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Promotion of Electromobility in ASEAN

States, Carmakers, and International Production Networks

Edited by

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Promotion of Electromobility in ASEAN:

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Preface

Martin Schröder, Fusanori Iwasaki, and Hideo Kobayashi

This section will outline the motivation behind the research and the framework for the subsequent chapters of this volume. First, the topic should be addressed. It should be highlighted that the Association of Southeast Asian Nations (ASEAN) may not be immediately associated with electric vehicles (EVs). A significant amount of the academic literature on EVs covers developed countries and China, which heavily supports EVs, specifically battery electric vehicles, to change the automotive industry and secure a leading position for domestic firms. In the case of China, it is evident that the government supports EVs to leapfrog the national automotive industry beyond internal combustion engine vehicle technology (Wang and Kimble, 2011; Wan et al., 2015), which, despite the success of some Chinese firms, is still by and large dominated by firms Europe, Japan, the Republic of Korea, and the United States. Smitka (2016) labels China's automotive industry as a 'success despite policy' because passenger car production, especially, remains dependent on the technology provided by foreign joint venture partners or suppliers. From this perspective, leapfrogging towards electromobility may be China's only realistic option to become independent from and compete against incumbent carmakers.

Addressing the question of how EVs affect developing countries aside from China is rather uncommon. Masiero et al. (2017) investigated the question of how Brazil may participate in the EV supply chain. Their findings suggest that even large, developing countries such as Brazil have limited potential to participate in the EV supply chain. Transnational original equipment manufacturers and suppliers may utilise raw materials and rely on emerging countries for developing software that controls EV components, which are both rather low value-added processes inside the EV supply chain.

Whilst little research has been conducted on emerging countries except China, the existing literature nevertheless suggests that these countries need to actively engage in new technology through policies if they do not wish to be relegated to the minor roles of providing unprocessed raw materials and qualified, yet inexpensive, white-collar workers.

By focussing on ASEAN Member States' automotive policy with special attention to EV support, this volume seeks to fill the void in the scholarly research on EV production and sales in emerging countries. The diversity of the ASEAN Member States in terms of population, geographic size, wealth, and industrial development offers the opportunity to highlight different challenges for countries with differing characteristics in the transition towards electromobility.

Simultaneously, this diversity also means that there is only a limited number of ASEAN Member States that currently engage or even just seek to engage in EV production. Therefore, some of the contributions on individual countries do not discuss EV-related issues but highlight the country-specific challenges in developing the automotive industry.

First, Schröder and Iwasaki provide an overview of the automotive policies of ASEAN Member States with special emphasis on EV-related policies and, wherever applicable, the carmaker stances, and contrast the cases with the rather well-studied case of China. They conclude that the main difference between China and ASEAN is that the former is clearly seeking to build a domestic EV industry and global industry leadership and (a subgroup of) the latter is merely seeking to maintain the individual countries' positions within foreign-dominated value chains. Their analysis suggests that ASEAN countries may be divided into four distinct groups that have vastly different stances towards electromobility. The first group consists of the three main automobile-producing countries in the region, i.e. Thailand, Indonesia, and Malaysia. These three countries have started to actively promote EV production, seemingly mostly motivated by either defending or extending their role as production bases. The second group consists of minor production locations, i.e. the Philippines and Viet Nam. Whilst both countries support EV production in principle, they have so far not formulated consistent policies towards this aim. The third group consists of Brunei Darussalam and Singapore. These two small nations are rather cautious towards electromobility, yet the underlying reasons differ significantly. The final group consists of Cambodia, the Lao PDR, and Myanmar. These three nations basically have no observable stance towards EVs. Since they are all least developed countries and are still in the pre-motorisation stage, this stance cannot be surprising as EVs are still significantly more expensive than conventional internal combustion engine vehicles. Hence, the diversity of approaches towards electromobility in ASEAN is rooted in the different stages of economic and automobile industry development as well as policy orientations.

Schröder then analyses Thailand's EV policy against the background of the so-called 'product champion approach', which was employed to promote specific kinds of vehicles for production in Thailand. His analysis first questions whether the label of product champion is appropriate for the second iteration of this policy, i.e. when small passenger cars were promoted. He shows that while policy coincided with increased production and the export of passenger cars, export growth actually occurred in passenger cars that fall outside the target vehicle type. Thus, he concludes that the label is not fitting as small passenger cars are not a dominant export like one-tonne pickup trucks, the original product champion. Second, comparative analysis of product champion policy measures finds that EV promotion suffers from an explicit production target. While former policies balanced support against high production targets, EV policy basically only supports investors without demanding targets. Thus, it is concluded that the product champion approach – like other targeting policies – is useful for catching up but is inappropriate for promoting innovative technology. Therefore, it is concluded that the product champion approach may be feasible as a policy tool to promote standard technology but lacks viability to support more innovative technology, meaning that policymakers must understand the limitations of existing policy tools instead of continuing to follow recipes that worked in the past.

Anazawa discusses Malaysia's automotive industry from a largely historical perspective. He traces the historical development from the birth of the industry during the import substitution era, through the state-led development push with the creation of the national carmakers Proton and Perodua, and the lack of development, especially concerning the former and its associated supplier base. Finally, he discusses the evolution of industrial policy, observing that policy largely failed to achieve established goals. Interestingly, failure does not seem to be accompanied by changing policy or the setting of more moderate goals, but policy aims seem to become even more demanding.

Kobayashi, Ishioka, and Schröder utilise a unique data source to investigate supplier activity in Viet Nam from the perspective of production processes conducted by supplier firms. They find that local supplier firms are concentrated in press, machining, and metal moulding operations but are more weakly represented in production processes that require deepened know-how. Conversely, foreign firms are strongly engaged in assembly operations, suggesting that foreign firms tend to utilise Viet Nam as a source of inexpensive labour. They follow up by outlining a potential development scenario for the local supplier industry, which hinges on the idea of upgrading the most capable motorcycle suppliers into automobile parts makers.

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CHAPTER 1:

CURRENT SITUATION OF ELECTRIC VEHICLES IN ASEAN

Martin Schröder and Fusanori Iwasaki

1. Introduction

Interest in electric vehicles (EVs) is growing in the Association of Southeast Asian Nations (ASEAN) and East Asia. In 2019, the total number of vehicle sales in ASEAN Member States was 3.4 million, according to the ASEAN Automotive Federation.[1] The number will increase in the coming 50 years due to population growth and economic development. Since automobiles are expected to be increasingly sought after with economic growth, it is necessary to consider how to cope with the growing demand for fuel consumption and air pollution, such as greenhouse gas (GHG) emissions, particulate matter (PM), nitrogen oxide (NO_x), and sulphur oxide (SO_x) in some city areas. Emerging EV technology could bring about improvements in energy efficiency as well as the environment and health of human beings.[2]

According to the International Energy Agency (IEA, 2018), the sales of new EVs worldwide surpassed 1 million units in 2017. The total stock of electric cars surpassed 3 million vehicles, with China occupying the largest portion at around 40% of the total in the world.

We shall outline basic definitions for analysing EV[3] supply chains in the ASEAN region. Within EVs, there exist various subtypes, namely hybrid electric vehicles (HEVs), plug-in hybrid electric vehicles (PHEVs), battery electric vehicles (BEVs), and fuel cell vehicles (FCVs).[4] Despite differences between and within these subtypes, all these subtypes share a number of components that differentiate them from internal combustion engine vehicles (ICEVs) (Table 1). Hence, EVs require a supply chain that is different from conventional vehicles.

[1] The actual number will be slightly higher as reported data only cover Brunei Darussalam, Indonesia, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Viet Nam, i.e. data on Cambodia and Lao PDR are not reported. However, as both countries are least developed countries with relatively small populations, the total number of vehicle sales should only be marginally higher.

[2] It should be stressed that this view presupposes that electricity is generated in a sustainable way. Research grounded in well-to-wheel analysis (Wang, 2001) highlights that EVs overall environmental impact depends on a country's electricity mix, i.e. some countries may actually have higher total emissions if they switch to EVs without simultaneously changing their electricity generation (Woo et al., 2017).

[3] The following description is a simplified overview that seeks to briefly explain the differences between EV types and the function of different EV components. As the purpose of the research project is to investigate industrial competitiveness and readiness for EV production, a lot of technical details, such as differences between series, parallel, and series-parallel hybrids, are omitted. For a recent, detailed discussion of EV types and components from a technological point of view, refer to the work of Un-Noor et al. (2017).

[4] As FCVs are still highly expensive and only produced in very low numbers, this subtype will not be excluded from the following investigation. Also, as will be shown in the subsequent discussion, no ASEAN Member State supports FCVs through policy.

Table 1.1: Components Used in Internal Combustion Engine Vehicles and Electric Vehicle Subtypes

Component	ICEV	HEV	PHEV	BEV
Engine	●	●	●	
Electric traction motor		●	●	●
Converter		●	●	●
Inverter		●	●	●
Traction battery		●	●	●
Of which: Battery cell		●	●	●
Of which: Battery management system		●	●	●
Plug			●	●

BEV = battery electric vehicle, HEV = hybrid electric vehicle, ICEV = internal combustion engine vehicle, PHEV = plug-in hybrid electric vehicle.
Source: Authors.

As the name implies, hybrids share components with both conventional and purely electric vehicles. It should be stressed that BEVs do not utilise a significant number of ICEV components, such as engines, exhaust systems, filters, fuel injection system, fuel pumps, radiators, and spark plugs, which, however, are all part of hybrids. It is, however, also obvious that all EV types share a significant number of components that constitute an enlarged or alternative supply chain.

To clarify the function of the EV components listed above, a brief summary of the components' functions is given below. It should be highlighted that these components constitute a significant share of the total cost of making EVs, so local manufacturing operations may mean that host countries capture value-added.

Electric motors have the task of transforming energy stored in the traction battery into motion, which turns the wheels. In the case of BEVs, the motors solely perform this task, whilst motors and internal combustions engines work in tandem to power the wheels of hybrids.

The traction battery is the source of energy. Whilst it is the only source of energy in BEVs, HEVs and PHEVs utilise chemical energy from the battery and engine fuel. Here, it needs to be stressed that battery production alone may not constitute significant value-added capture. EV batteries typically are packaged into so-called 'battery packs', which consist of various battery modules that in turn are constituted by several battery cells. In the case of lithium-ion (Li-ion) batteries, cells are the costliest component, and subsequent processing into modules and packs adds relatively limited value (Coffin and Horowitz, 2018). If one divides the costs of a final battery pack into the stages of the production process, 14% of costs stem from the pack production stage, 11% from the module production stage, and 20% from the cell production stage. Simultaneously, cells constitute 75% of the total costs of a battery pack. This is mainly due to the fact that relatively costly materials used in Li-ion batteries, such as lithium, cobalt, manganese, and (natural) graphite, are utilised during the cell production stage.[5] Whilst assembly into modules and packs is necessary, the costs mainly stem from the battery cells.

[5] The list of important raw materials may be extended to nickel, copper, aluminium, silicon (metal), and tin.

Thus, only if battery cells are manufactured locally are host countries capturing noteworthy value-added.

In general, an inverter's primary function is to convert direct current (DC) into alternating current (AC). This component is required as the traction battery releases electric energy in the form of DC whilst the motor utilises AC.

A converter is an electrical device that increases or decreases the voltage – either DC or AC – of an electrical power source. Inside EVs, inverters and converters may be combined into a single unit that functions as a managing device for the electric drive system. For instance, if the EV is utilising a so-called 'regenerative brake', kinetic energy from the brake is fed into the electric motor, which acts a generator. The electric load produced may be stored as chemical energy in the battery, as electric energy in capacitors, or as mechanical energy in a flywheel.

In PHEVs and BEVs, the plug has the basic function of allowing the re-charging of the traction battery.

2. Literature Review

We aim to explore the role of developing countries as both markets and producers of EVs. Since the literature on these topics is relatively scarce, we also compare developing and developed economies. In both cases, we look at the role of governments in promoting the adoption of EVs and the local production of these vehicles.

2.1. Developing countries as electric vehicle markets

Globally, EVs are still a niche market because these vehicles only occupied a global market share of 0.2% in 2016. Whilst some forecasts expected that 11 million EVs would be sold by 2020 (Automotive News 2009 quoted by Brown, Pyke, and Steenhof (2010: 3797)), progress has been significantly slower, with an accumulated 3 million sales in 2017.

Several factors may explain this slow progress. Studying EV adoption in 30 countries, Sierzchula et al. (2014) found that financial incentives and charging infrastructure played a main role in explaining EV adoption. Interestingly, they also found that sociodemographic variables, such as income, education, and concern for the environment had no explanatory power. Thus, countries with no or minimal consumer incentives and/or weakly developed charging infrastructure cannot be expected to have significant EV adoption. In general, this finding suggests that governments must play a proactive role in promoting the transition towards electromobility. Further, it has been found that current battery technology is not serving three distinct transportation markets, i.e. long-range, low-cost, and high-utilisation transport (Cano et al., 2018). For all developing countries, the absence of low-cost EVs must be assumed to be a major explanatory factor in the scarce adoption of these vehicles. EVs still command a price premium of about US$5,000 in comparison with conventional vehicles of similar size in both developed and emerging markets. Thus, even in developed markets, EV market shares so far remain limited.

One particularly exceptional case is China, which despite still being a developing country, has emerged as the main EV market in the world since 2016 when the country overtook the United States (US). Despite this leading position, it should be pointed out that EVs only accounted for a mere 1.43% of all vehicle sales in China in 2016 (Lin and Wu 2018: 234). Thus, whilst China is the principal EV market, the market penetration of EVs still remains limited. Nevertheless, it is meaningful to ask what kinds of factors led to China's emergence as the principal EV market.

Regarding Chinese consumers, comparative studies have found that Chinese consumers are more open to EVs than consumers in developed countries. Compared to their US counterparts, Chinese consumers are more open to considering adopting EVs despite the fact that subsidies from both national governments were similar but the average income of Chinese consumers was lower (Helveston et al., 2015). Simultaneously, it has been found that consumers in Brazil, China, India, and Indonesia are less willing to pay for the additional mileage of EVs (Cano et al., 2018). This suggests that general openness towards EVs may be moderate by practical considerations such as driving range. Also, it should be stressed that China's success needed considerable staying power. Studies pointed out that despite high subsidies of US$9,200 from the central government plus additional incentives from local governments, which amounted to combined total incentives of up to US$27,600 in Shanghai, initial adoption was low (Wan et al., 2015: 117). It appears that insufficient charging infrastructure was the main reason why consumers did not choose to buy EVs (Wang et al., 2017: 187). Studying the EV promotion policies of 88 Chinese cities, Qiu, Zhou, and Sun (2019: 27) found that EV adoption was positively influenced by infrastructure construction subsidies. Another important factor was that despite existing subsidies, the total cost of ownership was still considerably higher for consumers (Zhang et al., 2017: 705). Only when the central government introduced restrictions on ICEV registrations in major cities at the end of 2014 did consumers opt to purchase EVs (Wang et al., 2017: 187; Zhang et al., 2017: 704). This highlights that even generous subsidies will not persuade consumers to acquire EVs if the infrastructure required for daily operation is insufficient. In such cases, only radical restrictions on consumer choice seem to result in EV adoption.

Another exceptional case is Norway, which achieved a high EV share of total new vehicle sales with a combination of substantial subsidies and favourable framework conditions[6] (Figenbaum, 2017: 15f.). Nevertheless, even in the leading country of Norway around, 80% of new vehicle sales are not EVs. This suggests that even extensive policy support may only induce a gradual shift towards electromobility. Thus, critics have pointed out that Norway's EV support policy should not be adopted by other countries because it is costly, results in a limited reduction in GHG, and may even promote the adoption of EVs as households' second cars, where there used to be no demand for second cars prior to subsidisation (Holtsmark and Skonhoft, 2014).

Given lower per capita income in most ASEAN markets, the persisting absence of low-cost EVs may explain why these vehicles are not – and in the absence of extensive subsidies arguably will not be – widely adopted by ASEAN consumers. Nevertheless, a recent simulation of policy support for EV carsharing in Brazil found that even limited government intervention could induce the adoption of EVs and result in lowered CO_2 emissions (Luna et al., 2020). This suggests that ASEAN countries could also utilise EV support policy to reduce harmful GHG emissions.

[6] Norway produces 96% of its electricity through hydropower. Thus, EV use is indeed mitigating harmful GHG emissions. Further, the majority of households are capable of charging EVs as three-quarters of households use electricity for space heating. Finally, transportation is heavily taxed, i.e. there are high taxes on vehicle acquisition, road use, and fuels. Hence, Norwegian regulators could make EV adoption highly attractive by not only subsidising EV acquisition but also through exempting EVs from various indirect costs. Finally, Norway hosts no vehicle production, meaning that there are no powerful vested interests in ICEV technology.

Overall, the literature on developing countries as EV markets suggests that even massive government intervention may only result in a gradual transition towards electromobility. It is likely to require serious, long-term fiscal support to result in increased adoption. The exceptional cases of China and Norway suggest that both governments created a rather artificial market demand by strongly distorting consumer prices in favour of EVs. In the case of China, restrictions on ICEV registrations in major cities also forced adoption on consumers seeking individual mobility. Thus, it must be expected that only countries willing to make considerable investments in EV adoption will succeed in influencing consumer behaviour.

2.2. Developing countries as electric vehicle producers

Whilst developing countries, especially China, have been extensively studied as EV markets, studies on their role as EV producers are relatively scarce. There may be one main hypothetical explanation for this lack of research: EV production tends to be located within carmakers' countries of origin. As EV technology is still novel, there may be benefits from feedback from production to development in conducting EV production close to original equipment manufacturer (OEM) headquarters. This tendency makes it less likely that EV production is conducted in developing countries. Nevertheless, it is somewhat surprising that China's role as an EV producer is not as extensively analysed as is Chinese consumer behaviour as discussed in the preceding section. Chinese carmakers accounted for 43% of global EV production in 2016, according to a report by McKinsey (Hertzke, Muller, and Schenk, 2017). Also, Chinese lithium-ion battery makers are increasingly challenging the once-dominant Japanese and South Korean producers.

One point that must be stressed is that China promoted EVs due to multiple reasons, including industrial, environmental, public health, and national security considerations. Thus, its emergence as the principal market for EVs is closely linked to the ambition to become a leading industrial country with a sustainable industrial business model. Chinese support can be traced back to the early 1990s when the country started to sponsor EV research and development (R&D) (Zheng et al., 2012: 18). Support became more encompassing in the mid-2000s when demonstration programmes were sponsored to explore commercialisation. Clearly, China aimed to leapfrog towards EVs in order to pursue continued industrialisation whilst simultaneously mitigating the negative consequences of ICEV deployment, namely costly oil imports and air pollution (Wang and Kimble, 2011).

Overall, developing countries aside from China so far have not received much attention as EV production sites. This may be due to the relatively low scale of production and the relative novelty of shifting production towards developing countries. Thus, the subsequent section on EVs in ASEAN sheds some light on the role of smaller developing countries as EV producers. Further, it cannot be surprising that EV production in ASEAN is dominated by foreign carmakers. In comparison to China, ASEAN countries started to support EVs relatively late, so there are few cases of local firms engaging in EV or EV component production.

3. Country Cases

In this section, we would like to illustrate the current situation and the foreseeable policy directions of individual ASEAN Member States. This is due to the fact that there is no coordinated policy towards EVs amongst member states. As will be shown in the following discussion, some member states seek to establish themselves as (regional) hubs for EV production. Consequently, individual member states seek to attract and build supply chains inside their national borders. This is remarkable because the ASEAN automotive industry is currently characterised by regionally integrated supply chains, where the production of vehicle components is fragmented across national borders. Whilst Thailand is the current central ASEAN production hub for most OEMs, it appears that certain countries intend to challenge this leadership in production by promoting EV production. From the following discussion, we excluded Cambodia, the Lao PDR, and Myanmar because these countries do not have dedicated EV policies.

3.1. Brunei Darussalam

At present, Brunei Darussalam has only a small fleet of EVs. Moreover, data from Brunei's Land Transport Department indicate that the number of EVs has decreased. Whilst 600 HEVs and 32 BEVs were registered as active vehicles in 2014, the numbers dropped to 282 and 18 units, respectively, in 2017. With more than 300,000 registered vehicles, the share of EVs in the total fleet was below 0.1% in 2017. In other words, the rate of EV adoption is very low.

Brunei has only recently considered the promotion of EVs. Initiatives are embedded in the so-called Land Transport Master Plan (LTMP) (MTIC, 2014).[7] This plan is part of the overall Wawasan (Vision) 2035, the country's overall development plan. In general, it can be stated that EV promotion does play a very minor role in the LTMP. Regarding the LTMP's budget, only 0.2% is earmarked for green vehicle technologies, and it is currently unclear how actual policy towards these technologies will be implemented. However, it can be claimed that Brunei intends to mainly strengthen public transport to reduce harmful emissions as the budget is strongly concentrated in related projects such as bus rapid transit (40.4%), national school buses (10.4%), and buses (5%). Despite the so-far unclear support scheme for EVs, it is nevertheless clear that EV promotion is regarded as one tool amongst others to promote energy efficiency in transport. Thus, the LTMP states that the use of HEVs, BEVs, and so-called fuel-efficient vehicles (FEVs) should be increased. FEVs appear to not only include different types of alternative fuels, such as LPG (liquefied petroleum gas) and CNG (compressed natural gas), but also conventional ICEVs with low energy consumption.

Moreover, Brunei has announced that it plans to implement fuel economy standards in the near future (17.2 kilometres per litre (km/L) by 2020 and 21.3 km/L by 2025). Whilst the government is considering introducing subsidies for environmentally friendly vehicles, including inter alia EVs, concrete consumer subsidies have not been introduced as of May 2019.

