makes no reference to the need to coordinate the development of supply and demand concurrently.

Aspiring to develop the full spectrum of the EV value chain is also ambitious when the sectoral document (MITI 2023a) has already noted that neighbouring countries also share similar ambitions. Hyundai is already assembling EVs using locally made lithium-ion battery cells in Indonesia (Just Auto 2024). Likewise, Thailand (Thailand BOI n.d.) and Vietnam, with its rich nickel resources (Harsono 2023), are also developing the EV value chain domestically. Given this scenario, Malaysia being a much smaller country, lacks economies of scale, without strong export performance. Although exports are included in the targeting and planning, it is dependent on mainly Proton to drive export penetration, while in reality export penetration of Proton is still poor and Malaysia continues to depend on imports for domestic assembly and production.

The EV plan documents emphasise BEV assembly operations and the localization of assembly operations from the MNCs operating in Malaysia. This goal is no different from the goal of ICE assembly. Yet *green structural transformation* requires Malaysia to make the leap from depending on MNCs alone for technology transfer through localization towards the development of domestic innovation. While the automotive plan document mentions the goal to be a manufacturing and design centre for right-hand drive BEVs, this is not followed up by an action plan. It is implicitly assuming that Proton will drive this

ambition and Malaysia will achieve it through Proton's collaborative efforts with Geely to jointly develop an EV (Chan 2024).

Domestic innovation in the EV supply chain such as in batteries or components where Malaysia may possess a niche as shown in the case of the development of graphene by Graphjet should be promoted as well. If indeed Malaysia is to use EV development for shifting towards high value-added manufacturing products, based on domestic technology, rather than the transfer of technology from MNCs alone, then domestic companies in the EV supply chain must be encouraged to innovate. The Global Innovation Index (GII) shows that Malaysia continues to produce less innovation outputs relative to its level of innovation investments in 2023 as in 2015, highlighting a continued weakness in Malaysia (WIPO 2023, Rasiah, and Yap 2015).

Section 9: Policy Recommendations

Policy Sequencing

Since Malaysia has aspirations along a whole range of EEVs, including hydrogen and autonomous vehicles, it is important to prioritise carefully the current and future focus as funds and resources are limited, especially under the current fiscal conditions. As BEV is the focus of the NIMP, then resources should be focussed on BEV development and other developments can take place later, when the BEV ecosystem is developed. The sequencing can be used to form a roadmap to show Malaysia's transition to EV and later to other stages in automotive development such as autonomous and connected vehicles and hydrogen-powered vehicles. The latter cannot be developed without hydrogen resources and the development of hydrogen charging stations.

Policy coordination between supply and demand and different stakeholders in the EV supply chain

The new governance mechanism shown in Table 7 is to ensure policy coordination between demand and supply and as well across all the relevant ministries and agencies. While it is an excellent way forward, it should be complemented with a reporting of the outcomes of the steering committee, in the planned mid-term review of the NIMP 2030, scheduled for 2027 and the final report on the achievements of NIMP 2030 before the next industrial master plan is ushered in 2031.

Malaysia tends towards general reporting based on broad macro targets, rather than specific targets related to the task at hand. The former cannot provide any conclusion on the effectiveness of any policy implementation while the latter is usually overlooked as it is not targeted at all for reporting purposes. Specific outcomes which are tied to the ambitions for the sector such as, for example, exports by companies, models, and destination countries, will provide better information for reviews on the effectiveness of policies. It will also facilitate improvements in coordination during the duration of NIMP 2030 and the next plan.

Identify niches in EV supply chain for a more targeted approach towards value chain development

Rather than aiming for the entire EV supply chain in competition with others with the same aspirations in the region, Malaysia can strive to identify niches in the EV supply chain that can harness Malaysia's strengths to develop specialised areas. This can be aligned with the NIMP 2030 identified action plans for advancing economic complexity, which is fostering global integrated circuit design champions from Malaysia for electric vehicles, and a shift towards specialty chemicals that can be used for EV batteries, as well as building Malaysian champions for advanced materials such as graphene and rare earth for EVs (MITI 2023a).

Thus, for EV batteries, rather than focussing on assembly of EV batteries, the focus could be on the development of alternative mineral resources such as graphene and also speciality chemicals for EV batteries. MIDA has already started the ball rolling as can be seen in the approved investments in these areas explained in section on domestic and foreign investments in the EV supply chain. It is important to build on these to have more domestic and foreign firms in these segments of the supply chain in Malaysia.

As Malaysia has a matured electronics cluster and increasing FDI in the electronics due to the on-going technology war between the US and China, the country can also leverage on this strength to develop a range of specialized components, from electric motors to power electronics, which presents opportunities for growth in related manufacturing sectors. Developing a local supply chain for these components can stimulate broader industrial activity, spur technological innovation, and create a niche ecosystem within EV manufacturing for Malaysia where it has comparative advantage relative to other countries in the region. These niche segments can, in turn, facilitate export, thereby expanding the scale of operations in Malaysia for the region.