Regarding Brunei's approach towards EVs, we can highlight that Brunei's strategy must be interpreted against the background of its electricity generation mix, which is almost entirely based on thermal

[7] If not indicated otherwise, the below description is based on the LTMP, the central policy document for the transport sector.

power plants. Thus, based on ERIA's research survey, Brunei's shifts towards EVs would achieve little reduction or even cause an increase in harmful emissions (Kimura et al., 2017: 60, Figure 32). Therefore, Brunei's EV policy may only change if the country diversifies its current energy policy, especially concerning electric power generation, towards renewable energy sources.

Overall, we can evaluate that so far, Brunei has not prioritised EV support. Instead, the country intends to gradually improve energy efficiency in its transport sector via strengthening public transportation and introducing fuel economy standards. Managing its rather abundant natural resources more efficiently and reducing environmentally harmful emissions from ICEVs apparently takes precedence over a more fundamental shift towards EVs. This lukewarm approach makes sense as a politically and financially supported shift towards these vehicles is inconsistent with the country's electricity mix.

3.2 Indonesia

It took Indonesia considerable time to decide upon a concrete policy towards EVs. However, EV development captured the imagination of Indonesia's leadership. In 2012, then-president Yudhoyono supported the idea to develop a national EV to be developed by the nation's leading universities. His successor, President Widodo, is regularly portrayed as a supporter of EVs and invested in the idea of producing EVs in Indonesia.[8] For this reason, the current status of Indonesia's EV policy deserves attention.

In 2017, President Widodo asked its cabinet to develop measures, so various proposals have been put forward. In line with the president's vision for a home-grown EV industry, Minister of Research, Technology and Higher Education Nasir supports four Indonesian universities, which seek to develop a national EV (Xinhua, 2017). The minister aimed to start the mass production of developed EV prototypes by 2020. Moreover, Vice President Kalla stated that EV owners could be granted reduced value-added tax and import duties and Minister of Industry Hartarto plans a quota of 20% EVs sales by 2025, including HEVs, PHEVs, BEVs, and reportedly also FCEVs (Tempo, 2017; Jakarta Post, 2017a). Also, officials indicated that EVs could be supported via the existing Low Carbon Emission Program (LCEP), which provides incentives in the form of a lower luxury tax on vehicles. It is important to point out that this programme is not just directed at EVs but supports all fuel-efficient vehicles – qualifying vehicles must have a fuel efficiency of between 20 km/L and 28km/L of gasoline (equivalent) to receive a 25% reduction; vehicles whose mileage exceeds 28km/L are entitled to a 50% luxury tax cut; and BEVs are completely exempted from the luxury tax under this scheme. Whilst BEVs clearly receive the highest incentives, it is nevertheless obvious that the LCEP is designed to promote fuel efficiency in general rather than EVs in particular. Finally, Minister of Energy and Mineral Resources Jonan has proposed that Indonesia should prepare a system to allow BEV drivers to exchange empty batteries against fully charged ones at existing filling stations (Jakarta Post, 2017b).

One emerging characteristic of Indonesia's EV policy is the linked promotion of EV and battery production. Indonesia possesses significant reserves of nickel (nickel laterite), which is utilised in the

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[8] Similar to several other countries, such as France, India, the Netherlands, and the United Kingdom, Indonesia is considering introducing a ban on passenger ICEVs by 2040 to combat environmental and health issues related to emissions. Whilst concrete plans have not materialised at the time of writing, an ICEV passenger car ban has entered the draft of future transport policy. This idea alone indicates that the country indeed seeks to shift transportation towards EVs.

production of lithium EV battery cathodes. Recently, two projects have been launched to extract nickel on Sulawesi, one by the Japanese firm Sumitomo Metal[9] and another joint venture between three Chinese firms, namely battery maker CATL, battery recycler GEM, steel-maker Tsingshan, the Japanese Hanwa trading company, and the Indonesian Morowali Industrial Park.[10] In order to take advantage of the national resources, two state-owned enterprises, namely oil and gas extractor Pertamina and mining company Aneka Tambang, are planning to produce batteries (Asmarini, 2018).

Indonesia's strategy is explicitly about exporting EVs, especially to Australia and within ASEAN to leverage free trade agreements (Davies and Kapoor, 2019). Regarding the status of EV production, there are currently only plans or negotiations between carmakers and the Indonesian government. Whilst government sources suggest that Hyundai will produce EVs in a newly planned plant, it is unclear how much production capacity will be assigned to EVs (Soeriaatmadja, 2019). Hence, despite having formulated a straightforward strategy towards linking battery and EV production, there are currently no results.

However, Indonesia finally enacted an EV support policy in December 2019. The overall goal of the regulation is that EVs should constitute 20% of domestic vehicle sales by 2025. Incentives are granted only if investors meet local content requirements (see Table 1.2).

Table 1.2: Indonesia's Electric Vehicle Local Content Requirements for Investment Incentives

	Phase	**Time frame**	**Local Content** (in %)
E-motorcycles	1	2019–2023	40
	2	2024–2025	60
	3	2026–	80
Electric vehicles	1	2019–2021	35
	2	2022–2023	40
	3	2024–2029	60
	4	2030–	80

Source: FAMI.

Incentives require significant levels of local content, even in the early stages. Whilst investors will be allowed to import certain components during the initial stages of EV plant construction, the policy does not specify the time window. Aggressive targets indicate that policymakers indeed intend to utilise local nickel deposits for the domestic EV industry.

Incentives include (1) exemption from customs duty on semi-knock down (SKD) and complete knock down (CKD) kits during the initial stage of the project; (2) exemption from luxury sales tax; (3)

[9] Extracted materials will be exported for further processing to Japan. This suggests that the desired integration between EV battery and EV production may not be realised in each particular case.

[10] The project will produce battery-grade nickel sulphate and cobalt sulphate as by-products of nickel extraction dedicated for integrated stainless steel production.

reduction or exemption from regional or central government taxes (e.g. motor vehicle tax); and (4) exemption of customs duty on production-related capital goods, amongst others.

Overall, after extended periods of planning, Indonesia has formulated a concrete policy. However, the policy must still become more concrete, e.g. through the specification of which taxes are to be reduced or exempted. Regarding carmakers' responses to policy, BYD, Hyundai, JAC, and Toyota have expressed interest in producing EVs in Indonesia (Indonesia Economic Forum, 2019). Moreover, as the supply chain for EV batteries requires significant expertise and is dominated by a small number of firms from China, Japan, and the Republic of Korea, it remains to be seen if incentives are going to result in the creation of a local supply chain.

3.3 Malaysia

Compared to other ASEAN countries, Malaysia introduced policies supporting EVs relatively early. Malaysia's policy supports EVs due to a set of mixed motives, including environmental, energy, and industrial policy considerations.

EV support was put on the political agenda when the country launched its National Green Technology Policy in 2009. This policy rests on four pillars, representing energy, environmental, economic, and social considerations. This indicates that EV support is regarded as a part of a larger transformation towards a sustainable economy and society. As such, the transformation cuts across various political areas, and Malaysia set up Greentech Malaysia, a subsidiary organisation under the Ministry of Energy, Green Technology and Water, to promote this process according to the aims of the national policy.

Concerning EV use in Malaysia, the government later formulated the following goals (Greentech Malaysia, undated): until 2020, 100,000 passenger EVs, 2,000 bus EVs, and 100,000 electric scooters or motorcycles should be on national roads. In order to support the adoption of EVs, the government further aimed at installing 120,000 charging stations. Officially, BEVs are regarded as full EVs but HEVs and PHEVs as partial EVs (ibid). However, there is no information as to how partial EV types will be counted towards the 100,000 unit target. However, reaching this target will be difficult as less than 120 BEVs were registered by 2016. Further, it needs to be pointed out that the charging station target number includes the charging points of private PHEV and BEV owners as the government only wants to install 25,000 stations across the nation (The Sun Daily, 2016). Recently, news reports quoted Maximus Ongkili, Minister of Energy, Green Technology, and Water, that the goals, including a moderate increase to 125,000 charging stations, should be realised by 2030 (Clean Malaysia, 2017). As of December 2018, there were a total of 251 publicly accessible charging stations in Malaysia, suggesting that the minister's revision was a de facto acknowledgement that the infrastructure goal cannot be realised until 2020. Whilst press statements are currently not reflected in policy documents, the 2030 timeframe appears more realistic.

Regarding EV policy measures, Malaysia exempted HEVs and PHEVs with internal combustion engines below a 2L engine capacity from import tax and granted a 50% lower excise duty from 2011 to 2013. Whilst this measure provided consumer incentives, subsequent policies served industrial aims.

The National Automotive Policy (NAP) of 2014 supports EV production but, nevertheless, cannot be labelled as a dedicated EV policy. Rather, NAP aims to promote what it calls eco-efficient vehicles (EEVs). The government's definition of EEV is broad, i.e. it includes fuel-efficient ICEVs, HEVs, PHEVs, and BEVs, as well as ones using alternative fuels (biodiesel, CNG, LPG, ethanol, and hydrogen (for both combustion engines and fuel cells)). Further, the initial policy declaration stated that EEVs would be specified via fuel efficiency and carbon emissions. Concerning the latter, a subsequent publication (MITI, 2014b) stated that emission criteria would only be applied after the Euro 4M[11] fuel quality standard is introduced. After this step, a government study with stakeholder participation would investigate how this standard could be implemented. Subsequently, the level of carbon emissions would become a second parameter defining EEVs. In the meantime, EEVs are specified through fuel efficiency criteria. Regarding this indicator, the government has defined fuel efficiency parameters for different vehicle segments (Table 3).

Table 1.3: Eco-efficient Vehicle Specifications via Fuel Efficiency

Segment	Description	**Curb Weight** (kilogrammes)	**Fuel Efficiency** (litres per 100 kilometres)*
A	Micro car	< 800	4.5
	City car	801–1,000	5.0
B	Super mini car	1,001–1,250	6.0
C	Small family car	1,251–1,400	6.5
D	Large family car	1,401–1,550	7.0
	Compact executive car		
E	Executive car	1,551–1,800	9.5
F	Luxury car	1,801–2,050	11.0
J	Large 4x4	2,051–2,350	11.5
Others	Others	2,351–2,500	12.0

*Government officials stated that consumption will be measured via the New European Driving Cycle. Available government documents do not specify a fuel type, so it must be presumed that the above values apply to gasoline fuel consumption.
Source: MITI (2014).

The NAP provided several incentives for OEMs and parts producers to locate manufacturing activities related to EVs in Malaysia (MITI, 2014). First, Malaysia exempted domestically assembled HEVs and PHEVs from all duties and taxes until the end of 2015, and BEVs even until the end of 2017. Second, the country extended the use of existing policy tools, namely Pioneer Status (PS) and Investment Tax Allowance (ITA), to hybrid and electric vehicles.[12] PS with full tax exemption is granted for 10 years and 100% ITA within 5 years. Moreover, grants are available for related customised training and R&D as well as exemption from excise duty for locally assembled or manufactured cars. Similar to the

[11] Euro 4M is the official name for the Malaysian version of the Euro 4 fuel standard. The technical requirements are identical to the European standard.
[12] Both instruments are the most important policy tools that Malaysia has employed in its industrial policies since the 1970s: PS, which granted income tax exemption for 10 years to investors, and ITA, which is a tax allowance on capital investment (Gustafsson, 2007: 42–44). In automotive policy (MIDA, 2010; MITI, 2014), both incentives are alternatives, so investors have to choose which scheme is more beneficial. In general, ITA is designed to compensate large capital investments, whereas PS appears to be directed at companies that do not require much investment in machinery and production equipment.

promotion of conventional vehicle components, the producers of components critical for electric and hybrid vehicles – electric motors, electric air conditioning, electric batteries, battery management systems, air compressors, and inverters, as defined by the Malaysian authorities – can choose between PS or ITA with the aforementioned benefits.

The impact of EV policies must be described as limited at the time of writing. Regarding BEV adoption, there are fewer than 120 of these vehicles registered in Malaysia. Turning to production, some OEMs have taken advantage of the provided incentives and located CKD assembly in Malaysia: Honda started to assemble the Jazz Hybrid (HEV) in 2012, Nissan the Serena S Hybrid (HEV) in 2014, Toyota the Camry Hybrid (HEV), and Daimler commenced assembly of the Mercedes-Benz S400 L Hybrid (HEV) in 2014, and added the C350e (PHEV) and E350e (PHEV) in 2016 and 2017, respectively.

It is noteworthy that Malaysia's two national[13] carmakers, Proton and Perodua, did not display strong support for EV development and commercialisation. Whilst Proton announced that it would sell BEVs from 2014 and showcased a prototype EV version of its Iriz minicar in 2015, this plan was never realised (Hamid, 2016). Only after the recent partnership with Geely does Proton appear to be able to manufacture BEVs based on Geely's electric powertrain technology. Perodua, whose vehicle line-up consists of mini and small cars, stated that it does not plan to produce EVs (Saieed, 2017). Regarding the negative stance towards EVs, Perodua stated that the Malaysian charging infrastructure was insufficient to support EVs and that the firm intends to focus on improving ICEV technology. As Perodua heavily relies on Daihatsu for vehicle technology, this stance cannot be surprising because Daihatsu is also only offering a few HEV models.

Overall, despite the mixed motives for EV support, measures aimed at consumers have been phased out and those for producers were sustained for a longer period. Therefore, it may be concluded that policy is mainly motivated by industrial policy with environmental undertones. Malaysia did not create a dedicated EV policy programme but supports all emission-reducing technologies. Subsuming EVs under general automotive sector policy in such a way appears to have the drawback whereby issues such as charging infrastructure have been addressed in planning but not in policy implementation. Malaysian policy towards EVs has only been mildly successful in attracting manufacturing activities but largely a failure in consumer adaption. As most manufacturing is only assembly, the effectiveness of policy appears limited. Moreover, the key question is whether EV assembly will remain in Malaysia after the incentives are removed.

[13] In 2017, Geely acquired 49.9% of Proton, Malaysia's first national carmaker. Whilst Proton thus technically remains Malaysian-owned, it appears relatively clear that Proton requires technical assistance from the outside. Thus, it may be concluded that Geely will strongly influence, or perhaps even de facto control, the future direction of Proton. As for Perodua, the company has transferred control over its manufacturing operations to Daihatsu, its long-term technology partner. Thus, whilst Perodua management controls several aspects of the business, manufacturing, and by extension product development and policy, are largely controlled by Daihatsu.

3.4 Philippines

In the Philippines, EVs have been supported through public policy since 2006. That year, the government allowed the import of EV components free of tariffs to encourage local manufacturing.[14] Whilst this marks a head start in comparison with other ASEAN countries, the Philippines did not follow up by adding additional measures. In other words, the Philippines only granted benefits to the supply side, without addressing demand issues or infrastructure.

The latter issue was only addressed in the Investment Priorities Plan of 2014, which included charging stations (DTI-BOI, 2014). Under this plan, investors are eligible to a six-year income-tax holiday. However, this means that the country rather seeks foreign investment or public-private partnership projects instead of public infrastructure investment. Whilst the country's investment capability and geography indeed make public investment difficult, this nevertheless means that the key condition for EV utilisation and thus by extension adoption largely lies outside government control and depends on foreign investment.

As charging infrastructure is largely absent, the market must also be described as undeveloped. This is at least true for EVs that resemble conventional cars. The Chinese BYD is the only carmaker that currently sells BEV and PHEV models in the Philippines. On the other hand, leading EV producers, such as Mitsubishi and Nissan, do not offer EVs in the local market at the time of writing. This indicates that the consumer market for conventional EVs is limited. Despite this situation, there are signs that change may start. Recently, Mitsubishi has agreed to work with Philippine academia to develop policy proposals for supporting EV adoption. However, there appears to be a limited market for unconventional EVs, which are often produced locally. So far, locally produced EVs are not actual cars but can be described as various types of NEVs, including low-speed scooters, rickshaws, quads, and jeepneys,[15] which are all predominantly used for local transport.

Regarding policy, the so-called E-Trike Program appears to be a good example to illustrate the current state of EVs in the Philippines. Initiated by the Department of Energy (DOE) and largely financed by the Asian Development Bank (ADB) and the World Bank's Clean Technology Fund, the programme aimed to replace 100,000 internal combustion engine (ICE) tricycles through BEV versions until the end of 2017. The programme aimed to reduce emissions, create more sustainable transport, and support (local) EV parts manufacturers and assemblers. The Japanese Uzushio Electric (BEMAC) won the assembly contract for US$10,000 per unit. In 2016 however, the DOE stopped the programme after 3,000 EV tricycles had been manufactured without finding driver-operators willing to utilise the vehicles as the initial costs and maintenance proved to be too expensive for operators.[16] Further, the DOE argued that the number of charging stations in planned deployment areas in Manila was

[14] The actual directive (Executive Order 488 (s. 2006)) eliminated import tariffs not only for EV components but also for components of other low-emission vehicle types, such as CNG and so-called flex-fuel, i.e. internal combustion engines that can utilise fuel blended with varying degrees of (bio-)ethanol.

[15] Jeepneys are best described as crossovers of jeeps and minibuses. Originally converted from US military jeeps left in the Philippines after the Second World War for public transport means or taxi services, jeepneys are today quintessential Philippine vehicles and are mainly used for commuting.

[16] Indeed, ADB's target price had been US$3,000–US$4,000 in order to realise lower operating costs for drivers (ADB, 2012). Thus, it may be concluded that despite an initial assessment indicating the need for a minimal purchase (or lease) cost for would-be operators, the project was driven forward even as costs increased by 250% above the intended maximum price. Against this background, it cannot be surprising that the EV tricycles could not be leased.

insufficient to enable utilisation (Rivera, 2016).[17] Subsequently, the DOE worked on a solution to get the already produced units on the road. The programme was redesigned as a part of the already existing tricycle modernisation programme under the aegis of the Department of Transport (DOT). The redesign mainly resulted in lower cost for operators. Now, units are sold to municipalities which in turn sell them to operators. In the case of Manila, the city gives them to operators for a daily fee of ₱150 (US$2.92) for five years under the so-called E-Vehicle and Assistance Program (Barahan, 2017).[18] Moreover, vehicles given out under this programme can be charged freely, indicating that the programme is now part of municipal social policy. Obviously, the price for operators is highly subsidised as the total amount of fees is US$5,329 for five years, roughly half of the original cost.

Last, it appears questionable whether EVs could contribute to lower or at least slower-growing emissions. The country's Power Development Plan suggests that the bulk of newly installed electricity generation capacity will be constituted by thermal power plants. Hence, EVs only contribute to lower local emissions but increase the total emissions of the Philippines. As mentioned previously, however, the country only has to achieve relative reductions, so environmental concerns play a lesser role.

Overall, the Philippine government has rather shown than practised public support for EVs. It appears that the key issue of infrastructure has only recently been addressed through tax incentives for investors. Besides this issue, it is questionable if still-expensive EVs can be adopted without any kind of consumer incentive. However, there appears to be a potential niche market for unconventional, low-speed EVs utilised for short-range commuting and public transport.

3.5. Singapore

Until recently, the city state of Singapore had not adopted a proactive policy stance towards EVs. Whilst Singapore's Land Transport Authority (LTA) and Energy Market Authority (EMA) initiated an EV taskforce that represented multiple agencies in 2010, actions may be best described as a large-scale feasibility study. Also in 2010, the task force appointed Bosch to develop, install, and operate the EV charging infrastructure on behalf of the city state. In 2011, it was decided to conduct a field test with Daimler (smart) and Mitsubishi BEVs to collect additional data. Beyond these steps, Singapore did not deploy any special policies towards EVs. This may explain why EVs are rarely utilised in Singapore. According to data from the LTA, all EV types (HEVs, PHEVs, BEVs) only occupied a share of 3.61% of the country's vehicle fleet of roughly 930,000 vehicles in 2018. The lion's share of EVs is constituted by HEVs (97.75%), meaning that only a minute share of EVs in use need to be charged externally. Thus, despite Singapore's status as one of the wealthiest countries in terms of per capita gross domestic product, the still relatively costly EVs are currently only a niche product.

The low share of PHEVs and BEVs in the EV fleet hints to a major obstacle for the application of these EV types in Singapore. Currently, there are only about 100 publicly accessible charging points.[19] i.e.

17 The validity of this argument appears questionable. According to Uzushio, the e-trikes do not require dedicated charging infrastructure but can be charged through conventional electrical outlets. The author would like to thank Yasushi Ueki for providing this information.
18 The programme's acronym ERAP hints to former President Joseph Estrada, commonly called Erap, the present mayor of Manila.
19 Charging points refer to individual chargers that are grouped into so-called charging locations (stations).

basically one charger per vehicle that requires external charging. Lacking infrastructure development for EVs is, thus, one main reason why the number of EV early adopters is rather small.

Recently, Singapore's government has implemented several measures that support EV usage. First, Singapore allowed the French Bolloré Group[20] to set up a car-sharing service. The service, called blueSG, debuted in December 2017 and aims at providing 1,000 BEVs. Amongst the contractual obligations the French investor agreed to is the installation of 2,000 charging points (divided into 500 charging stations) across the country until 2020, of which 400 should be accessible to the public. At the time of writing, blueSG had installed 531 charging points (at 135 charging stations) (Channel News Asia, 2019). The service operates under the condition that users park rented vehicles at one of the charging points when ending use. Moreover, charging stations were made accessible to private EV owners in 2019.[21] The introduction of an EV car-sharing programme and included infrastructure development are positive steps. The number of charging points is sufficient to support the vehicles of the car-sharing service and private EVs.

Second, Singapore has clarified the so-called Vehicle Emission Scheme (VES), which is basically an emission penalty-rebate scheme which specifies emissions ratings for all vehicles sold in Singapore. Based on categorisation, consumers can receive a rebate on the additional registration fee which must be paid when registering a purchased vehicle (Table 4).

Table 1.4: Vehicle Emission Scheme

	Pollutant					**Rebate** (in S$)	**Surcharge** (in S$)
Band	**CO_2** (g/km)	**HC** (g/km)	**CO** (g/km)	**NO_x** (g/km)	**PM** (mg/km)		
A1	≤90	≤0.020	≤0.15	≤0.007	0.0	20,000	
A2	91–125	0.021–0.036	0.151–0.19	0.0071–0.013	0.01–0.30	10,000	
B	126–160	0.037–0.052	0.191–0.27	0.0131–0.024	0.31–0.50	0	0
C1	161–185	0.053–0.075	0.271–0.35	0.0241–0.030	0.51–2.00		10,000
C2	>185	>0.075	>0.350	>0.030	>2.00		20,000

CO = carbon monoxide, CO_2 = carbon dioxide, g = gramme, HC = hydrocarbon, km = kilometre, mg = milligramme, NO_x = nitrogen oxides, PM = particulate matter.
Note: Rebates and surcharges apply to private car owners. Taxis are subject to rebates and surcharges of S$30,000 (A1/C2) and S$15,000 (A2/C1).
Source: Land Transport Authority (https://onemotoring.lta.gov.sg/content/onemotoring/home/buying/upfront-vehicle-costs/emissions-charges.html#VES_At_a_glance) (accessed 01 February 2021).

20 Bolloré Group is conglomerate active in diverse fields such as logistics, paper, and plantations. The group co-developed a BEV dubbed the Bolloré Bluecar together with Pininfarina and Renault. It is deployed in various BEV car sharing programmes across the world, including, Paris, Lyon, and Bordeaux in France, London in the United Kingdom, Torino in Italy, and US cities such as Indianapolis and Los Angeles.
21 Parallel to Bolloré, public utility Singapore Power also plans the installation of a total of 1,000 charging points in the city state. This should result in sufficient EV charging infrastructure, because Singapore basically applies a zero growth policy towards the vehicle fleet via its quota system, known as Certificate of Entitlement.

As the VES covers various pollutants, vehicles are categorised according to the worst-ranked pollutant, i.e. if a car's emissions fall into category A1 for four pollutants but category B in the fifth, the vehicle is designated as category B.

Clearly, the VES is designed to encourage consumers to adopt less-polluting vehicles. The maximum rebate of S$20,000 (roughly US$15,000) is considerable. However, only BEVs can be categorised as A1 because they are the only vehicle type that emits no PM. Whilst EV operation itself is emission-free, these vehicles nevertheless cause emissions related to electricity generation and distribution. In essence, this means that Singapore does not treat EVs as zero-emission vehicles. Whilst the rating had been set at 0.5 g CO_2/watt hour (Wh), a detailed review conducted by LTA concluded that the rating was lower, namely 0.4 g CO_2/Wh in 2016. This means that PHEVs and BEVs will be regarded as causing fewer emissions under the VES from 2018. Whilst this measure will make said types more attractive vis-à-vis ICEVs, the impact of this measure is likely to remain limited. Also, it is noteworthy that ICEVs are only rated based on their use-related emissions, i.e. emissions from petrol and diesel fuel production and distribution are not included in their VES rating (Tan, 2017). Thus, it can be criticised that ICEVs are still enjoying structural preferential treatment in Singapore.

Third, the LTA started to shift its procurement policy for public transport towards EVs. As a means to improve air quality and reduce emissions, the LTA has recently procured 50 diesel hybrid buses from Volvo and plans to procure 60 BEV buses to be introduced to the fleet from 2019. As measures are mainly aiming at emission reduction in the public sector, the benefits for private car users will likely remain zero.

Regarding the impact of policy on EV adoption, the newly introduced VES seems to have promoted sales by increasing the costs for ICEVs. In 2018, the year VES became effective, the number of registered HEVs and PHEVs increased from roughly 25,000 in 2017 to almost 33,000 units. Similarly, the number of BEVs more than doubled from 349 to 707 units. Nevertheless, it should be pointed out that Singaporean policy rather promotes adoption in a limited way and maintains a general policy of limiting private car ownership. Whilst it can be expected that the penalty-rebate nature of the VES is continuing to promote the proliferation of EVs within Singapore's vehicle fleet, it stands to reason that this shift will be slow as Singapore is basically a replacement market.

Overall, Singaporean policy measures are introducing fairly limited benefits for EV adoption by private car owners. Adopted policy instruments or instrument calibrations are rather promoting car sharing and public transportation in the city state. This is in line with established transport policies, such as the Certificate of Entitlement, which is basically a quota system that effectively limits private car ownership via regulating the fleet size. Therefore, the preference for policy tools that promote public and intermodal forms of transportation is consistent with past Singaporean transport policy and should be understood against this background. The case of Singapore nevertheless deserves attention as it demonstrates that even wealthy consumers still seem to prefer ICEV over EV technology despite incentives. This may be explained by the still higher price of EVs compared to ICEVs, so that either a price reduction from the supply side or incentives for the demand side are necessary to promote EV adoption.

3.7. Thailand

According to the International Organization of Motor Vehicle Manufacturers (OICA), Thailand was the world's eleventh-biggest vehicle producer in 2018, documenting its position as the leading vehicle manufacturing country of the ASEAN region. Thailand's EV support is mainly motivated by securing the country's current position in regional and global production networks. Following the assumption that EVs are indeed the future of the automobile industry, Thai policy is seeking to manage the technological transition. Thus, as will be shown below, policy not only addresses consumers and producers but also the local production of specific EV components.

On the demand side, Thailand revised taxation in a way that makes EVs more attractive to consumers. In 2016, Thailand introduced a new excise tax scheme that shifted taxation away from being based on engine capacity alone towards one based on CO_2 emissions (Table 5).

Table 1.5: Thai Automotive Excise Tax Scheme as of January 2018

Vehicle Type	**Engine Size**	**CO_2 g/km**			
		< 100	**100–150**	**150–200**	**> 200**
Passenger car	< 3,000 cc		30%	35%	40%
	E85/CNG		25%	30%	35%
	> 3,000 cc	50%			
Hybrid vehicle	< 3,000 cc	5%	20%	25%	30%
	> 3,000 cc	50%			
BEV	-	2%			
Eco-car	1,300–1,400 cc	14%	17%		
	E85	12%			
		< 200		**> 200**	
Pickup	Single cab	3%		5%	
	Space cab	5%		7%	
	Double cab	12%		15%	
Pickup passenger	< 3,250 cc	25%		30%	
	> 3,250 cc	50%			

BEV = battery electric vehicle, cc = cylinder capacity, CNG = compressed natural gas, CO_2 = carbon dioxide, km = kilometre.
Note: E85 signifies a fuel blend of 85% ethanol and 15% gasoline.
Source: Thai Board of Investment.

Whilst the table indicates that CO_2 emissions and engine capacity are actually combined to determine the payable taxes, emissions play a more crucial role under the new scheme. Besides this new tax regime, Thailand also reduced import tariffs on BEVs to zero to lower costs for consumers. Measures suggest that Thai policymakers prefer supporting BEVs over hybrids.

On the supply side, Thailand has promoted the local production of eco-cars since 2007. According to the definition of the Thai administration, eco-cars are vehicles that have a mileage above 20 km/L gasoline (or diesel equivalent) and emit less than 120g CO_2/km and meet criteria for other pollutants as required by the Euro 4 standard. To further the domestic production of such eco-cars, the Thai Board of Investment (BOI) granted several incentives to both producers and consumers under the condition that investors agree to production target figures of 100,000 units, which had to be reached after a certain period of operation.[22] Clearly, this policy is designed to promote the evolution of the Thai automotive industry. As past targeting policies led to the specialisation of one-tonne pickup trucks, this new policy consciously seeks to emulate its success. As Thai policymakers, and especially the BOI, understand that pickup trucks are both relatively polluting and technologically simple in comparison to eco-cars, this also indicates that the intention is to stimulate industry development towards more complex, higher value-added products.

Whilst the eco-car programme has provided incentives for fuel-efficient ICEVs, Thailand has also introduced support measures for EV parts manufacturing in the country. From 2012, it offered exemptions from corporate income tax (with a maximum cap) for eight years for investments directed at the production of advanced vehicle technologies. These included ICEV components as well HEV, PHEV, and BEV batteries, and traction motors for HEVs, PHEVs, BEVs, and FCEVs.

In March 2017, the Thai government issued its EV policy. In comparison with other ASEAN Member States, the formulated aims are more long-term oriented. The target number for EVs on Thai roads is 1.2 million vehicles by 2036 and 690 charging stations. The available information suggests that the Thai government only includes all types except FCEVs in its definition of EVs. However, the incentives are most generous for BEVs, reflecting a clear preference of government planners for this type.

BEV investment projects are entitled to a corporate tax exemption of between five to eight years. The duration of this tax exemption can be extended under the following condition: investment in manufacturing in more than one EV core component in Thailand is rewarded by an additional year per component up to a maximum duration of 10 years.

PHEV and BEV bus investment projects are eligible for corporate income tax exemption for three years and import tariff exemptions on production machinery. As in the case of BEVs, production beyond the first EV core component entitles additional years of tax exemption to a maximum of six years.

Investment into HEV manufacturing is entitled to fewer incentives than PHEVs and BEVs. Investing firms will only be granted import tariff exemption on production machinery. Some striking aspects should be highlighted. First, whilst there is still a minimum investment required, the amount is only B1 million (roughly US$26,000). In comparison to the preceding eco-car programmes, this sum is very low, one may say symbolic. Secondly, differing from eco-car policy, production targets are not included under this scheme. This suggests that policymakers are unable to define a target production figure. Taken these less strict requirements into consideration, it may be concluded that whilst EVs are regarded as important for the future of Thai car manufacturing, the technology is too novel and the demand too uncertain to apply standard policy instruments.

[22] Due to limitations in space, additional investment conditions and incentive details cannot be discussed. Detailed information may be obtained from the author through email communication.

Further, incentives will be granted for producing important EV components. Firms investing in manufacturing the following components are entitled to eight years of corporate income tax exemption: batteries, traction motors, battery management systems, DC/DC converters, inverters, electric circuit breakers, portable EV chargers, and EV smart charging systems. Most remarkable is that battery technology has not been specified clearly. The way the policy is phrased, it appears possible that both major EV battery types, i.e. nickel metal hydride (NiMH) and Li-ion batteries are entitled to government support. Whilst the overall direction of policy measures shows a strong tendency to favour BEVs, it would make sense to give priority to Li-ion batteries, which are commonly used in BEVs and PHEVs, and no or at least lower incentives to NiMH batteries, which are mainly utilised in HEVs.

According to the plan, EV policy is divided into three phases. The first was conducted in 2016 and 2017. It should basically prepare subsequent activities by setting up a limited number of charging stations and organise field tests with a limited number of BEVs. The actual research was to be conducted in the second phase, scheduled to last from 2018 to 2020. Trials should test the performance of different battery types and motors and determine the technical standards for vehicles and charging infrastructure. Further, this phase should be utilised to prepare legal and tax frameworks, train bureaucratic staff, and conduct user promotion. The phase should produce a coordinated action plan for the implementation of concrete policy measures from 2021 onwards. Thus, the third stage should see the actual deployment of infrastructure and BEVs in Thailand. Here, it is noteworthy that the EV Action Plan is intended to integrate with other policies, most notably Thailand's Industry 4.0 plans and the smart grid. BEVs should not only be charged through the grid but also be able to feed stored electricity into the grid (so-called vehicle-to-grid capability (V2G)). Therefore, it can be stated that BEV use and production are part of an intended large-scale transformation of the Thai economy away from a country that faces the 'middle-income trap' towards an industrially and economically advanced nation.

Looking at current automobile manufacturing in Thailand, Toyota is locally producing the Camry Hybrid (HEV) since 2009 and manufactured the Prius (HEV) from 2010 to 2015. The Japanese OEM recently announced that it would intensify HEV production in Thailand to take advantage of the provided incentives. Before the Thai government announced its production incentives, Toyota stated that it regarded charging infrastructure as insufficient, indicating the main reason why it would not invest into PHEV or BEV production (Bangkok Post, 2017). Apparently, the incentives did not convince the carmaker to rethink its approach. Nissan located manufacturing of the X-trail Hybrid (HEV) in 2015, i.e. before government incentives were granted. After incentives were introduced, Nissan applied and pledged to produce hybrids and batteries at its plant in Samut Prakan. In January 2019, it was disclosed that the carmaker seeks to make Thailand its second EV production hub besides Japan, which should produce for local demand and export markets (Maikaev, 2019a). Honda has assembled HEV versions of its Jazz, Civic, and Accord models since 2012, 2013 and 2014, respectively. After the BOI's EV scheme was introduced, Mazda decided to produce an undisclosed hybrid model and several components in Thailand (Maikaev, 2018). After gaining approval from the BOI, Mazda recently even applied to extend production to BEVs (Maikaev, 2019b).

Daimler started to assemble CKD kits of the HEV version of its C-class and E-class (C300 and S300 BlueTEC Hybrid) in 2013 and 2014. In 2016, the carmaker updated its model line-up by starting assembly of PHEV versions of the Mercedes-Benz C-class and S-class (C350e and S500e). After Thailand offered incentives, Daimler decided to deepen its production footprint by applying for PHEV battery production and the production of the EQC, a battery-powered SUV (Maikaev, 2019c). Premium rival BMW adopted a similar model strategy by assembling PHEV versions of its X5 and 3-series (330e) in Rayong since 2017. Government support policy convinced the German carmaker to extend PHEV production to the 5-series and 7-series (530e and 740Le, respectively) (BMW, 2018). As part of the localisation effort, German supplier Dräxlmaier will produce traction batteries for BMW Thailand. Whilst the two German premium brands produced and offered EVs prior to government incentives, the joint venture between Shanghai Automotive Industry Corporation and local conglomerate Charoen Pokphand (SAIC-CP) pledged to produce PHEVs under the BOI's scheme (Apisitniran, 2018).

Also, there is the case of Vera Automotive, a firm founded by five Thai engineers of King Mongkut's Institute of Technology Ladkrabang (Bangkok Post, 2017). The firm developed a BEV called V1, but the vehicle is produced by Geely in China and then exported to Thailand. Thus, whilst the firm is Thai, production is not located in the country, obviously due to the costs related to entering automobile manufacturing. The vehicles are not only sold domestically but also exported to other ASEAN markets and China. First One Mile Mobility (FOMM), a Japanese start-up, entered the Thai market with an investment of roughly US$30 million to build its first factory with annual production capacity for 10,000 units in Chonburi Province (Kotani, 2018). The newcomer will produce its FOMM One minicar and actually was the first project that was approved under the BOI's EV scheme.

Overall, it appears that most firms already had limited EV assembly operations in Thailand before incentives were offered. This suggests that OEMs made these decisions based on brand strategy in order to increase local sales. Only premium brands currently manufacture PHEVs, indicating that this type of vehicle is a niche market. However, incentives convinced numerous carmakers to invest in the production of various EV types for both local consumption and export.

It has to be pointed out again that the Thai government will be concentrating its efforts on BEV technology, continuing its 'product champion' approach (Natsuda and Thoburn, 2013) to target specific products and promote production and usage. Indeed, representatives of the Thai Automotive Industry Association (TAIA) have already lobbied for EVs to become the third product champion after pickup trucks and eco-cars (The Nation, 2012). However, as an industry lobby that represents carmakers that prioritise different EV types, the fact that the TAIA did not advocate a concentrated BEV push as a strategy is clearly risky in a situation where competition between different technologic solutions – ICEVs, HEVs, PHEVs, BEVs, and even FCEVs – is still open-ended. On the other hand, Thailand's policy to pick winners has been successfully employed in the past, so it is understandable that policymakers prefer to use and further develop tried and tested policy instruments. In the end, Thai policymakers apparently decided to maintain a clear preference whilst simultaneously offering incentives to all EV types. Thailand's vision is clearly the most ambitious of all EV policies, but the strategic approach of how to actually implement this vision is also more concrete than any other national EV policy within ASEAN. As policy has only been recently drafted, there are currently no concrete results visible. Given Thailand's past track record, it may only be stated that the country has demonstrated the ability to attract export-oriented manufacturing and promote domestic sales of targeted vehicle types. Therefore, it is reasonable to assume that a similar strategy could be implemented again with a new product champion. From an academic standpoint, the question of whether the related targets, such as for V2G-capable smart grids and Industry 4.0, can be implemented is highly speculative, because even countries regarded as leading in Industry 4.0 initiatives, such as Germany, cannot state with certainty if or how this Fourth Industrial Revolution will be realised.

Regarding Thai environmental and energy policies, there are two main development goals. Firstly, despite its official status as an upper middle-income country, Thailand nevertheless is amongst those countries that have to achieve relative emission reductions under its commitments against climate change (the Paris Accord), not total reductions. Thus, the aforementioned measures such as the altered vehicle taxation scheme may be appropriate tools for achieving targeted reductions. Secondly, the country seeks to diversify its electricity generation mix towards renewable energy. Currently, renewable sources constitute 8.5%, whilst the remaining 91.5% is based on fossil sources, predominantly gas (70.6%) (IEA, 2016). Until 2036, the country aims to increase the share of renewables to 30%, accounting for growing electricity demand. Moreover, plans to introduce nuclear energy to lower emissions. Whilst plans indicate a shift towards less thermal power generation, a sizable part will remain based on fossil fuels. Against this background, it appears questionable whether targeted BEVs could make an actual contribution towards lower emissions in Thailand. Overall, however, Thailand's environmental and energy policies aim at achieving relative improvements, i.e. improving energy efficiency and diversification of the currently strongly fossil fuel-based electricity mix. Therefore, achieving gradual improvements in fuel efficiency through EV use can be regarded as consistent with environmental policy commitments.

Overall, Thailand's policy on EVs can be regarded from two standpoints. From perspectives that consider market demand and infrastructure, the aims appear highly ambitious and difficult to implement. However, as the aims are rather long-term than short-term and linked to various other plans in the energy and environmental policy fields, many open questions are to be expected. Due to the transformational character of EVs however, policy plans that are aware of various challenges and seek integration and coordination may be appropriate for managing EV-related issues. From an industrial policy standpoint, the measures are straightforward and clearly structured. This may be interpreted as a symbol of Thailand's ambition to defend its position as the leading automotive production hub in the ASEAN region. Policy is obviously concerned with attracting investment in what is regarded as a future core technology. Following by and large existing product champion strategy in industrial policy, Thailand mainly targets a specific type of EV, namely BEVs. At the same time, the absence of production targets indicates that this technology is indeed too novel to be subject to standard policy tool deployment. Whilst carmakers' reluctance toward establishing BEV production in Thailand should be noted, there is less reservation against HEV manufacturing. Despite some open questions, Thailand has drafted the most encompassing and ambitious aims and simultaneously put forward the clearest policy towards the industrial manufacturing of EVs. Therefore, this mixture of tried and tested industrial policy and an agenda that aims at transforming not just the automotive industry but the Thai national industry as a whole appears appropriate to achieve the minimum goal of defending the country's leading position in the regional automotive industry.

3.8. Viet Nam

Regarding electromobility, Viet Nam is an outlier within the ASEAN region. Whilst the government has so far not had electromobility on its agenda, private enterprises have attempted to promote EVs.

At the time of writing, Viet Nam has no policy to support EVs, be it incentives for adoption, production, or infrastructure creation. Only recently, electromobility is starting to be discussed. The Ministry of Industry and Trade (MOIT) has cooperated with Mitsubishi Motors to study the feasibility and potential promotion of EVs in Viet Nam (Hanoi Times, 2018). The cooperation has so far resulted in the creation of the first EV charging stations in the country – one in Hanoi on the grounds of the MOIT, and one each in Da Nang and Hoi An in Quang Nam Prefecture. The latter two are part of a cooperation between Mitsubishi Electric, the University of Da Nang, and the Central Power Corporation, a subsidiary of Vietnam Electricity, which aims at training technical personnel and the production of charging stations. Thus, if one applies the policy cycle model of Howlett and Ramesh (2003), it may be stated that the topic of electromobility is currently moving from agenda-setting towards formulation. Government action appears to be largely a reaction to impulses set by member firms of the Mitsubishi Group that are active in EV production and EV infrastructure development.

Besides foreign business interests, there are also Vietnamese enterprises that promote electromobility. Most notably, newly founded carmaker Vinfast, a subsidiary of the local conglomerate Vin Group, plans to become an EV producer. Whilst its first three models are conventional vehicles, the fourth model scheduled for release in 2021 should be an EV (Vu, 2020).

Similar to Mitsubishi, Vinfast seems to have identified the lack of charging infrastructure as the Achilles heel of its pronounced business strategy. To overcome this bottleneck, the company has announced its intention to launch between 30,000 and 50,000 charging stations. A major step towards this realisation has been made by signing a memorandum of understanding with PetroVietnam Oil Corporation, the state-owned company in charge of the oil and gas sector, including service stations. According to the memorandum, charging stations should be constructed on 20,000 service stations operated by its partner until 2020 (Reuters, 2018).