Stimulate Domestic Innovation for #3

An important lesson from China is the concurrent use of absorbing foreign technology from FDI and harnessing domestic innovation for technology development. Malaysia has numerous grants for innovation (MASTIC n.d.). MASTIC is an agency under MOSTI and although MOSTI is also part of the NEVTF, it is represented by Nano Malaysia which is the agency tasked to consolidate and spearhead the commercialisation and industrialisation of nanotechnology activities in Malaysia.

However, given that not all companies are involved in nanotechnology, and domestic innovation is still weak, priorities for innovation grants can be accorded to the identified niches in the EV supply chain so that domestic companies can collaborate with foreign companies in these niche areas. This will attract domestic companies to work in the identified niches. Close coordination between MOSTI and MITI in the award of research grants is required for successful implementation.

Collect data at the firm level and work with universities for analysing firm level development

Firm level data is scarce in Malaysia and the data collected on companies awarded with research grants are not public information as these are with the agencies and ministries that are in charge of the grants. However, agencies and ministries are tied up with their internal activities and so the data collected on these companies are not analysed to see the effectiveness of these grants in spurring new innovation and the types of innovation that have emerged. This type of analysis can help to improve the selection of companies by refining the criteria used for selection.

Collaborations between ministries and agencies with local universities in this matter can be useful for harnessing academia into analysing the requisite firm level data for policy purposes. For this to work, universities have to adjust the key performance indicators used for promotion purposes, which are ISC-cited journal publications rather than policy papers. Trust also needs to be cultivated so that ministries and agencies will know that the data is handled carefully without any breach of confidentiality.

Section 10: Conclusion

Malaysia has used different industrial policy instruments to develop the automotive sector in the country. While domestic manufacturing/assembling companies and parts and components manufacturers have emerged, these serve primarily a domestic market that remains protected by non-tariff barriers such as excise duties. As the domestic market is small relative to regional competitors, domestic companies are less cost competitive without exports that can provide the necessary economies of scale in production.

While policy goals for this sector continue to be grand and aim to locate Malaysia as a hub for EV development in the region, there are formidable challenges in implementation. Policy coordination between supply and demand, and also across the numerous institutions engaged in EV development are needed. Absorbing foreign technology from FDI while fostering domestic technology development are other equally important challenges if Malaysia aims to reinvigorate the manufacturing sector via EV development. The shift towards EVs to facilitate green structural transformation requires a shift from being dependent on FDI alone to drive innovation and change. Instead, domestic companies have to be motivated to invest and innovate in the emerging new segments in the EV supply chain.

Rather than aiming for a large spectrum of EEV, a more focused and phased in approach can help Malaysia to prioritise EV development before attempting to develop all types of new energy vehicles. Policies can also help to position Malaysia in niche areas in the EV supply chain where Malaysia enjoys a relative comparative advantage over its ASEAN neighbours, rather than compete to develop the whole supply chain.

Finally, while resources have been poured into the development of the two national cars, other local players have emerged in the local assembly of EVs, with technology partners

from China. A more competitive domestic landscape for local manufacturers can instigate domestic players to shift towards export markets and greater investments for innovation in technology development.

Appendix

Table 1. Top 10 Export destination from Malaysia (USD Millions).

Rank	Country	Battery Materials	Country	Battery Pack	Country	Electric Vehicles (EV)	Country	Processed Minerals	Country	Raw Minerals
1	Netherlands	366.90	USA	228.98	Thailand	119.36	China	20.86	United Arab Emirates	10.80
2	China	160.32	China, Hong Kong SAR	226.18	Viet Nam	10.74	Singapore	7.81	Türkiye	5.53
3	India	112.16	China	203.27	Other Asia, nes	3.86	India	2.02	Indonesia	5.06
4	USA	78.67	Viet Nam	151.40	Indonesia	3.35	Poland	1.83	Viet Nam	4.96
5	Japan	61.47	Mexico	136.70	Australia	2.38	Japan	1.10	Brazil	3.30
6	Thailand	58.17	Hungary	61.74	USA	1.45	Thailand	0.72	Japan	3.17
7	Indonesia	40.77	Singapore	28.18	United Kingdom	0.42	Germany	0.53	Thailand	2.55
8	Rep. of Korea	34.35	Germany	25.38	Singapore	0.10	Viet Nam	0.37	Saudi Arabia	2.35
9	Singapore	32.69	Italy	18.42	Sweden	0.04	United Kingdom	0.37	India	2.22
10	Belgium	29.56	Netherlands	17.39	China	0.04	Australia	0.32	China	1.72
	World	1,217.05	World	1,207.52	World	141.76	World	37.12	World	49.92

Source: UN Comtrade

Table 2. Top 10 Export destination share (% of total Malaysia export of that particular product)*