It should be pointed out that Vinfast's first product, launched in late 2018, was an electric scooter dubbed Klara. With this move, Vinfast followed in the footsteps of several smaller firms. Pega, formerly HKBike, is a local start-up producing electric scooters since 2012. In 2017, Pega opened a factory with an annual production capacity of 40,000 units in Bac Giang Province that employs 300 workers. Reportedly, Vinfast unsuccessfully tried to take over Pega. Despite this failure, Pega claims that all members of Vinfast's Klara development team were former Pega employees (NNA Business News, 2018). Whilst electric scooters and motorcycles are still a niche, this market is currently exclusively served by local firms. However, this situation is going to change. MDI, a Korean transmission supplier, has set up a joint venture with the Vietnamese N&G Group to produce electric scooters (The Korea Economic Daily, 2017). Similarly, Son Ha Development of Renewable Energy JSC, a member of the local Son Ha Group, inaugurated a plant for electric motorcycle production with an initial annual capacity of 20,000–30,000 units in Bac Ninh Province in northern Viet Nam in October 2020 (Vietnam Plus, 2020). Amongst the major five motorcycle makers in Viet Nam, i.e. Honda, Yamaha, Suzuki, Sanyang Motor (SYM), and Piaggio, only the Italians will launch a competing product, the Vespa Elettrica, in 2019 (Vietnamnet, 2019).

Two aspects stand out from the above description of business activities. First, not electric cars but electric scooters are the focus of enterprise activity. This may be explained by several factors. As Vietnamese roads are still dominated by two-wheelers instead of four-wheelers, targeting this market appears more promising than offering EVs which still cost more than conventional vehicles of a similar size. Additionally, electric scooters do not require specialised charging infrastructure, which is, as aforementioned, currently non-existent. Instead, electric scooters can be charged through any conventional outlet. Second, the market is currently served by start-ups, joint ventures, or newcomers to the automotive industry. Incumbent car and motorcycle producers have refrained from trying to create a market or market niche. Whilst it remains to be seen if electric scooters or even EVs are a sustainable trend or a dead end for business activity, it appears clear that smaller, partly or exclusively local firms seek to promote electromobility as a means to compete against industry incumbents that by and large stick to conventional vehicles.

To summarise, Viet Nam's move towards electromobility is a fairly recent phenomenon that is mainly promoted by private enterprises. It must be emphasised that local business has so far concentrated on electric scooters, and EV production is only planned to commence in 2021. Local motorcycle makers and the newly founded Vinfast regard electromobility as a way to challenge incumbent industry players whose extensive know-how in internal combustion engine technology is hard to challenge. Thus, it may be stated that local enterprises enter the electromobility niche market to avoid competition in an area where incumbents enjoy the depth of technological expertise. The Vietnamese government has only recently started to explore the topic of electromobility, seemingly due to foreign, private sector engagement. This, however, means that local enterprises entered a niche without any dedicated government support.

4. Discussion

Based on the preceding description of EV policy in ASEAN Member States, we would like to propose a division into groups of countries that share distinct characteristics in their policy approach towards electromobility (Table 6).

Table 1.6: Definition of Electric Vehicles, Electric Vehicle Fleets, Electric Vehicle Targets, and the Number of Charging Stations in ASEAN

Country	**EV Definition**	**EV Fleet** (year)	**EV Unit Target** (year)	**Charging Stations** (year)
Brunei Darussalam	HEV/PHEV/BEV	HEV: 293 (2018) BEV: 15	-	n.a.
Indonesia	HEV/PHEV/BEV	4.2 million by 2050 (proposal by National Energy Plan) (Tempo, 2017b)	400,000 EVs + 2.1 million E-motorcycles (20% locally manufactured) (2025)	479 10,000 units by 2050 (proposal by National Energy Plan) (Tempo, 2017b)
Malaysia	BEV (full EV) HEV/PHEV (partial EV)	BEV <120 (2016)	100,000 (2020; 2030?)	200 (309 charging points) (2020)
Philippines	HEV/PHEV/BEV/NEV	E-tricycle: 1,420 E-motorcycle: 952 HEV: n.a. PHEV: n.a. BEV: 64 NEV: 89 (2018)	1 million (2020)	4 (only 2 public) (2019)

Singapore	HEV/PHEV/BEV	HEV: 44,894 PHEV: 473 BEV: 1,336 (2019)	-	143 (569 charging points) (2019)
Thailand	HEV/PHEV/BEV	HEV: 153,184 BEV: 2,854 (2019)	1.2 million (2036)	527 (charging station) 817 (charging points) (2019)
Viet Nam	HEV/PHEV/BEV/NEV	1,086 (2016)	100,000 (2020) (included in 6 million eco-friendly vehicles target)	1 fast charging station

BEV = battery electric vehicle, EV = electric vehicle, HEV = hybrid electric vehicle, NEV = neighbourhood electric vehicle, PHEV = plug-in hybrid electric vehicle.
Source: Author's investigation and Vietnam Economic News 22.11.2017.

First, Indonesia, Malaysia, and Thailand all seek to promote EV adoption and domestic EV production (Tab. 7). All three countries are mainly interested in promoting their automotive industries.

Second, a shared characteristic of the Philippines and Viet Nam is that they include low-speed vehicles resembling rickshaws, which cannot be used on highways in their target numbers. This in turn explains why target EV adoption numbers are relatively ambitious in comparison to both countries' levels of economic development. Whilst there is no common name for those vehicles, they may be called neighbourhood electric vehicles (NEVs), a term originally coined in California when debating the zero-emission vehicle mandate. A second shared characteristic is that both countries mainly rely on foreign investment or assistance for EV infrastructure development. This is due to the fact that both countries are still developing economies with low infrastructure investment budgets.

Third, Brunei and Singapore have not formulated any dedicated policy towards EVs. Nevertheless, both nations address EVs in their overall transport policies. In the case of Brunei, there are no signs that EVs should be promoted. Whilst government policy aims at improving energy efficiency, policy documents are rather vague and mention a large variety of vehicle and fuel types that should be utilised to achieve this aim.[23] It appears that Brunei's economic dependency on the export of fossil fuels is the main reason for it taking a rather lukewarm approach towards EVs.

The final group consists of Cambodia, the Lao PDR, and Myanmar, which all have no EV policy or aims put in place. All countries lack consumer purchasing power for costly EVs and the public budget to develop EV-related infrastructure. Hence, it cannot be surprising that these countries do not address EVs through public policy. This, however, does not mean that there are no EV projects. In the case of the Lao PDR, for instance, EV buses, mini buses, rickshaws, and motorcycles are promoted via Official Development Assistance (ODA) projects to take advantage of the country's abundant hydropower for sustainable mobility. In these countries, EVs in the conventional sense do not seem to have a bright future. The price gap between a conventional ICEV and an EV of comparable size is still around US$5,000, i.e. the price difference is greater than the per capita gross domestic product in these least

[23] Brunei's Land Transport Master Plan mentions BEVs and HEVs as well as fuel-efficient vehicles (FEVs), which include vehicles that use CNG, LPG, and fuel-efficient ICEVs. However, there is no further specification of which criteria define the latter type.

developed countries. Therefore, assuming widespread EV adoption appears highly unlikely. Simultaneously, electric scooters and motorcycles may be an option to foster personal mobility without creating negative externalities in the form of air pollution.

Table 1.7. Incentives for Electric Vehicle Adoption and Production

Country	**Incentive**
Brunei Darussalam	-
Indonesia	Producers: 1. Exemption from customs duty on SKD and CKD kits during the initial stage of the project 2. Exemption of customs duty on production-related capital goods 3. Incentives for charging station production (including equipment) Consumers: 1. Exemption from luxury sales tax 2. Reduction or exemption from regional or central government taxes (e.g. motor vehicle tax) 3. Lowered parking tariffs (determined by the local government)
Malaysia	Announced in National Automotive Policy (NAP) 2020 but not specified
Philippines	Under deliberation
Singapore	Consumers: EVs are subject to a rebate on the Additional Registration Fee under the Vehicle Emission Scheme
Thailand	Producers: 1. Corporate tax exemption (duration depends on electric vehicle type) 2. Import tariff exemption for production machinery Consumers: Lowered excise tax rates
Viet Nam	Under deliberation

SKD = semi-knock down, CKD = complete knock down.
Source: Authors' investigation.

5. Conclusion

Electromobility is a topic that receives differing levels of attention and support in the ASEAN region. The differences are due to different national objectives towards the topics of energy, environment, and transportation, which are all interrelated with electromobility. Despite differences in detailed policy, grouping countries that share basic policy objectives for EVs is possible.

First, Indonesia, Malaysia, and Thailand all seek to promote electromobility to defend and potentially expand their positions as vehicle manufacturing bases. Thai policy follows established policy to support assembly and component production. Simultaneous support aims at attracting a significant part of the EV supply chain to promote technological upgrading. Amongst all ASEAN members, Thailand has the strongest automotive industry, so it stands to lose significantly if the anticipated shift towards EVs is missed or mismanaged. Thus, Thai policy is the most comprehensive and seeks to link electromobility to issues such as smart grids and increased automation, often dubbed Industry 4.0. Malaysia also promotes EVs to support its local manufacturing industry. The main difference with Thailand's policy is in the details. Whilst Thailand formulates clear conditions for incentives, Malaysia's policy is vaguer and welcomes negotiations between the state and (foreign) investors. Indonesia's policy was only recently announced. The aim for EV market share must be called ambitious as EVs are still considerably more expensive than conventional cars. Whilst the intention is very clearly aimed at promoting local vehicle manufacturing and local supply chain creation, it can be doubted that ambitious local content requirements can be realised.

Second, the Philippines and Viet Nam also seek to promote electromobility but lack both the fiscal muscle and policy coordination to actively support private sector activity. It appears that policy in both countries consists of either just aims or is still under deliberation. Thus, whilst the policy objectives are similar to those of the first group, actual policy is too vague to effectively promote the aims.

Third, the small nations of Brunei and Singapore are somewhat reluctant proponents of electromobility. The sources of their reluctance, however, are different. As a country whose national economy is based on fossil energy sources, Brunei has little interest in promoting mobility based on electricity. Whilst electricity can be generated from fossil sources, electromobility is increasingly promoted in tandem with renewable energy generation, so the sultanate may not be inclined to actively promote EV use. In the case of Singapore, the city state simply follows its established policy practice to limit private car-ownership due to scarcity of land and air pollution. As Singapore has actively promoted public or at least multi-modal transport for almost two decades, the general tendency to limit private vehicle use in any form is also applied to EVs. Thus, whilst there are some trials, support is rather limited, especially considering the wealth of Singapore.

Fourth, the least developed ASEAN members, Cambodia, the Lao PDR, and Myanmar, lack the economic muscle to promote EVs. These countries are all still in a pre-motorisation phase, so national policymakers' priorities lie in other fields of economic development. Hence, they have not been covered in this analysis.

Our analysis strongly suggests that the basic question of whether an (ASEAN) country has an automotive industry influences its engagement with EV policies. Countries with an industry, especially one that goes beyond mere assembly, are all trying to convince carmakers to invest in EV production within their borders. Quite clearly, all countries in the first group perceive EVs as the likely evolutionary step for automotive industry development and seek to position their domestic industries within this anticipated new paradigm. Whilst the Philippines and Viet Nam also seem to be interested in promoting EV production and adoption, their policies are less clearly defined. Arguably, these countries are still seeking to secure positions in current ICEV supply chains and further lack the level of economic development to be able to support demand for still-costly EVs. Countries without an industry, such as Brunei and Singapore, as well as Cambodia, the Lao PDR, and Myanmar, display a much lower tendency to support EV adoption. Whilst this is not unsurprising in the case of the latter three countries, the former two have distinct policy priorities that explain their lack of engagement.

Regarding lessons for other developing countries, the comparison with China may provide a basic differentiation. China was rather successful in promoting EVs, especially BEVs. It used supply and demand side policies to nurture domestic vehicle and component producers. Thus, Chinese firms have emerged as principal challengers against incumbent Japanese and Korean EV battery suppliers. Therefore, it may be stated that China is building a supply chain that encompasses domestic firms and know-how. In contrast, ASEAN countries, especially the described groups one and two, mainly seek to join supply chains as processors or final assembly destinations. It may be stated that China is attempting to build a highly integrated (B)EV industry, and ASEAN countries are attempting to moderate (anticipated) technological change that is spearheaded by China, the triad (Europe, Japan, and the US) and the Republic of Korea. Ambitions are simply different – whilst China sees BEVs as a chance to challenge incumbent industry leaders by leapfrogging into BEV technology, ASEAN countries basically seek to maintain their position as car-making countries without attempting to create industry leadership. This also explains why demand side policies differ. China artificially creates demand for BEVs in order to give domestic firms the opportunity to acquire skills in production as well as in product development and improvement. As this is not the motivation of ASEAN Member States, the countries currently concentrate incentives in the supply side to attract carmakers and component producers. Thus, China and ASEAN Member States' policies may be differentiated by the difference between creating and joining a supply chain.

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CHAPTER 2

ELECTRIC VEHICLE AND ELECTRIC VEHICLE COMPONENT PRODUCTION IN THAILAND

Martin Schröder

1. Introduction

Whilst other countries or regions, such as Mexico, Turkey, and Central or Eastern Europe, have attracted more scholarly attention as newly integrated peripheries of the global automotive industry (Frigant and Layan, 2009; Özatagan, 2011; Pavlinek and Zenka, 2011; Pavlinek, 2017; Brincks et al., 2018), Thailand has also established itself as a global production and export hub. It has done so largely by deploying a similar set of policies as these countries, i.e. deregulation, integration into production networks dominated by foreign firms, and the provision of investment incentives.

As technology in advanced and in some emerging markets, especially China, is slowly shifting towards electric vehicles (EVs), Thailand's position seems to be threatened by this development as future production will require skills and know-how differing from present standards.

Against this background, Thailand recently initiated policy to support local EV and EV component production. This chapter will investigate the country's current position in EV supply chains, the Thai automotive sector policy, and policy outcomes. The study adopts a historic perspective in that it incorporates not just recent policy but reviews past policy as a framework to understand recent measures. It will be argued that continuing to implement industrial policy along lines that proved to be successful in the past may no longer be appropriate as technology shifts, and suggests that tools may have to be repositioned towards more encompassing innovation policy.

This chapter is structured as follows. A brief review of the difference between industrial and innovation policy will be conducted as well as a review of different explanations of Thailand's successful transformation into a global production and export hub. Subsequently, a review of the trade data will be conducted to assess Thailand's current position in EV supply chains. However, as trade data lack the sufficient level of disaggregation, this step will be supplemented by an analysis of the supply chain for lithium ion (Li-ion) batteries, the most promising EV-grade traction battery subtype. This will be followed by an analysis of the past and present automotive policy as well as an attempt to evaluate the policy success (or lack thereof). Finally, some conclusions regarding the present policy, especially concerning the main policy tool, will be drawn.

2. Literature Review

2.1 Industrial policy and innovation policy

Targeting is a well-known and controversially discussed industrial policy practice. Linked to Johnson's (1982) seminal study of Japanese industrial policy, targeting means that policymakers strategically employ measures, such as preferential loans, tax breaks, accelerated depreciation, informal steering of production quantities, export promotion, and import restrictions, to nurture selected industrial sectors. Whilst targeting is frequently mentioned by Johnson, it is subsumed under what he termed administrative guidance. Arguably, the term administrative guidance better describes the nature of political and/or bureaucratic intervention than targeting because it highlights that the state needs cooperation from privately owned enterprises to achieve targeted objectives. The automotive industry provides several cases that illustrate how targeting did not work if the state attempted structural intervention in a growing industry: Japanese bureaucrats could neither hinder Honda from entering automobile production nor consolidate the 10 independent Japanese original equipment manufacturers (OEMs) into two groups centred around Toyota and Nissan (ibid: 277). Whilst targeting worked in cases where industries were experiencing downturns, Japanese policy could never prohibit entry into growth sectors.

Similar to industrial policy in general (Pack and Saggi, 2006), targeting has received significant critique, especially from orthodox economists. Beason and Weinstein (1996) pointed out that not growing but struggling sectors of the Japanese economy were subject to most targeted assistance, concluding that policy either performed poorly at targeting growth sectors or intentionally supported declining sectors, which contradicts developmental state literature. Simultaneously, it is worth noting that even critics who argue that targeting broke down in the 1970s or 1980s, do not deny positive impacts of Japanese industrial policy before this time (Callon, 1995: 4). Further, Johnson (1999: 54–56) later qualified his argument for targeting and the developmental state by pointing out that it may time-specific in two regards. First, during much of the Cold War era, the United States (US) tolerated protectionists' practices to support allied states economically. Second, countries such as Japan were catching up to more advanced economies, i.e. choosing target industries revolved around emulating existing industrialisation trajectories but speeding up development through various state interventions.

During the 1990s, it was observed that relatively broad industry targeting shifted towards more focussed technology targeting (Chiang, 1993). Lately, several researchers (Soete, 2007; Vorley and Nelles, 2010) have observed industrial policy increasingly shifting towards innovation policy. Soete (2007) emphasises that this entails a significant broadening of policies, i.e. industrial development is no longer framed within the context of firms that constitute an industrial sector but incorporates questions of (higher) education, research capacity, geographic proximity (or embeddedness), and what Cohen and Levinthal (1990) christened absorptive capacity.

2.2 Thailand automotive policy: Targeting, clustering, and liberalisation

Thailand has been recognised as a successful case of integration into global automotive supply chains and the resulting relatively strong competitiveness. When it comes to explaining how Thailand positioned itself as a global export hub, several factors have contributed to this achievement.

Firstly, Thai policy strongly focussed on promoting one particular type of vehicle, namely the one-tonne pickup truck. It should be highlighted that this occurred before and after deregulating protective measures, such as foreign ownership restrictions and local content requirements. Policy encouraged the manufacturing of one type of vehicle, the so-called ‘product champion’, by providing incentives for producers and Thai consumers (Natsuda and Thoburn, 2013). By including incentives for components specifically used in one-tonne pickup trucks, Thai policy aimed at localising a significant part of the supply chain in order to capture value-added in manufacturing. It should be pointed out, that focussing on one-tonne pickup trucks was by no means accidental but rather a continuation along a long-established trajectory of Thai industrialisation policy. This particular vehicle type captured roughly 50% of the local market during the 1980s and has been the target of dedicated import substitution policies, such as a series of projects aiming at the rationalised, local production of diesel engines (Doner, 1991: 202–218). Obviously, the product champion approach is a variant of technology targeting because policy promoted a narrowly defined type of vehicle for local production. Thailand’s success in applying this strategy suggests that targeting can still be utilised within an increasingly restricted policy space.

Secondly, deregulation before the Asian financial crisis (AFC) attracted foreign automotive firms to Thailand. In 1993, Thailand announced that it would abolish both foreign ownership restrictions and local content requirements (LCR) by 1997, i.e. before this was ruled out by the World Trade Organization (WTO). This step made investing in Thailand more appealing in comparison to competing ASEAN countries which continued these practices (Warr and Kohpaiboon, 2017). The impact of deregulation is, however, not undisputed. First, it has been claimed that carmakers nolens volens redirected production capacities towards exports to overcome the implosion of the Thai market (Edgington and Hayter, 2001). Lauridsen (2004) demonstrated, however, that especially Japanese small and medium-sized enterprises from the automotive as well as electric and electronic industries invested in Thai operations before the crisis broke out. This tendency was strongly supported by carmakers. Whilst Kohpaiboon (2009) stressed increased foreign direct investment (FDI) inflows after the crisis started, he also reports considerable growth of production capacity in Thailand before it hit the country. Thus, carmakers clearly began encouraging the foundation of a deepened local supply chain in Thailand well before the crisis, although it is noteworthy that they invited Japanese suppliers rather than engage Thai suppliers to develop deepened production capabilities. If one keeps in mind that liberalisation was announced well before the crisis, this tendency cannot be overly surprising because Thailand provided a more attractive business environment than neighbouring car-producing countries, such as Indonesia and Malaysia. Second, several researchers (Wad, 2009; Athukorala and Kohpaiboon, 2010; Warr and Kohpaiboon, 2017) described deregulation as wholly positive and doubt the positive role of the LCR in promoting Thai participation in the supply chain. Warr and Kohpaiboon (2017: 5) argued that many Thai firms were eliminated from competition after liberalisation and that increased exports should be attributed to newly created FDI parts suppliers and new Thai firms. Whilst this is plausible, they do not present any conclusive evidence to support their claim. Nevertheless, it is plausible that only the most competitive Thai suppliers survived the double impact of the AFC and liberalisation. Also, it should be noted that even before the AFC occurred, local sourcing was mainly achieved through reliance on FDI suppliers. In the case of Toyota, it has been reported that local content was 50% in 1996, with 70% of these parts being supplied by Japanese suppliers, 20% from firms who received Japanese (technical) assistance, and only 10% from Thai firms which did not receive any form of assistance (Guiheux and Lecler, 2000: 211). Third, Hassler (2009: 2237) pointed out that Thailand's abolition of national LCR should not be overemphasised since LCR partly remained in place in the form of regional LCR under the ASEAN Free Trade Area. He also emphasised that around 1,700 parts suppliers had been established during the LCR era. Whilst the number of parts suppliers in Thailand greatly increased during the post-liberalisation era to around 2,400 firms in 2014, this should not be regarded as evidence that LCR did not provide opportunities for local firms to join supply chains. Undoubtedly, however, there are clear qualitative limitations towards supply chain participation. Today, Thai-owned enterprises tend to be confined to the supply of less technologically sophisticated, non-functional components, whereas functional, higher value-added components are mainly produced by foreign-invested enterprises (Intarakumnerd and Charoenporn, 2015: 1317).

Thirdly, Thailand proactively engaged in the creation of infrastructure and industrial clusters, most notably the so-called Eastern Seaboard. Infrastructure development was supported for several reasons. First and foremost, Bangkok was not accessible for large, ocean-going container vessels, so locating export-oriented manufacturing in Bangkok did not make economic sense. Further, Bangkok was already suffering from traffic congestion, so additional manufacturing investment and related supply chains would arguably worsen the logistical situation. Indeed, traffic congestion was perceived so critical that it was ranked third amongst issues that firms wanted to be addressed by government policy in a survey investigating business conditions in Bangkok (Tsuji et al., 2008: 221). Moreover, providing modern infrastructure alone should attract export-oriented FDI as such infrastructure can reduce various costs related to transport and communication. Regarding the Eastern Seaboard, it is well documented that Thai policies provided strong incentives to promote industrial agglomerations in the region in order to avoid overconcentration in and around Bangkok. As a result, FDI increasingly located production in targeted areas, which means that the original concentration of the automotive sector in Bangkok and Samut Prakan was reduced as Eastern provinces, such as Chachoengsao, Chonburi, and Rayong, attracted new investments (Lecler, 2002; Kuroiwa and Techakanont, 2017). Geographic clustering was pursued to enable low-cost logistics for delivery under just-in-time supply chain arrangements prevalent in the automotive industry.

Despite some shortcomings, Thailand is nevertheless considered as a case of successful industrial development. Lately, South Africa, an example of a developing country, seeks to learn from Thailand's experience in order to emulate its success (Barnes, Black, and Techakanont, 2017; Monaco, Bell, and Nyamwena, 2019). Thailand's success in becoming a global production and export hub is only overshadowed by Mexico, whose geographic location has enabled a strongly symbiotic relationship with the US automotive industry. Lacking such favourable geography, the Thai case is all the more remarkable as it lacks direct access to a large, wealthy consumer market.

Whilst Thailand's current position in the global automotive industry and supply chain is well understood, what are the potential consequences of a shift towards EVs? Before turning to this question, it should be highlighted that only general implications will be analysed, that is implications for the potential role of Thai firms in the supply chain will not be investigated in detail. However, the aforementioned confinement to non-functional parts (Intarakumnerd and Charoenporn, 2015) suggests that incumbent Thai suppliers may not be strongly affected as functional internal combustion engine vehicle (ICEV) components, such as engines and transmissions, which are no longer used in fully electric types, are dominated by foreign suppliers. Nevertheless, this confinement does not necessarily mean that Thai suppliers may not be significantly affected. As EVs will require several technological improvements to become competitive vis-à-vis ICEVs, pressure to reduce component weight or decrease components' electricity consumption is encompassing the whole automotive supply chain. Thus, Thai suppliers may encounter challenges indirectly related to electromobility.

3. Thailand's Position in the Electric Vehicle Supply Chain

3.1 Trade data review

Whilst Thailand is the centre of the automotive industry in the ASEAN region and a global export hub for one-tonne pickup trucks, does the country play a role in the supply chain for EVs?

To answer this question, attention should first be focussed on battery trade. As batteries are used in all EV types under investigation and are a key component, exploring Thailand's ability to export may provide some indication about its position in the EV supply chain.

Answering this question is not easy as the available statistical data obscure important details. Trade data recorded under the UN Comtrade database organised according to the six-digit Harmonised System (HS) code do distinguish between different battery types (primary or secondary) and according to differences in cell chemistry, but do not specify applications, e.g. for use in EVs or consumer electronics. Thus, the reported data must be interpreted with caution. Further, the HS code allows differentiation between battery packs on the one hand and modules and cells on the other (Table 1).

Table 2.1: Thai Trade in Battery Types and Components in 2019

HS Code	Covered Items	Imports (in US$ million)	Global Rank	Exports (in US$ million)	Global Rank
8507.10	Lead-acid starter battery	54.3	31	197.7	12
8507.50	NiMH battery pack	21.0	17	0.1	39
8507.60	Li-Ion battery pack	122.5	30	8.4	33
8507.90	Battery modules, cells, and components	110.0	9	112.2	6

HS = Harmonized System, NiMH = nickel metal hydride.
Source: UN Comtrade.

First, the data indicate that Thailand has a strong position in conventional starter battery production and exports. Second, in terms of trade value, nickel metal hydride (NiMH) batteries are not a significant item. This may be due to the fact that this battery type is not widely used compared to others. However, NiMH batteries must be addressed as they have been used in many hybrid electric vehicles (HEVs), most notably the Toyota Prius. The rather low HEV production volume (see below), however, suggests that local NiMH battery production may be dedicated for other applications. Third, a significantly higher import than export value for Li-ion batteries suggests that Thailand does not play a significant role in the global supply chain for this type of battery. As Li-ion batteries are used for many applications, most notably consumer electronics, drawing conclusions about the EV supply chain is not possible. Fourth, apart from the issue that the data do not specify use, the rather strong position in battery components must also be interpreted carefully. As the subheading covers the components of all battery types reported in other subheadings, the actual nature of imported and exported components is unclear. Thus, it may be possible that Thailand imports mainly components for advanced types, such as EV traction batteries, but exports components of standard types, such as vehicle starter batteries. As more than 95% of Thai battery components are imported from Malaysia, the former assumption appears somewhat unlikely. However, as more than 95% of Thailand's battery components are exported to Viet Nam, the latter assumption appears at least plausible.

Regarding other EV components, the available trade data also lack the level of disaggregation to allow a detailed exploration of Thailand's positioning inside EV supply chains. Regarding electric motors, only the level of electrical output is indicated but not the specific applications, such as for aircraft, EVs, or power electronics. Thus, the data can only provide an approximate idea of the extent of the role Thailand may play in EV supply (Table 2).

Table 2.2: Thai Trade in Electric Components in 2019

HS Code	Covered Items	Imports (in US$ million)	Global Rank	Exports (in US$ million)	Global Rank
8501.32	Electric motors, output 750W–75kW	6.7	34	1.7	35
8501.33	Electric motors, output 75kW–775kW	0.6	45	3.6	19
8504.40	Electrical static converters	501.4	27	1,336.1	8

kW = kilowatt, W = watt.
Source: UN Comtrade; accessed 1 June 2020.

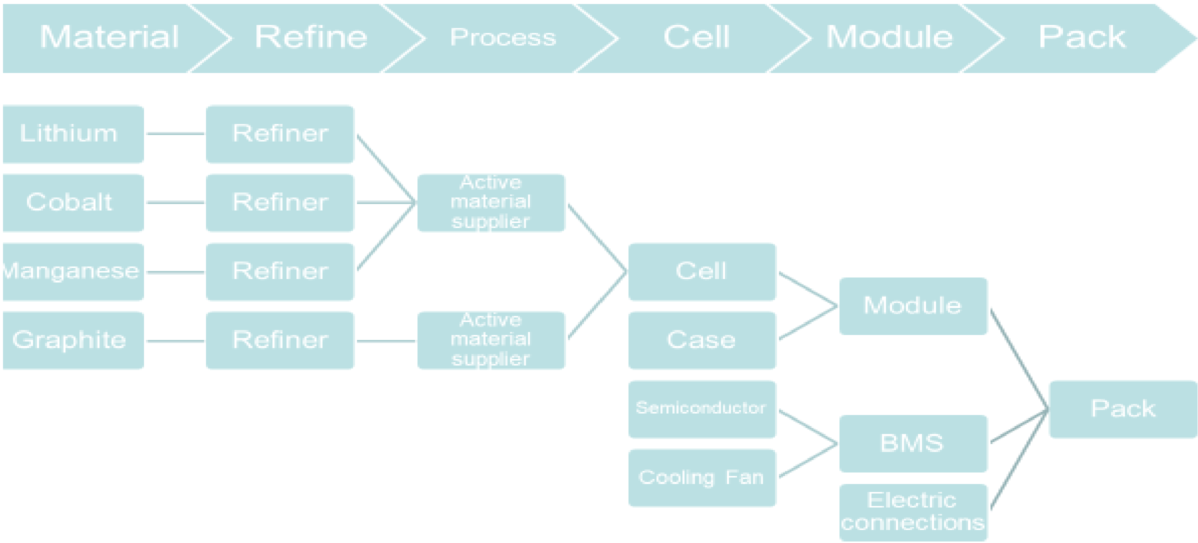
With due caution, it can be stated that Thailand has a relatively strong export position in some EV-related components, such as electric motors as well as converters and inverters, suggesting that local sourcing for EV production and participation in the EV supply chain may be possible.

Overall, the trade data only provide a limited insight due to a lack of disaggregation that could represent complexity at the product level. Therefore, it can only be stated that Thailand may be in a position to locally produce and export components such as electric motors, converters, and inverters, including parts thereof. When it comes to batteries, the lack of disaggregated data and multi-use battery types only allow for the general observation that Thailand is currently not a significant exporter of battery types relevant for EV production.

3.2. Supply chain analysis

As trade data do not provide conclusive information about Thailand's position in the evolving EV supply chain, it was decided to analyse the Li-ion battery supply chain to get a clearer picture. To break down the supply chain, the stages outlined in the framework for the overall project were applied (Figure 1).

Figure 2.1. Lithium-ion Battery Supply Chain



Source: Based on the author's investigation.

To gain an understanding of the parts of the supply chain Thailand participates in for Li-ion batteries, which are regarded as the dominant type of EV batteries, the global production footprint of major industry players was analysed based on publicly accessible information from industry publications, the online journal *InsideEVs*, Thai newspapers *The Nation* and *Bangkok Post*, as well as company websites.

At the time of writing, only a single company is conducting EV-grade Li-ion pack, module, or cell production in Thailand (see below and Appendix). Whilst several other companies plan to establish production in Thailand, it appears that projects will start at the pack stage. Thus, when it comes to battery production, it appears that Thailand will only serve as an assembly location that produces modules and packs from imported cells. This suggests that local value-added will be rather low.

When it comes to so-called active materials, i.e. those materials that are processed[24] into the cathode, anode, electrolyte, and separator, Thailand plays no significant role. However, it should be pointed out that this part of the EV battery supply chain is highly specialised and dominated by a few firms that mainly hail from China, Japan, or the Republic of Korea. Indeed, research conducted on behalf of the US government found that these three countries have established production capacities for particular active materials that form strong national supply chains and explain strong export performance (Sandor et al., 2017). Thus, Thailand's absence from this particular link in the Li-ion battery supply chain cannot be surprising as only a limited number of firms from a few countries have established themselves as strong players.

As for the raw materials used in Li-ion battery production, Thailand is neither a significant source nor a user (Table 3).

[24] Processing generally occurs during the cell production stage – cathodes and anodes are made from pre-processed materials that usually are in powder form. However, materials may also be delivered in large rolls, so the electrodes are merely cut into shape and further processed. Electrolytes are produced by mixing salts containing lithium with solvents to form liquid solutions or gels.

Table 2.3: Thai Trade in Raw Materials Used in Lithium-ion Batteries in 2019

HS Code	Covered Items	Imports (in US$ million)	Global Rank	Exports (in US$ million)	Global Rank
2825.20	Lithium oxide and hydroxide	4.3	15	0.0	25
2836.91	Lithium carbonate	1.1	22	0.6	16
2605.00	Cobalt ores and concentrates	0.0	21	0.4	6
8105.20	Cobalt; mattes and other intermediate products of cobalt metallurgy, unwrought cobalt, powders	9.1	20	0.2	29
2504	Graphite; natural	4.2	18	0.0	29
2602.00	Manganese and concentrates	6.2	22	12.4	13
2604.00	Nickel ores and concentrates	0.0	17	0.2	22

HS = Harmonized System.
Source: UN Comtrade; accessed 1 June 2020.

Regarding the marginal raw material exports, this does not necessarily mean that the country does not possess any deposits. Potential raw material deposits may be too expensive to be extracted at current market prices. Regarding the limited raw material imports, this may indicate a lack of a processing industry that can engage in the refining of industry-grade materials. These findings are consistent with a recent analysis of potential material supply shortages in the Li-ion battery supply chain (Olivetti et al., 2017) that reviewed raw material extraction and processing. Whilst other ASEAN countries such as Indonesia and the Philippines are mentioned as important global sources of nickel, Thailand is not mentioned once in the analysis. Thus, it can be concluded that Thailand currently is not a significant source of raw or intermediate processed materials for Li-ion battery production.

4. Thai Automotive Industry Policy and Vehicle Production

According to the International Organization of Motor Vehicle Manufacturers (OICA), Thailand was the world's eleventh-biggest vehicle producer in 2019, documenting its position as ASEAN's leading vehicle manufacturing country. Thai EV support is apparently aiming to secure the country's current position in regional and global production networks. Following the underlying assumption that EVs are the future of the automobile industry, Thai policy is seeking to manage the technological transition. Thus, as will be shown below, policy not only addresses consumers and producers but also the local production of specific EV components.

This section will introduce overviews over several generations of product champion policies towards the automotive industry in Thailand. Policies aimed at the automotive industry can be divided into different phases. Researchers who have developed explicit chronologies of Thai automotive industry history (Natsuda and Thoburn, 2013; Kuroiwa and Techakanont, 2017) have tended to distinguish between five different phases which, however, differ in detail. For the purpose of this investigation, it appears unnecessary to reiterate the historic development of the automotive industry in Thailand. Instead, the study will focus on policies that have been developed during the latest stage of industry development, which is said to have occurred after the year 2000.

As aforementioned, the main policy aim of the consecutive automotive sector policies was to promote Thailand as a regional, ideally global, export platform. Given this aim, production figures, as well as foreign investment into production, may be regarded as indicators for the success or failure of these industrial policies. Therefore, the available data will be reviewed in order to evaluate the impact of sectoral policy.

4.1 One-tonne pickup trucks: Emergence of the product champion approach

4.1.1 New automotive investment policy

After the AFC hit and triggered the aforementioned changes in industry regulation, it was necessary to develop a future-oriented strategy to develop the industry. In 2001, Prime Minister Thaksin Shinawatra announced his vision to turn Thailand into 'the Detroit of the East' (Busser, 2008). As Thailand had pledged to deregulate and no longer apply LCR, another approach to strengthen Thai competitiveness was required. It appeared clear that Thailand had to position itself as an export production base as its national market was not large enough to support production with a minimal efficient scale, i.e. to attain a level of production output that enables of economies of scale. As noted earlier, pickup trucks were already popular and there had been past attempts to rationalise diesel engine production (Doner 1991: 202–18). Thus, choosing one-tonne pickup trucks appears to be a path-dependent choice.

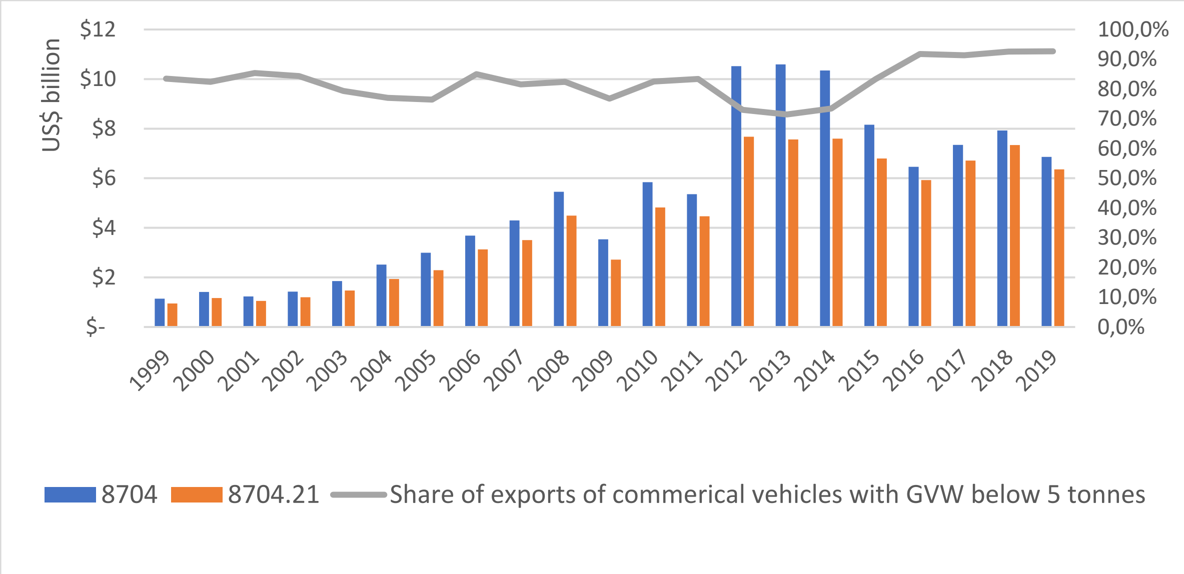
According to Natsuda and Thoburn (2013), this type of targeting should be labelled as the 'product champion approach'. The product champion approach has two noteworthy characteristics. First, both supply and demand side policies are utilised. Despite the fact that policy targets exports, the domestic demand for targeted vehicle types is stimulated in order to avoid being solely dependent on external market development. Second, supply side incentives are clearly structured and tied to performance criteria that not only entail economic targets but also define what particular type of vehicle should be produced. In the case of one-tonne pickup trucks, investors could qualify for corporate tax exemption if they met several investment requirements. The key point of Natsuda and Thoburn is that despite increasing limitations of policy space through the WTO, i.e. the banning of such tools as LCR, export requirements, and trade balance obligations, developing countries still have policy options.

4.1.2 One-tonne pickup truck production

Carmakers responded positively to Thailand's new automotive policy. This cannot be overly surprising as pickups had already been selected by OEMs as export products even before the crisis broke out (Kohpaiboon, 2009: 4). Indeed, Mitsubishi and Auto Alliance, the joint venture plant of Ford and Mazda, had already designated Thailand as an export base for this vehicle type before the crisis, and the partnership between General Motors and Isuzu had applied the same orientation in 2001 (Techakanont, 2011: 209). Toyota designated Thailand as the leading hub for pickup trucks amongst several production hubs for its Innovative International Multi-purpose Vehicle platform, which enabled the production of various models differentiated by body type, i.e. pickup truck, sport utility vehicle (SUV), and minivan (Nomura, 2015: 83-84). Therefore, the post-crisis product champion policy reinforced existing firm strategies rather than shaping them.

Export trade data support these findings, as they display that commercial vehicle exports were almost entirely constituted by light commercial vehicles with a gross vehicle weight (GVW) below five tonnes before Thai policy supported one-tonne pickup trucks (Figure 2).

Figure 2.2: Thai Commercial Vehicle Exports and the Light Commercial Vehicle Share, 1999–2019



GVW = gross vehicle weight.
Source: UN Comtrade; accessed 1June 2020.

Whilst trade statistics are again not disaggregated enough to only capture one-tonne pickup trucks, the fact that the HS subheading they occupy represents more than 90% of total commercial vehicle exports in value terms combined with the aforementioned OEM strategy suggests that pickup trucks are indeed the primary Thai vehicle export. Concerning the export destinations, the ASEAN market is not as important as may be expected. Of all exports in this category, 29.1% were destined for fellow ASEAN markets in 2019. However, the single-most-important export market was Australia with US$2 billion or 32% of all exports in this category in 2019. Other important non-ASEAN export destinations were New Zealand (ranked third; US$470 million), Saudi Arabia (ranked sixth; US$284 million), and the United Kingdom (UK) (ranked seventh; US$270 million).

It is necessary to point out that whilst production in Thailand was primarily focussed on one-tonne pickup trucks, the adoption of a product engineering strategy greatly increased OEM flexibility. Some carmakers located the production of models that were based on platforms[25] in Thailand. Toyota's so-called Innovative International Multi-purpose Vehicle (IMV) platform is perhaps the best example. The IMV platform supported three different models, namely the Fortuner SUV, the Hilux pickup truck, and the Innova minivan. Thailand was the main production location for the Hilux, and further produced completely knocked-down kits of this model for assembly in other developing countries as well as diesel engines for all models of the IMV platform (Agustin and Schröder, 2014: 97-98). Thus, Thailand not only participated in Toyota's intra-regional production network in ASEAN, which increased economies of scale in component and vehicle production, but manufacturing could also be more flexibly adjusted between models using the same platform. Hence, whilst one-tonne pickup trucks

[25] Takayasu and Mori (2004: 222) refer to this as modular strategy. However, from the perspective of product engineering, it appears more appropriate to term this a platform strategy. The main difference between platform and architecture is that whereas platforms have limited scalability and can only support the production of closely related models, e.g. from the same segment, architectures possess greater scalability, especially regarding the wheelbase, and can support production of various models from different segments.

clearly were the most important product, OEMs had the option to adjust production volumes between different, yet related, models.

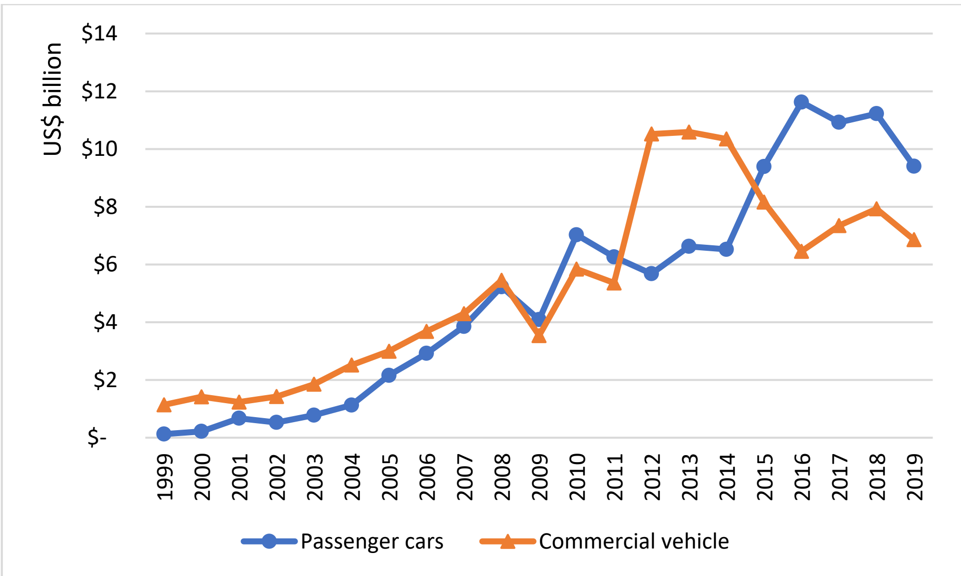
4.2. Eco-cars: Sticking to the recipe

4.2.1 Eco-car programme

Following the success of its first product champion, Thailand has promoted the local production of so-called eco-cars since 2007. The Thai administration defines eco-cars as vehicles that have a mileage above 20 kilometres per litre of gasoline (or diesel equivalent), emit less than 120 grammes of carbon dioxide (CO_2) per kilometre, and meet criteria for other pollutants as required by the Euro 4 standard. Moreover, gasoline engines were limited to a size of 1,300 cylinder capacity (cc) and diesel engines to 1,400 cc in order to require the production of relatively small vehicle types. To further the domestic production of such eco-cars, the Thai Board of Investment (BOI) granted several incentives to both producers and consumers under the condition that investors agree to production target figures of 100,000 units, which had to be reached after a certain period of operation.[26]

Clearly, this policy is designed to promote the evolution of the Thai automotive industry. As past targeting policies led to the specialisation of one-tonne pickup trucks, policy consciously sought to emulate past success. As Thai policymakers, especially the BOI, understood that pickup trucks are both relatively polluting and technologically simple in comparison to eco-cars, this also indicates that the intention was to stimulate industry development towards more complex, higher value-added products. Whilst eco-car promotion clearly aimed at adding another vehicle type to Thailand's exports, exports were already diversifying away from one-tonne pickup trucks at the time the programme was initiated (Figure 3).