Rank	Country	Battery Materials	Country	Battery Pack	Country	Electric Vehicles (EV)	Country	Processed Minerals	Country	Raw Minerals
1	Netherlands	30.1*	USA	19.0	Thailand	84.20	China	56.20	United Arab Emirates	21.63
2	China	13.2	China, Hong Kong SAR	18.7	Viet Nam	7.58	Singapore	21.05	Türkiye	11.07
3	India	9.2	China	16.8	Other Asia, nes	2.72	India	5.43	Indonesia	10.14
4	USA	6.5	Viet Nam	12.5	Indonesia	2.36	Poland	4.92	Viet Nam	9.93
5	Japan	5.1	Mexico	11.3	Australia	1.68	Japan	2.96	Brazil	6.60
6	Thailand	4.8	Hungary	5.1	USA	1.02	Thailand	1.93	Japan	6.34
7	Indonesia	3.4	Singapore	2.3	United Kingdom	0.29	Germany	1.42	Thailand	5.11
8	Rep. of Korea	2.8	Germany	2.1	Singapore	0.07	Viet Nam	1.01	Saudi Arabia	4.70
9	Singapore	2.7	Italy	1.5	Sweden	0.03	United Kingdom	0.99	India	4.46
10	Belgium	2.4	Netherlands	1.4	China	0.03	Australia	0.87	China	3.45
	World**	0.035		0.034		0.04		0.01		0.01

Note:

*e.g Malaysia export of battery materials to Netherlands / Malaysia total export of battery materials to the world

**share of the product to Malayia Total exports of ALL products. E.g Malaysia export of battery materials to the world / Malaysia total exports to the world.

Source: UNComtrade

Table 3. Top 10 Import source for Malaysia (USD Millions).

	Country	Battery Materials	Country	Battery Pack	Country	Electric Vehicles (EV)	Country	Processed Minerals	Country	Raw Minerals
1	Rep. of Korea	337.81	China	245.24	Germany	190.48	China	615.73	China	70.66
2	China	162.68	USA	15.56	Rep. of Korea	23.52	South Africa	58.48	Japan	27.36
3	Indonesia	59.56	Rep. of Korea	13.95	China	18.10	Rep. of Korea	16.72	USA	20.47
4	Japan	46.39	Other Asia, nes	12.32	USA	14.63	Mozambique	12.96	Spain	3.60
5	USA	42.42	Germany	11.70	United Kingdom	10.61	United Arab Emirates	9.70	India	3.23
6	Germany	34.10	Japan	4.68	Japan	2.08	Malawi	7.09	Rep. of Korea	2.03
7	Singapore	31.14	Thailand	3.77	China, Hong Kong SAR	0.83	Japan	5.70	Indonesia	1.65
8	Other Asia, nes	20.92	China, Hong Kong SAR	3.62	Belgium	0.34	United Kingdom	5.19	Thailand	0.80
9	United Kingdom	8.92	Sweden	3.28	Australia	0.33	Belgium	3.79	Other Asia, nes	0.69
10	Netherlands	6.86	Singapore	1.05	Austria	0.24	USA	3.00	United Kingdom	0.46
	World	801.21	World	317.55	World	261.77	World	745.23	World	132.41

Source: UNComtrade

Table 4. Top 10 Import source for Malaysia (share %)

Rank	Country	Battery Materials	Country	Battery Pack	Country	Electric Vehicles (EV)	Country	Processed Minerals	Country	Raw Minerals
1	Rep. of Korea	42.16	China	77.23	Germany	72.77	China	82.62	China	53.37
2	China	20.30	USA	4.90	Rep. of Korea	8.99	South Africa	7.85	Japan	20.66
3	Indonesia	7.43	Rep. of Korea	4.39	China	6.91	Rep. of Korea	2.24	USA	15.46
4	Japan	5.79	Other Asia, nes	3.88	USA	5.59	Mozambique	1.74	Spain	2.72
5	USA	5.29	Germany	3.69	United Kingdom	4.05	United Arab Emirates	1.30	India	2.44
6	Germany	4.26	Japan	1.47	Japan	0.79	Malawi	0.95	Rep. of Korea	1.53
7	Singapore	3.89	Thailand	1.19	China, Hong Kong SAR	0.32	Japan	0.76	Indonesia	1.24
8	Other Asia, nes	2.61	China, Hong Kong SAR	1.14	Belgium	0.13	United Kingdom	0.70	Thailand	0.60
9	United Kingdom	1.11	Sweden	1.03	Australia	0.13	Belgium	0.51	Other Asia, nes	0.52
10	Netherlands	0.86	Singapore	0.33	Austria	0.09	USA	0.40	United Kingdom	0.34
	World*	0.27		0.11		0.09		0.25		0.05

Note *share of the product to Malayia exports of ALL products.
Source: UNComtrade

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