Figure 3. Thai Passenger Car and Commercial Vehicle Exports, 1999–2019



Source: UN Comtrade; accessed 1 June 2020.

[26] Due to limitations in space, additional investment conditions and incentive details cannot be discussed.

As the data indicate, vehicle exports had already diversified from being largely constituted by commercial vehicles, especially one-tonne pickup trucks, when the eco-car policy was promoted. Whilst passenger car exports have recently overtaken commercial vehicle exports, it is nevertheless remarkable that passenger car export growth started before the eco-car policy sought to establish a second product champion. Thus, it may be concluded that carmakers were already utilising Thailand as a broader production and export platform before policy promoted diversification. It is, therefore, not sensible to attribute passenger car export growth to sectoral policy alone. Rather, it appears that policy reinforced pre-existing OEM production and export strategies instead of actively shaping them.

4.1.3 Eco-car production

Under the eco-car programme, only Japanese OEMs are still making cars in Thailand. During the first phase of the programme, Honda, Mitsubishi, Nissan, Suzuki, and Toyota established production capacities. Originally, five carmakers joined the second phase of the eco-car programme, namely Ford, General Motors, Mazda, Shanghai Automotive Industry Corporation (SAIC), and Volkswagen. Whilst the German carmaker never set up production in Thailand, all carmakers except Mazda retreated from the programme (Grant, 2015; Reuters, 2015; Maikaew, 2017c).

Whilst the participating carmakers still have time to meet the required production targets, it can be stated that meeting these targets may be challenging for some carmakers.

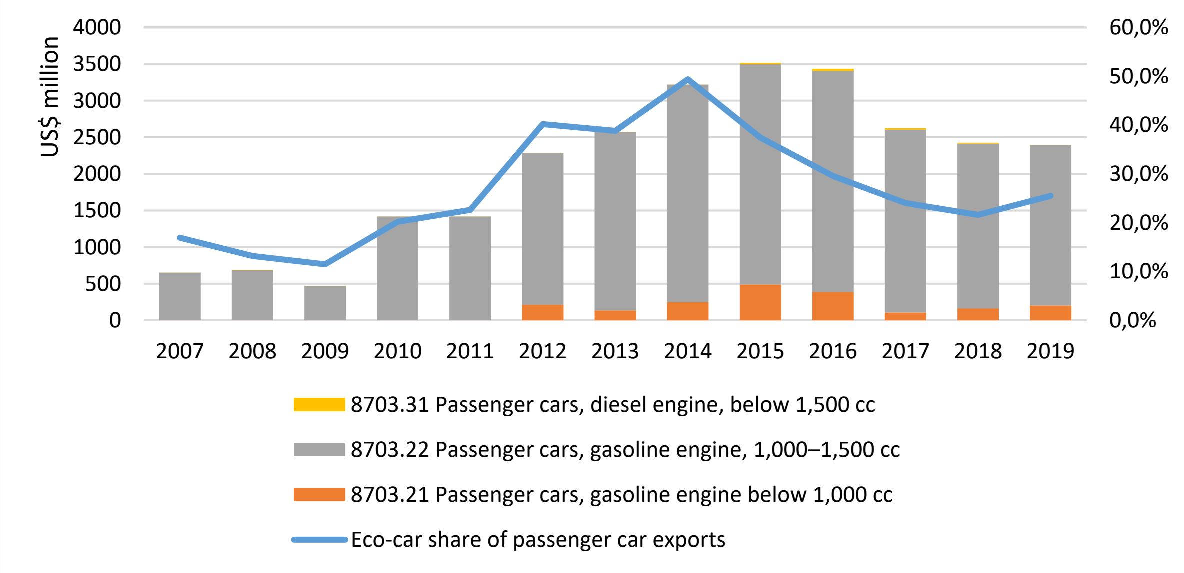
Table 4. Eco-car Domestic Sales and Production

Make	2017	2018
Honda	2,475	2,132
Mazda	31,760	45,972
Mitsubishi	22,833	25,784
Nissan	33,673	42,205
Suzuki	21,300	24,625
Toyota	44,200	68,804
Total sales	**156,239**	**209,522**
Total production	**364,000**	**n.a.**

Note: All brand data are sales, only the final row is production.
Source: Bangkok Post & Federation of Thai Industries.

As the above data indicate, promoting Thailand as an export base was achieved successfully as more than half of the produced eco-cars were exported in 2017. Further, differing sales data suggest that OEMs may adopt different strategies towards mixing production for the Thai market and for export. As Thailand’s population is too limited to support its rather large automotive industry, promoting the country’s position as an exporter is necessary. Trade data allow a similar conclusion; according to the UN Comtrade database, Thai exports of passenger cars with gasoline and diesel engines below 1,500 cc increased from around US$650 million in 2007, the year the programme started, to US$2.39 billion in 2019 (Figure 4).

Figure 4. Thai Passenger Car Export and Eco-car Export Share, 2007–2019



Source: UN Comtrade; accessed 1 June 2020.

This suggests that carmakers indeed intensified exports of this vehicle class as quasi-required by industrial policy. However, industry trends such as downsized and turbo-charged engines promoted the production and sales of nominally smaller vehicles, so the increased exports should not be solely attributed to the programme. Regarding export destinations, the role of the ASEAN market deserves attention. Whilst all ASEAN markets together were the largest market with US$572 million in 2019, the single-largest export destination was Australia with US$466 million, followed by Viet Nam with US$377 million, Mexico with US$274 million, the US with US$179 million, and Japan with US$118 million. Thus, Thai eco-cars are neither a product solely dedicated to the ASEAN region nor dedicated to other developing or emerging countries. Moreover, eco-cars do not occupy the same role in passenger car exports as one-tonne pickup trucks do in commercial vehicle exports, in that their share of passenger car exports only increased from roughly 17% at the start of the programme to about 25% in 2019. Whilst pickup trucks are the clear product champion when it comes to commercial vehicle exports, eco-cars are just one type amongst others. Whilst one may conclude that the eco-car programme did not succeed in creating a dominant product champion, this is arguably not negative. Instead, it is rather remarkable that passenger car export growth also occurred in vehicle types not specifically supported through policy. This suggests that Thailand is an internationally competitive production and export base that does not necessitate explicit government support for each locally produced vehicle type.

Whilst the retreat of several carmakers may be regarded as a partial failure of the eco-car programme, it can nevertheless be concluded that the programme was relatively successful. First, Thailand diversified the product range of locally made automobiles away from one-tonne pickup trucks towards passenger cars, including not just targeted eco-cars. Whilst the new product champion is characterised by narrow OEM profit margins and is strongly reliant on rather low labour costs, Thailand's ability to attract the production of a cost-sensitive segment suggests that the country is cost-competitive. Second, eco-cars are exported to several markets, suggesting that Thailand is internationally competitive in this segment.

4.3 Electric vehicles: Limitations of the product champion approach?

4.3.1 Electric vehicle programme

Whilst the eco-car programme provided incentives for fuel-efficient ICEVs, Thailand also introduced support measures for EV parts manufacturing in the country. From 2012, it offered exemptions from corporate income tax (with a maximum cap) for eight years for investments directed at the production of advanced vehicle technologies. These included ICEV components as well HEV, plug-in hybrid electric vehicle (PHEV), and battery electric vehicle (BEV) batteries, and traction motors for HEVs, PHEVs, BEVs, and fuel cell electric vehicles. At this time, however, support for EVs can be characterised as a general form of industrial support policy, not a dedicated product champion programme.

This changed in March 2017, when the Thai government issued its EV policy. In comparison with other ASEAN members, the formulated aims are more long-term oriented. The target number for EVs on Thai roads is 1.2 million vehicles by 2036 and 690 charging stations. The available information suggests that the Thai government defines EVs as all types except fuel cell electric vehicles. However, incentives are most generous for BEVs, reflecting a clear preference of government planners for this type.

First, BEV investment projects are entitled to corporate tax exemptions of between five and eight years. The duration of this tax exemption can be extended under the following condition: investment in manufacturing in more than one EV core component in Thailand is rewarded by an additional year per component up to a maximum duration of 10 years.

Second, PHEV and BEV bus investment projects are eligible for corporate income tax exemption for three years and import tariff exemptions on production machinery. As in the case of BEVs, production beyond the first EV core component entitles additional years of tax exemption to a maximum of six years.

Third, investment in HEV manufacturing is entitled to fewer incentives than PHEVs and BEVs. Investing firms will only be granted import tariff exemption on production machinery.

Some striking aspects of the EV programme should be highlighted. First, whilst there is still a minimum investment required, the amount is only B1 million (roughly US$26,000). In comparison to the preceding eco-car programmes, this sum is very low, not to say symbolic. Secondly, differing from eco-car policy, production targets are not included under this scheme. This suggests that policymakers are unable to define a target production figure. Taking these less strict requirements into consideration, it may be concluded that whilst EVs are regarded as important for the future of Thai car manufacturing, the technology is too novel and demand too uncertain to apply standard policy instruments.

Further, incentives will be granted for producing important EV components. Firms investing in manufacturing in the following components are entitled to eight years of corporate income tax exemption: batteries, traction motors, battery management systems, DC/DC converters, inverters, electric circuit breakers, portable EV chargers, and EV smart charging systems. Most remarkable is that battery technology has not been specified clearly. The way the policy is phrased, both major EV battery types, i.e. NiMH and Li-ion batteries, are entitled to government support. Whilst the overall direction of policy measures shows a strong tendency to favour BEVs, it would make sense to give priority to Li-ion batteries, which are commonly used in BEVs and PHEVs, and no or at least lower incentives to NiMH batteries, which are mainly utilised in HEVs.

According to the plan, EV policy is divided into three phases. The first was conducted in 2016 and 2017. It should basically prepare subsequent activities by setting up a limited number of charging stations and organise field tests with a limited number of BEVs. The actual research should be conducted in the second phase, scheduled to last from 2018 to 2020. Trials should test the performance of different battery types and motors and determine the technical standards for vehicles and charging infrastructure. Further, this phase should be utilised to prepare legal and tax frameworks, train bureaucratic staff, and conduct user promotion. The phase should produce a coordinated action plan for the implementation of concrete policy measures from 2021 onwards. Thus, the third stage should see the actual deployment of infrastructure and BEVs in Thailand. Here, it is noteworthy that the EV Action Plan is intended to integrate with other policies, most notably Thailand's Industry 4.0 plans and the smart grid. BEVs should not only be charged through the grid but also be able to feed stored electricity into the grid (so-called vehicle-to-grid capability). Therefore, it can be stated that BEV use and production are part of an intended large-scale transformation of the Thai economy away from a country that faces the 'middle-income trap' towards an industrially and economically advanced nation.

On the demand side, Thailand revised taxation to make EVs more attractive to consumers. In 2016, Thailand introduced a new excise tax scheme that shifted taxation away from being based on engine capacity alone towards one based on CO_2 emissions (Table 5).

Table 5. Thai Automotive Excise Tax Scheme as of January 2018

<table>
<tr><th rowspan="2">Vehicle Type</th><th rowspan="2">Engine Size</th><th colspan="4">CO_2 g/km</th></tr>
<tr><th>< 100</th><th>100–150</th><th>150–200</th><th>> 200</th></tr>
<tr><td rowspan="3">Passenger car</td><td>< 3,000 cc</td><td></td><td>30%</td><td>35%</td><td>40%</td></tr>
<tr><td>E85/CNG</td><td></td><td>25%</td><td>30%</td><td>35%</td></tr>
<tr><td>> 3,000 cc</td><td colspan="4">50%</td></tr>
<tr><td rowspan="2">Hybrid vehicle</td><td>< 3,000 cc</td><td>5%</td><td>20%</td><td>25%</td><td>30%</td></tr>
<tr><td>> 3,000 cc</td><td colspan="4">50%</td></tr>
<tr><td>BEV</td><td>-</td><td>2%*</td><td colspan="3"></td></tr>
<tr><td rowspan="2">Eco-car</td><td>1,300–1,400 cc</td><td>14%</td><td colspan="3" rowspan="2">17%</td></tr>
<tr><td>E85</td><td>12%</td></tr>
<tr><td></td><td></td><th colspan="2">< 200</th><th colspan="2">> 200</th></tr>
<tr><td rowspan="3">Pickup</td><td>Single cab</td><td colspan="2">3%</td><td colspan="2">5%</td></tr>
<tr><td>Space cab</td><td colspan="2">5%</td><td colspan="2">7%</td></tr>
<tr><td>Double cab</td><td colspan="2">12%**</td><td colspan="2">15%</td></tr>
<tr><td rowspan="2">Pickup passenger</td><td>< 3,250 cc</td><td colspan="2">25%</td><td colspan="2">30%</td></tr>
<tr><td>> 3,250 cc</td><td colspan="4">50%</td></tr>
</table>

BEV = battery electric vehicle, cc = cylinder capacity, CNG = compressed natural gas, CO_2 = carbon dioxide, g = gramme, km = kilometre.
* The excise tax will be reduced to zero from 2020 to the end of 2022, after which it will be re-increased to 2%.
** The excise will be reduced to 10% from 2020 to the end of 2022.
Note: E85 signifies a fuel blend of 85% ethanol and 15% gasoline.
Source: Thai Board of Investment.

Whilst the table indicates that CO_2 emissions and engine capacity are actually used in combination to determine the payable taxes, emissions play a more crucial role under the new scheme. Besides this new tax regime, Thailand also reduced import tariffs on BEVs to zero to lower cost for consumers. The measures suggest that Thai policymakers prefer supporting BEVs over hybrids.

4.3.2 *Electric vehicle production plans and investment*

Due to the recent nature of the programme, it is not possible to review and evaluate this latest policy based on the production data. It is only possible to trace OEM plans through investment decisions and in some cases through commenced production activity.

Looking at current automobile manufacturing in Thailand, Toyota is locally producing the Camry Hybrid (HEV) since 2009 and manufactured the Prius (HEV) from 2010 to 2015. Battery packs used to be imported from Japan, where the carmaker and Panasonic operate three plants under the joint venture named Primeearth EV Energy. The Japanese OEM announced that it would intensify HEV production in Thailand to take advantage of the provided incentives. Before the Thai government announced its production incentives, Toyota stated that it regarded charging infrastructure as insufficient, indicating the main reason why it would not invest in PHEV or BEV production (Maikaew, 2017a). Apparently, the incentives did not convince the carmaker to rethink its approach. Under the EV programme, Toyota applied to produce 7,000 HEVs per year plus 70,000 EV batteries as well as other non-EV specific components, such as bumpers, doors, front and rear axles (Maikaew, 2019a). Toyota commenced production of NiMH batteries at its Gateway plant in Chachoengsao Province in May 2019. The produced batteries are currently used in HEV versions of the Camry sedan and the C-HR SUV manufactured at the Gateway plant. Nissan located the manufacture of the X-trail Hybrid (HEV) in 2015, i.e. before government incentives were granted. After incentives were introduced, Nissan applied and pledged to produce hybrids and batteries at its production complex in Samut Prakan Province. In January 2019, it was disclosed that the carmaker seeks to make Thailand its second EV production hub besides Japan, which should produce for local demand and export markets (Maikaew, 2019b). Honda has assembled HEV versions of its Jazz and Accord models since 2012 and 2014, respectively. Between 2013 and 2015, the Civic HEV was also produced, but due to weak sales of the model, the Japanese carmaker discontinued its production worldwide. Under the EV programme, Honda pledged to invest in HEV and HEV battery production. The carmaker plans to shift Accord HEV production from Japan to Thailand (Furukawa, 2019). In 2017, Honda announced that by March 2022, it would shutter its Sayama plant, which represents roughly a quarter of production capacity in Japan. As its plant in Ayutthaya Province also produces the Accord, investment incentives may have only acted as an additional incentive for an already planned reallocation of production within Honda's global production network. After the BOI's EV scheme was introduced, Mazda decided to produce an undisclosed hybrid model and several components in Thailand (Maikaew, 2018). After gaining approval from the BOI, Mazda recently even applied to extend production to BEVs (Maikaew, 2019c).

One example of EV production and partial supply chain localisation is BMW. The premium carmaker started to produce PHEV versions of its 3-series (330e) and X5 models in 2017, i.e. before Thai policy supported local EV production. After the Thai government introduced incentives, BMW extended production to PHEV versions of the 5-series and 7-series (530e and 740Le, respectively) (BMW, 2018). As part of the localisation effort, German supplier Dräxlmaier started to produce Li-ion traction batteries for BMW in Thailand in September 2019. As for the battery, the battery cells are not made locally but imported from Samsung SDI, which has been BMW's exclusive source for EV batteries outside of the Chinese market. Dräxlmaier assembles battery modules and subsequently packs from procured cells and other components, such as aluminium housing and electronic components. The company claims that it is the only plant that produces Li-ion batteries starting from the module stage in Southeast Asia (Maikaew, 2019f). Another German premium rival follows a remarkably similar trajectory. Daimler started to assemble completely knocked-down kits of HEV version of its C-class and E-class (C300 and E300 BlueTEC Hybrid) in 2013 and 2014. In 2016, the carmaker updated its model line-up by starting assembly of PHEV versions of the Mercedes-Benz C-class and S-class (C350e and S500e). After Thailand offered incentives, Daimler decided to deepen its production footprint by applying for PHEV battery production and production of the EQC, a battery-powered SUV (Maikaew, 2019d). Whilst the battery may be produced in Thailand, battery cells will be imported: In the case of the EQC, LG Chem is the sole supplier (The Investor/Korea Herald, 2018).[27] As LG Chem does not produce EV battery cells in Thailand, they will be imported by Daimler. Whether only the cells will be imported or whether they will be already be assembled into modules is unclear at the time of writing. Whilst the two German premium brands produced and offered EVs prior to government incentives, the joint venture between SAIC and local conglomerate Charoen Pokphand (SAIC-CP) pledged to produce PHEV and BEV versions of the MG ZS SUV under the BOI's scheme (Apisitniran, 2018). This is somewhat remarkable as EVs can be imported duty-free from China. Mitsubishi also received approval for its plan to produce an undisclosed PHEV model in Thailand (Theparat, 2019). Given Mitsubishi's production footprint in Thailand, it appears likely that the produced model will be the PHEV version of the Outlander SUV.

Also, there is the case of Vera Automotive, a firm founded by five Thai engineers of King Mongkut's Institute of Technology Ladkrabang (Maikaew, 2017b). The firm developed a BEV called V1, but the vehicle is produced by Geely in China and then exported to Thailand. Thus, whilst the firm is Thai, production is not located in the country, obviously due to the costs related to entering automobile manufacturing. The vehicles are not only sold domestically but also exported to other ASEAN markets and China. First One Mile Mobility (FOMM), a Japanese start-up, entered the Thai market with an investment of roughly US$30 million to build its first factory with annual production capacity for 10,000 units in Chonburi Province (Kotani, 2018). The newcomer will produce its FOMM One minicar, which actually was the first approved project under the EV programme. Finally, Energy Absolute, a Thai corporation mainly active in renewable energy and bio fuel production, successfully applied for BOI support (Maikaew and Praiwan, 2019). The company will produce Li-ion batteries suitable for PHEV and BEV use in a joint venture with the Taiwanese Amita Technologies. The plant will initially have the annual capacity to produce batteries able to store 1 gigawatt hour (GWh) of electrical energy and be expanded to 50 GWh by 2021. Further, it will install a network of 3,000 charging stations under its EA Anywhere brand, and ally with an unidentified vehicle assembler to produce three different EV models – one city car, one multi-purpose vehicle and a sports car – developed in-house.

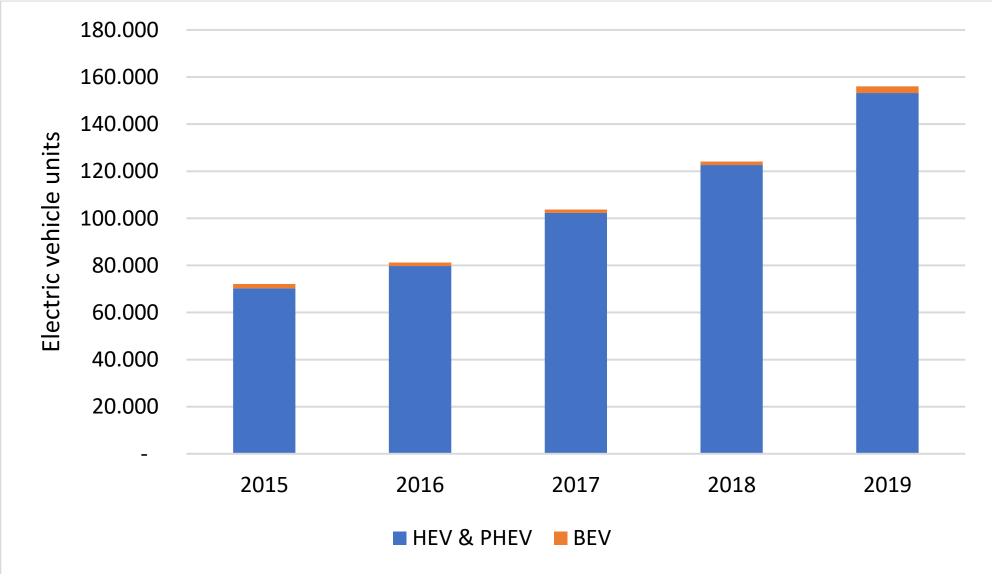
Overall, the EV programme may be called moderately successful. With the notable exceptions of Honda and Nissan, carmakers do not seem to consider Thailand as a significant EV production base. Available data on intended production volumes rather suggest that companies invested to cater to the local market through limited production. It is doubtful that production of this scale will have a significant positive impact on the Thai automotive industry and support a shift towards electromobility. Whilst Honda and Nissan's ambitions may be a ray of hope that Thailand could still be a relevant vehicle production location if the shift to electromobility occurs, the generally lukewarm response from carmakers to the EV programme suggests that the policy may not lead to a transformation of the Thai automotive industry towards EV production.

4.3.3 Local electric vehicle market

[27] At the time of writing, Daimler has supply contracts with three battery cell producers, namely CATL, LG Chem, and SK Innovation.

One reason for carmakers' reserved attitude towards investment in EV production capacities in Thailand is the local market demand. Currently, demand is strongly concentrated on hybrids, and BEVs are a marginal niche market that is mainly constituted of electric motorcycles, not cars (Figure 5 and Table 6).

Figure 5. Accumulated EV Registrations by Type in Thailand



BEV = battery electric vehicles, HEV = hybrid electric vehicles, PHEV = plug-in hybrid electric vehicles.
Source: Electric Vehicle Association of Thailand (2020).

Table 6. Accumulated Battery Electric Vehicle Registrations by Body Type in Thailand as of June 2020

Battery Electric Vehicle Body Type	Registrations
Two-wheeler	2,301
Passenger car	1,731
Bus	120
Three-wheeler	149
Total	**4,301**

Source: Electric Vehicle Association of Thailand (2020).

Overall, the Thai EV market is still a niche market. Whilst annual growth rates are high, they come from a low base. Registrations have increased by roughly 20,000 units annually over the past few years, but given the total market size of about 1 million units sales, EVs are clearly not a mass market. Moreover, data indicate that Thai customers mainly use hybrids instead of BEVs. Further, those few BEVs in use are not cars, but motorcycles. This may explain some carmakers' reluctance towards localising BEV production in Thailand despite more generous incentives for this type in comparison to hybrids. As BEVs are a niche within the Thai EV market niche, this reluctance appears justified, especially if acknowledging that BEVs are still significantly more expansive than conventional ICEVs.

4.4 Eco electric vehicles: Will the product champion approach survive?

At the time of writing, a new programme, dubbed the Eco EV programme, is under deliberation. As it is still under deliberation, concrete measures are unclear, but its aim is identifiable – manufacturers that produce eco-cars should be encouraged to produce electrified versions of these models (Maikaew, 2019e). The reason is quite simple: the EV programme has not resulted in significant EV production capacity but rather promoted the local assembly of a limited number of HEV and PHEV models. Especially in the latter case, vehicles are aimed at market segments beyond the average consumer, meaning that electromobility will not be significantly promoted. The aim of the Eco EV programme is to locally produce EVs that can be both consumed by average Thais and exported in larger numbers.

Therefore, it can be stated that the programme is designed to address the shortcomings of the EV programme. In particular, the lack of clear requirements, such as minimum production targets, seems to have caught the attention of policymakers. As the absence of requirements have allowed carmakers to apply for incentives without building a substantial EV production capacity or supply chain, this policy apparently should provide better-defined requirements.

Carmakers have openly communicated their displeasure with the proposed rules, stating that the required technology was not appropriate to be used.

5. Discussion and Policy Implications

Against the background of Natsuda and Thoburn's argument for the product champion approach, some fundamental observations are noteworthy. First, policy tools banned by the WTO can still be applied if repackaged into conditional investment incentives. Basically, the requirements to qualify for incentives are variants of the LCR and export requirements. As observed, the required production targets exceed the local market capacity, indirectly forcing OEMs to export from Thailand. In essence, this means that whilst certain policy tools can no longer be unilaterally applied by developing countries, they can be repacked as conditions for fiscal incentives. Thus, it may be stated that formerly unilaterally applied policy tools were transformed into mutual agreements, i.e. incentives are only provided if firms support industrial development goals. Second, policy tools are still usable but require fiscal muscle. Whilst upper-middle-income countries such as Thailand may realistically adopt such repackaged policy tools, lower-middle-income and low-income countries will commonly lack sufficient government expenditure to pursue incentive-based tit-for-tat development strategies.

Applying past policy blueprints, Thailand seeks to transition domestic vehicle and automotive component production towards the anticipated age of electromobility. Whilst the programme has not been completed, only limited conclusions can be drawn. Most carmakers that applied under the EV programme aim to produce a limited amount of EVs in Thailand, suggesting that OEMs take advantage of incentives to produce EVs locally for a niche market. BMW and Daimler are probably the best examples, as their target customers are already in a fairly narrow segment of the overall market. Honda and Nissan are the only carmakers that plan to establish more substantial EV production in Thailand. However, Honda's intention to produce HEVs indicates that the carmaker anticipates a gradual transition, i.e. a rather evolutionary than revolutionary change in vehicle production. It must be stressed that the degree of change inside Thailand's automotive industry may be linked to Honda and Nissan’s future EV production volume. If both Japanese OEMs are successful in establishing Thailand as their EV production and export hub, competitors may emulate their strategy.

Regarding the implications for Thailand’s automotive sector policy, it must first be pointed out that there is a significant underlying issue with the product champion approach. Basically, this policy approach practices targeting in that it attempts to single out a vehicle type or segment in order to promote large-scale production in Thailand for global export. Arguably, this is possible as long as the automotive industry is subject to incremental innovation and development because policymakers only have to be able to identify a vehicle type that should be fairly attractive for a large number of consumers around the globe. However, EVs, and especially BEVs, which are the obvious target of Thai policymakers, do not fit into this pattern easily. As outlined, there are several EV types with specific costs, environmental performance, and infrastructure requirements, etc. Furthermore, different markets display differing preferences for different EV types, often rooted in government policies and consumer subsidies. Hence, targeting EVs is significantly more challenging than ICEVs. Specifically, requiring production at a level that quasi-mandates export is not possible as OEMs will not commit to large-scale EV production without being able to forecast demand with an acceptable margin of error. Therefore, the product champion strategy may be well-suited for catching-up in a stable automotive industry environment, but it appears inappropriate for promoting innovative EV types with uncertain demand.

Challenges to targeting innovative vehicle types such as EVs apparently have consequences for policy design (Table 7).

Table 7. Overview of Thai Post-crisis Automotive Industry Policies

		New Automotive Investment Policy	**Eco-car**		**Electric Vehicle**
			Phase I	**Phase II**	
Year		2002	2007	2013	2017
Minimum investment		B10 billion	B5 billion	B6.5 billion (B5 billion for Phase I participants)	B1 million
Export requirement (% of production)		80	-	-	-
Annual production		-	100,000 units in the fifth year	100,000 units in the fourth year	-
Mileage		-	20 km/L	23 km/L	-
Emission standard		Euro 2*	Euro 4	Euro 5	-
CO_2 emissions		-	120 g/km	100 g/km	-
Engine displacement	Gasoline engine		≤ 1,300 cc		
	Diesel engine		≤1,400 cc		
Incentive		3–7-year income tax exemption; 1-year extension requires Thai supplier development or local R&D; import tax	8-year income tax exemption	6-year income tax exemption; 1- or 2-year extension requires Thai supplier development	Income tax exemption (BEV: 8–10 years; PHEV and BEV buses: 3–6 years); import tax exemption for production

	reduction for production machinery			machinery (BEV, PHEV, HEV)

BEV = battery electric vehicle, cc = cylinder capacity, CO_2 = carbon dioxide, g = gramme, HEV = hybrid electric vehicle, l = litre, R&D = research and development, PHEV = plug-in hybrid electric vehicle.

* There was no formal requirement. However, the local adoption of the Euro 2 emission standard plus the export requirement can be regarded as making the adoption quasi-mandatory.

Source: author's investigation.

Whereas the earlier product champions required a relatively high investment and output targets to qualify for subsidies, the latest iteration of the EV programme lacks such clear requirements and evaluation criteria. What may be described as a balance between incentives and investment requirements in the past has degenerated into subsidisation that does not require significant investor performance. Arguably, the inability to establish performance criteria is due to the uncertain nature of the targeted technology. It follows that whilst the product champion approach has its merits if technology is developing rather incrementally, it is not suitable to target technologies that are more radical and unpredictable in nature. If Thai policymakers intend to continue targeting specific product champions, it appears advisable to focus on ICEV segments for which global demand may be forecasted more reliably.

In more general terms, this suggests that Thailand should shift away from traditional industrial policy instruments such as the product champion approach towards a more encompassing innovation policy. Simultaneously, it is noteworthy that the EV programme is embedded into a broader EV plan that seeks to create linkages with other sectors, such as smart electricity grids, i.e. there are signs that Thai policy is already shifting towards innovation policy. As outlined above, however, established policy tools may have to reconfigured or even abandoned for this shift.

Concerning EV component production, it appears advisable to reconsider support for EV battery production. As value-added is low if only pack or module production is conducted, providing incentives corresponding to the particular stage of battery manufacturing performed in Thailand seems reasonable. Creating different echelons of support could encourage firms to perform more production steps inside Thailand, allowing the country to capture higher value-added. In this way, Thailand may not overpay investors that only locate pack assembly. Regarding the preceding refining and processing stages of the EV Li-ion value chain, it appears unlikely that Thailand will be able to attract production. This is not due to deficient policy but rather due to a very narrow specialisation in these processes by a few Northeast Asian firms. Even advanced economies, such as France, Germany, and the US, do not play any significant role in this part of the global supply chain, i.e. production in these countries also only starts at the cell stage at the earliest.

Secondly, regarding the product champion approach, its potency must be scrutinised more critically. Whilst the term appears appropriate for pickup trucks, which dominate both domestic sales and commercial vehicle export, the term appears questionable for eco-cars. As discussed, eco-cars have never constituted a dominant share of Thai passenger car exports. Whilst passenger car export growth has accelerated after the eco-car programme was implemented, exports of larger passenger cars grew more strongly than eco-cars. Whilst this suggests that the product champion policy failed, this may not necessarily be true.

Considering the question of why export growth occurred mainly in the above segments targeted by the eco-car programme, the cases of Mazda and Toyota may hint at an explanation. Whilst the Mazda

2 model is part of the programme, only its gasoline version meets the programme criteria. Whilst the gasoline engine with 1.3 L engine displacement does not exceed the engine capacity requirement, the diesel engine (1.5 L) falls outside this requirement. Regarding Toyota, the model that qualifies under the programme is the Yaris (1.2 L gasoline), which has been produced since 2013 at the Gateway plant in Chachoengsao province. In the same year, Toyota also started to produce the Vios (1.5 L gasoline; 1.5 L flex fuel since 2016) at the same location. Both vehicles are based on Toyota's B platform. Both examples suggest that carmakers have developed increasingly encompassing product platforms or architectures that allow them to simultaneously meet politically defined production requirements and retain manufacturing flexibility to produce vehicles that fall outside targeted parameters. Thus, the export growth of non-targeted segments may be attributed to the utilisation of production capacity for vehicles outside the policy target. The capability to produce a mix of politically supported and other vehicles is beneficial to carmakers in case targeted vehicle types prove unsuccessful in the market. Concerning the product champion approach, it may have been successful at attracting manufacturing investment to Thailand, but the increasing scalability of product platforms (or better architectures) allows carmakers to comply with policy requirements and simultaneously retain options to shift production away from targeted vehicle types if the market shifts towards non-targeted types. It follows that evaluating the success (or lack thereof) becomes increasingly complicated due to more adaptable design and production. Policy may accidentally have targeted vehicle types that fall within the scope of a sufficiently adaptable platform, and OEMs decided that untargeted types of these platforms had higher export potential than targeted eco-cars alone.

6. Conclusion

Thailand's position in EV and related parts production was investigated against the background of industrial policy and global supply chains. For the former, Thailand is not currently a significant producer of EVs or EV-grade batteries but may have the potential to participate in the production of other components, such as electric motors, converters, and inverters. Further, at least two Japanese carmakers plan to make Thailand their secondary EV production hubs after their home country, suggesting that Thailand may successfully transform itself from a producer of conventional vehicles to one of electric alternatives.

Regarding policy, past Thai targeting appears to have been relatively successful. However, the case of eco-cars indicates that despite targeting smaller passenger cars, export growth did also occur in other passenger car segments. Thus, it may be questioned whether policy achieved its objectives even in cases that appear superficially successful.

Finally, the product champion approach of targeting a particular vehicle type for production and export clearly reaches its limitations when it is employed to target more innovative technology, such as EVs. Thus, whilst this policy tool can be successfully used within favourable framework conditions, it may be inappropriate when the context changes. Therefore, adapting policy tools towards changed framework conditions, or in this case shifting from industrial towards more encompassing innovation policy, seems to be advisable.

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Appendix: Electric Vehicle Lithium-Ion Battery Supply Chain Locations

Product	Component	Part	Company	Country of Origin	Production Location(s)
Pack			AESC	China	Jiangsu (China); Kanagawa (Japan); Tyne and Wear (United Kingdom (UK)); Tennessee (United States (US))
			BYD	China	Guangdong (2x), Qinghai, Under construction: Chongqing (all: China)
			CATL	China	Guangdong, Jiangsu, Qinghai (China); Under construction: Thuringia (Germany)
			Dräxlmaier	Germany	Baden-Württemberg & Bavaria (Germany); Chonburi (Thailand)
			Energy Absolute	Thailand	Under construction: Chachoengsao (Thailand)
			GS Yuasa	Japan	Kyoto (2x) (Japan); Borsod-Abaúj-Zemplén (Hungary)
			LG Chem	Republic of Korea	Chungcheongbuk (Republic of Korea); Jiangsu (China); Lower Silesia (Poland); Michigan (US)
			Northvolt	Sweden	Västerbotten (Sweden)
			Panasonic	Japan	Hyogo (3x) (Japan); Liaoning (China); Nevada (US)
			Samsung SDI	Republic of Korea	Styria (Austria); Jilin (China); Pest (Hungary); Michigan (US)
			SK Innovation	Republic of Korea	Chungcheongnam (Republic of Korea); under construction: Jiangsu (China); Komárom-Esztergom (Hungary); Georgia (US)
	Battery management system (BMS)		Calsonic Kansei	Japan	
			Denso	Japan	
			Dräxlmaier	Germany	
			Hyundai Kefico	Republic of Korea	
			Mitsubishi Electric	Japan	
	BMS semiconductor		Fujitsu Semiconductor	Japan	
			Infineon	Germany	
			NXP	Netherlands	
			Renesas	Japan	
			Texas Instruments	US	
Cell			AESC	China	Tyne and Wear (UK); Tennessee (US)
			BYD	China	Guangdong (2x), Qinghai, Under construction: Chongqing (all: China)

			CATL	China	Guangdong, Jiangsu, Qinghai (China); Under construction: Thuringia (Germany)
			GS Yuasa	Japan	Kyoto (2x) (Japan)
			LG Chem	Republic of Korea	Chungcheongbuk (Republic of Korea); Jiangsu (China); Lower Silesia (Poland)
			Northvolt	Sweden	Västerbotten (Sweden)
			Panasonic	Japan	Hyogo (3x) (Japan); Liaoning (China); Nevada (US)
			Samsung SDI	Republic of Korea	Ulsan (Republic of Korea); Shaanxi (China); Pest (Hungary)
			SK Innovation	Republic of Korea	Chungcheongnam (Republic of Korea); Under construction: Komárom-Esztergom (Hungary); Georgia (US)
	Cathode	Aluminium foil	UACJ Foil	Japan	
		Active materials	Nichia	Japan	Tokushima (Japan)
			Toda Kogyo	Japan	Yamaguchi, Fukuoka (Japan); Michigan, Ohio (US)
			Umicore	Belgium	Guangdong (China); Chungcheongnam (Republic of Korea); Under construction: Opole (Poland)
	Anode	Cooper foil	Furukawa Electric	Japan	Tochigi (Japan)
			Nippon Denkai	Japan	Ibaraki (Japan)
			UACJ Foil	Japan	Shiga (Japan)
		Active materials	BTR Energy	China	Heilongjiang, Shaanxi; Under construction: Guangdong) (all: China)
			Hitachi Chemicals	Japan	Ibaraki (Japan)
			Nippon Carbon	Japan	Toyama (Japan)
			ShanShan Tech	China	Hunan, Shanghai, Zhejiang (2x) (all: China)
	Electrolyte		CapChem	China	Jiangsu (China); Lower Silesia (Poland)
			Panex-Etec	Republic of Korea	Chungcheongnam (Republic of Korea); Johor (Malaysia)
			Mitsui Chemicals	Japan	Aichi (Japan); Zhejiang (China)
			Ube	Japan	Osaka (Japan); Jiangsu (China); Michigan (US)
			Zhangjiagang Guotai-Huarong	China	Jiangsu (China); Lower Silesia (Poland)
	Separator		Asahi Kasei	Japan	Miyazaki, Shiga (Japan); Shanghai (China), Chungcheongbuk (Republic of Korea); North Carolina (US)
			SK Innovation	Republic of Korea	Chungcheongbuk (Republic of Korea); Under construction: Jiangsu (China); Silesia (Poland)

		Teijin	Japan	Chungcheongnam (Republic of Korea)
		Toray	Japan	Tochigi (Japan); Chungcheongbuk, Gyeongsanbuk (Republic of Korea)

Source: Author’s investigation.

CHAPTER 3

THE AUTOMOTIVE INDUSTRY IN MALAYSIA

Makoto Anazawa

Introduction

Malaysia's national car project was planned since the early 1980s. It was a unique project compared to those in other developing countries, including the Association of Southeast Asian Nations (ASEAN) Member States. The project was to develop the automotive industry with a focus on national cars. However, there have been large changes in the circumstances of the automotive industry from the 1980s until present, such that the automotive industry in Malaysia currently standing at a crossroads.

We will review the development and present state of the automotive industry in Malaysia, followed by a description of the national car projects, mainly Proton and Perodua. In the third section, we will refer to industrial policies and the National Automotive Policies (NAP). The final section concludes.

1. The Automotive Industry in Malaysia

1.1. Brief history of the automotive industry in Malaysia

After Malaysia gained its independence in 1957, European companies started completely knocked down (CKD) automobile production in the 1960s. Japanese companies entered the market during the latter half of the same decade. All of them were joint ventures with local companies, and the automotive industry was developed as an import-substituting industry. However, due to the small domestic market in Malaysia, none of them could enjoy an economy of scale.

Japanese companies occupied more than 70% of the domestic market (including passenger cars and commercial vehicles) before the establishment of the national car company, Proton. Although the main parts were imported for CKD production, some parts were produced by local companies with joint ventures or alliances with foreign companies.

In the 1980s, the Malaysian government started import substitution for heavy industries, including the automotive sector. Manufacturing businesses in Malaysia were mainly run by foreign-owned and Malaysian Chinese (Chinese-ethnic Malaysian) companies. The government intended to expand the entry of Bumiputera[1] companies into the manufacturing sector in keeping with the New Economic Policy (NEP)[2], which started in 1971. As Bumiputera companies lacked much capital and experience,

[1] 'Bumiputera' means 'child of the land' in the Malay language, which represents ethnic Malays and the natives of Sabah and Sarawak.
[2] The policy included poverty eradication and the enhancement of Bumiputera participation in commerce and industrial sectors.

the government itself initiated industrialisation by establishing public companies (government-owned or linked companies). Public companies played significant roles in leading industrialisation after the 1970s. In particular, the Heavy Industry Corporation of Malaysia (HICOM) was established in 1980 to play the role of a promoter of heavy industries. HICOM set up joint ventures mainly with Japanese companies. As a conglomerate, it included in its portfolio not only the first national car manufacturer, Perusahaan Otomobil Nasional Bhd (Proton), but also joint ventures of cement, steel, and motorcycle manufacturing. The decision to have joint ventures with Japanese companies might have been influenced by the Look East Policy[3] and the increasing global presence of Japanese companies in heavy industries.

The government initiative for Proton was promoted under the strong leadership of Prime Minister Dr. Mahathir Mohamad. Due to the difficulty in integrating automotive production through a local company alone, Proton was established as a joint venture with Japanese companies in 1983. HICOM invested 70% and Mitsubishi Corporation and Mitsubishi Motors invested the remaining 30% of the total capital of RM150 million.

The national car project in Malaysia was referred to in the industrial master plan and its future plan was drawn up in the Medium- and Long-Term Industrial Master Plan Malaysia, 1986-1995 (IMP), which was announced in 1985. The IMP showed Proton's role in developing local parts manufacturers during the period, and some related policies were introduced.

In response to the IMP, which suggested another national car project, Perusahaan Otomobil Kedua Sdn. Bhd. (Perodua) was established in 1993. Perodua was the second national car manufacturer and was a joint venture with Daihatsu. From 1994, Perodua started to sell a compact car based on Daihatsu' Mira model. When Perodua entered the market, Proton no longer enjoyed its Gulliver-type oligopoly. Since then, both companies have continued to maintain an oligopoly by keeping the lion's share of the market from the early 2000s.

The number of national car manufacturers has increased in Malaysia. There are another three companies: Malaysian Truck and Bus (MTB), which produces trucks; Industri Otomotif Komersial Malaysia Sdn. Bhd. (Inokom), which produces commercial vehicles; and NAZA, which mainly produces passenger cars. In spite of the entrance of other national car manufacturers, the production volumes of both Proton and Perodua have been much larger than the other companies.

Trade liberalisation in ASEAN, which began in 1992, was a big turning point for the automotive industry in Malaysia, which had been protected up until then. The Second Industrial Master Plan, 1996-2005 (IMP2), which started in 1996, showed a way to strengthen the competitiveness of the automotive industry to face trade liberalisation. More specifically, it described the intensification of the automotive industry's research and development abilities, human resource development, and overseas expansion.

With the implementation of the Common Effective Preferential Tariff (CEPT) scheme in the ASEAN Free Trade Area (AFTA), Malaysia had to decrease its import duties to 0%–5% by 2002. However, the government designated automobiles as sensitive items in order to hold off trade liberalisation until 2005. In 2004, the government suddenly decreased its import duties for fully assembled vehicles and CKD parts. Following the formulation of the National Automotive Policy (NAP), further decreases in import duties were made in 2006. However, an excise tax was strategically imposed to offset the

[3] The policy endorses the importance of learning the work ethics of Japan and the Republic of Korea.

decrease in import duties. The import duties of general automobile parts in ASEAN decreased before those for fully assembled vehicles and CKD parts were reduced, and the rates for them were below 5% for almost all items by 2003.

The conclusion of the Economic Partnership Agreement (EPA) between Japan and Malaysia in 2007 further accelerated the liberalisation process. Under the EPA, automobile-related tariffs must be reduced gradually by category, and all import duties were abolished by 2015. For the purpose of strengthening the competitiveness of the automotive industry in Malaysia, Japan agreed to offer support in various ways. A total of 10 projects have been initiated, including the introduction of the Toyota production system and business-matching to automotive parts manufacturers in Malaysia.

The NAP, which was announced in 2006 also appeared in the Third Industrial Master Plan, 2006-2020 (IMP3). IMP3 pointed out the future direction of the automotive industry in Malaysia. The NAP was further revised in 2009 and implemented as NAP 2009. NAP 2009 included maintaining and expanding competitiveness amid progressing trade liberalisation and developing environmentally friendly technology. NAP 2009 retains the agenda of expanding Bumiputera business participation, which is a special yet important issue in Malaysia. In 2014, NAP 2014 was revealed. It emphasised investment, technology, human capital, and environmental issues. The details will be presented in Section 3.

Proton always gained attention as the first national car manufacturer and as a government-owned company. In 2012, it was bought by DRB-HICOM, a non-governmental company. Although DRB-HICOM has embarked on city development, its main business remains in transportation equipment such as automotive equipment. It collaborates with foreign companies to produce CKD, automotive parts, and motorcycles. DRB-HICOM agreed to sell 49.9% of Proton’s equity to Geely in China at the end of 2017. Geely paved the first step for penetrating into the Malaysian market.

In 2018, Dr. Mahathir returned to the position of prime minister and announced the Third National Car Project. A Malaysian company, DreamEdge, was appointed to be the anchor company of this project.

1.2. Development of the automotive industry

The ownership of passenger cars in Malaysia has already surpassed 9 million units. The ownership ratio is 3.3 persons per 1 car. This is the largest ownership ratio in ASEAN. Since the domestic market in Malaysia is rather small and has already matured, we cannot expect further rapid expansion in the domestic market. Hence, there is a strong awareness of the need to export completed vehicles and parts and components. The future direction for both automotive manufacturers and parts manufacturers, as it was shown in the NAP, will be to penetrate foreign markets.

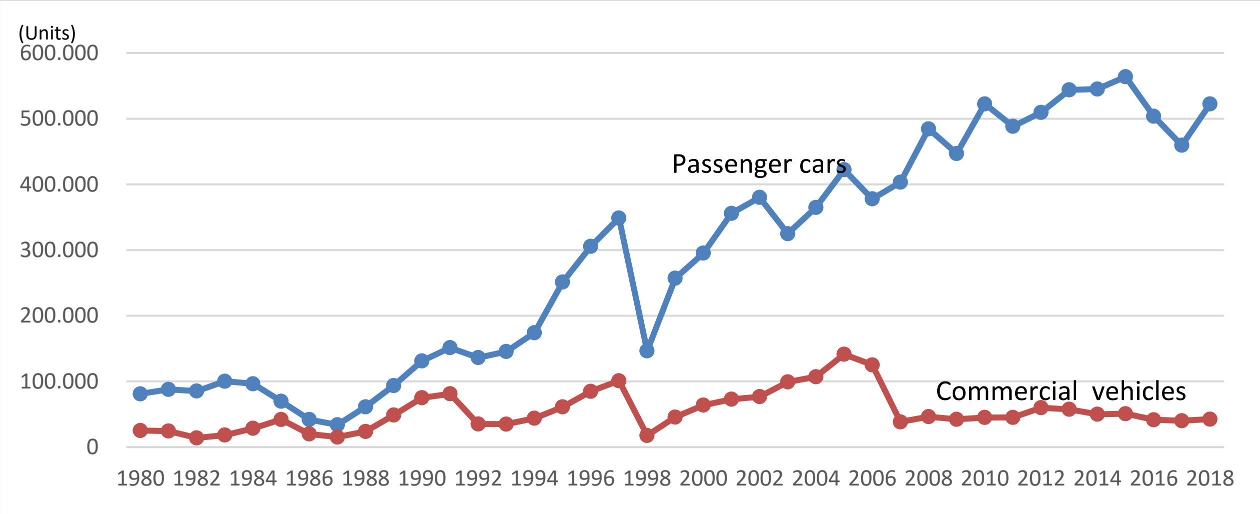
A feature of the automotive market in Malaysia is the predominance of passenger cars. This is quite different from the other ASEAN Member States, where commercial vehicles comprise rather high market shares. Figure 3.1 shows the changes in the production volumes of passenger cars and commercial vehicles from 1980 to 2018. It is observable from the figure that the passenger car production volume increased to more than 500,000 to 600,000 units from around 100,000 units in 30 years. On the other hand, the volume of commercial vehicles stayed below the production volume of passenger cars at only about 140,000 units, even at its peak period in 2005. After 2007, the production volume has been keeping stable at around 50,000 units.

Even though the volume of passenger cars has increased exponentially, the production volume of passenger cars has sharply decreased twice. The first decline occurred in the middle of the 1980s, with negative economic growth experienced for the first time after the country's independence. Due to the economic depression, both the production and sales volumes experienced significant drops. The second decline took place during the economic slump in 1998, immediately followed by the Asian financial crisis of 1997. The production of passenger cars decreased by 52% from 1997 to 1998.

A nearly parallel upward movement in the sales volume and production was observed. This suggests that sales of imported cars were relatively small. Recent trade liberalisation has caused an increase in imports of passenger cars. After 2007, commercial vehicles experienced sluggish growth in terms of production. On the other hand, sales of commercial vehicles grew slightly. This suggests the increasing sales volume of imported commercial vehicles.

Since there is preferential treatment for passenger cars in the automotive market in Malaysia, both production and sales mainly concern passenger cars. With the diversification in consumer needs and increasing incomes, the demand for vehicles other than passenger cars has shown an increase.

Figure 3.1. Automotive Production Volumes of Passenger Cars and Commercial Vehicles in Malaysia



Source: Data from 1980 to 1985 is from Malaysia Industrial Development Authority (MIDA). Data from 1986 to 2004 is from Fourin (2006). Data from 2004 onwards are from Fourin (2017) and the Malaysia Automotive Association (MAA) (2019).

Within the market segment of passenger cars, the demand for foreign luxury cars is expanding. This trend does not favour Proton, because its brand name is still weak compared to the strong brand names of foreign car manufacturers, and Proton is facing tough competition in the market.

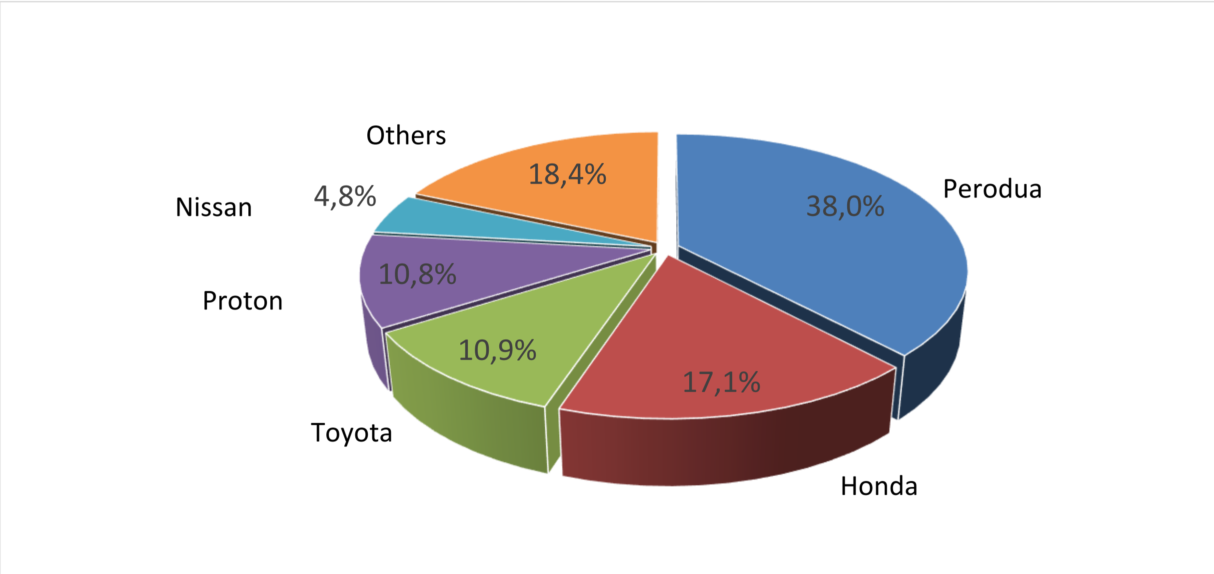
As mentioned above, Japanese automotive manufacturers enjoyed a large market share before Proton entered the market in 1985. Since Proton joined the market, the composition has changed, with Proton capturing nearly 60% of the market share during certain periods. The new entry of Perodua in 1994 caused a considerable reshaping of the market. Proton had been keeping around a 50% market share until 2001, but after 2003 it dropped sharply, and by 2006 it had fallen to less than 30%, only to drop again to its present market share of 10%. On the other hand, Perodua has kept its market share of 20%

since 1998. It managed to achieve a 30% market share after 2006 and overtook Proton to dominate the market. Besides these two national cars, the share of Japanese automotive manufacturers, such as Toyota and Honda, has increased since 2003. The general increasing trend in automotive production can be observed from 2000 in the figure, although there have been some ups and downs in production levels over the years.

1.3. Current state of the automotive industry in Malaysia

According to the latest manufacturing census in 2015, there are 33 passenger car manufacturers and 45 commercial vehicle manufacturers. The production value of passenger cars, RM29,651 million, is much larger than that of commercial vehicles, at RM2,156 million.[4] The total number of employees amounts to 28,585 persons. There are 525 automotive parts companies with production totalling RM21,339 million and employing 49,677 persons. The production value of bodies for vehicles by 139 companies reached RM1,306 million with 4,654 employees.

Figure 3.2. Market Shares of Major Companies in 2018



Note: The chart shows the share of total sales of passenger cars and commercial vehicles.
Source: MAA (2019).

The total value of production for the abovementioned three sectors is RM 54,456 million, which is equivalent to 4.8% of the total production of all manufacturing industries in Malaysia. This figure is much smaller than that for electronics-related production (28.2%), oil products-related production (26.2%) and food-related production (17.5%). The employment share is even lower, accounting for only 3.9% of the total of all manufacturing industries in Malaysia.

Figure 3.2 shows the market shares (for passenger cars and commercial vehicles) of major companies

4 The US dollar–ringgit exchange rate was around RM4.0780 as of 1 December 2020.

in 2018. Currently, Perodua has the largest market share of 38%, and its share has been increasing in the last five years. Honda recently has the second-largest market share. Toyota has been supplying both passenger cars and commercial vehicles and is in the third-ranked position. Proton, which used to have the lion's share for many years has failed even to keep third position and has dropped to fourth. The Nissan brand produced by Tan Chong Motor is fifth by market share. The total share of national car producers has been decreasing because of the bad sales situation by Proton. On the other hand, Japanese car producers are increasing their market share gradually.

The national car producers Proton and Perodua will be discussed in the next section. The profile of the other major producers will be presented below.

In November 2000, Honda was established as a joint venture with three companies, namely, Honda, DRB-HICOM, and Oriental Holdings. The investment ratio was 51%, 34%, and 15%, respectively. Its production capacity for passenger cars is about 100,000 units per year, but it also has assembly for engine frames and constant velocity universal joints. Honda Malaysia is one of Honda's major production bases for constant velocity universal joints in the world, and it exports them to other subsidiaries.

The production of Toyota cars was conducted by a local company, Assembly Services, from 1968. Toyota was established in 1982 as a joint venture with a local company, UMW. The capital amounted to RM59 million with a shareholder structure of UMW at 51%, Toyota at 39%, and Toyota Tsusho at 10%. UMW Toyota has three subsidiaries. Two companies are in charge of production, whilst the other one produces parts for their group companies. UMW also invested in Perodua. Toyota also has three subsidiaries, including the Japanese parts manufacturer. The subsidiary, which produces parts, was established for the purpose of domestic sales as well as exports.

Toyota's sales in Malaysia increased from 2003 when 40,000 units in sales were recorded. In 2005, sales increased sharply to reach 91,000 units. The sales volume was in the range of 83,000 to 91,000 units after 2005, and around 60,000 units in 2018, amounting to 10.9% of the market share. After 2007, sales exceeded production due to the increasing sales of imported cars.

The production capacities of Toyota's subsidiaries in Thailand and Indonesia were exceeding those of Malaysia. Based on the specialisation strategy for the ASEAN market, the Hiace model was produced in Malaysia and exported to Thailand in the early 2000s. The parts-producing subsidiary in Malaysia contributes to the mutual complementation of parts within the subsidiaries of Toyota in ASEAN.

A local company, Tan Chong Motor produces passenger cars in cooperation with Nissan and Renault. The history of the company goes back to the first OEM production of the Nissan car that was manufactured from the 1970s.

1.3 Trading patterns

Figure 3.3 shows the trading pattern of passenger cars from 2000 to 2017. Under AFTA, and later the ASEAN Economic Community (AEC), trade was liberalised. However, in terms of the trade of passenger cars, imports surpassed exports, resulting in huge trade deficits. AFTA encouraged the import of passenger cars from Thailand and the EPA with Japan promoted to import of cars from Japan. These two countries have been major exporters of passenger cars. Germany maintained its third-ranked position after Japan and Thailand until 2008 and surpassed Thailand in 2009 and Japan in 2017 to become the largest exporter of passenger cars to Malaysia with a share of imports of 45.0%.

As explained in Section 2, still, the domestic market in Malaysia is predominantly occupied by locally produced passenger cars. The exports of passenger cars are still limited and not contributing to the production enlargement of local producers. In 2017, Thailand was the major exporting destination, comprising more than 80% of the total exported Malaysian passenger cars.

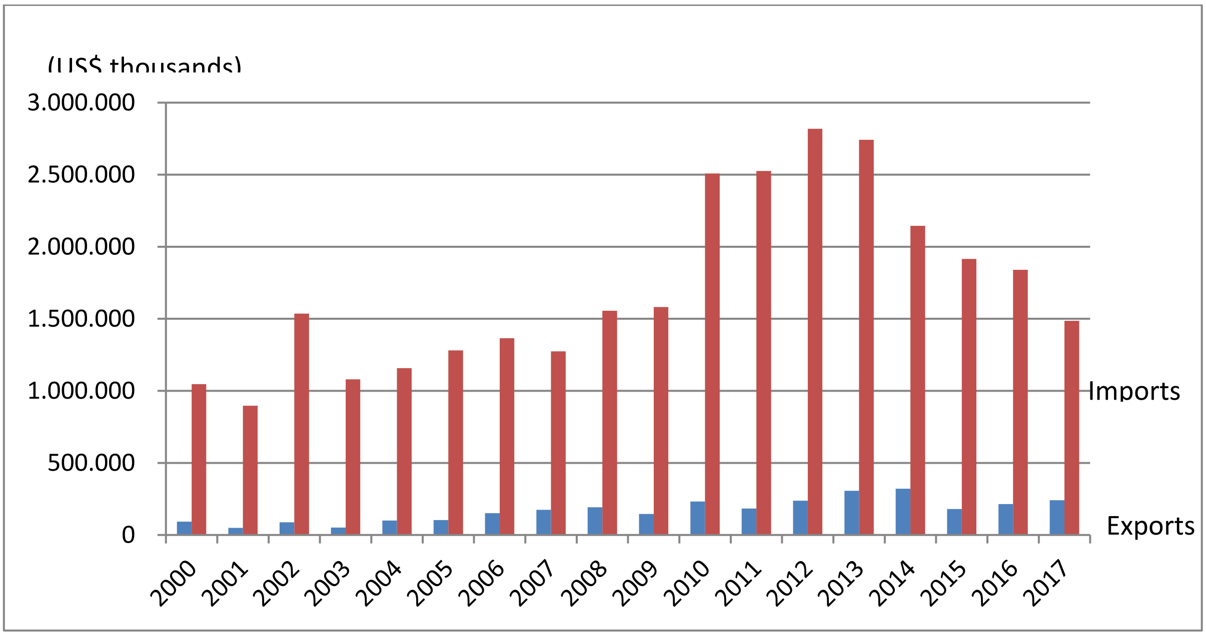
Exports and imports of passenger cars have fluctuated based on the strategies of the major foreign car producers in ASEAN. For many passenger car producers, Thailand is the largest production base followed by Indonesia. For instance, Perodua used to export small cars to Indonesia under the strategies of the Daihatsu group.

The census of the manufacturing sector in 2015 revealed that the export ratio (the percentage of exports in the total sales value) of motor vehicles (passenger cars and commercial vehicles) was 11.5%. Out of 78 manufacturers, 22 companies were involved in exports. However, if we compare with the figures for the export-oriented industries, such as electronics, we can see an export ratio of over 80%, so the figure for motor vehicles was much smaller.

The trade pattern of commercial vehicles is similar to that of passenger cars. We can observe again a huge trade deficit. The import amounts are, however, much smaller than those of passenger cars because of the rather limited domestic market, and exports of the commercial vehicles were negligible.

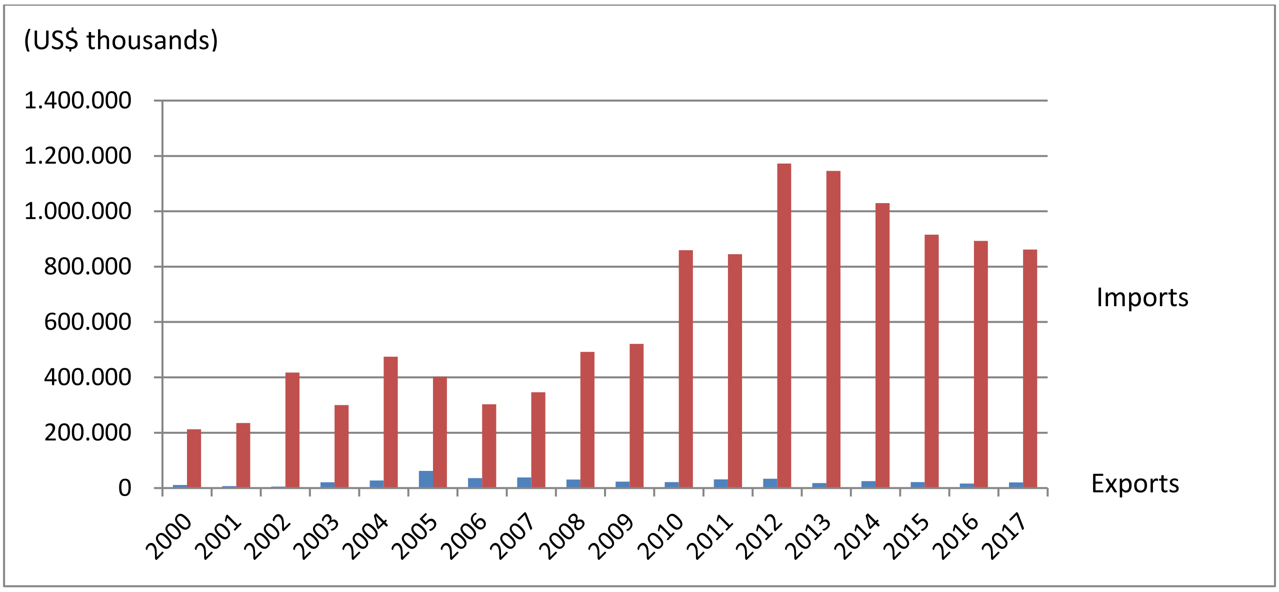
The major export markets for commercial vehicles have been Indonesia, Thailand, and Papua New Guinea. The export amounts to the former two countries have fluctuated year by year; on the other hand, exports to Papua New Guinea have been showing an increasing trend.

Figure 3.3. Exports and Imports of Passenger Cars



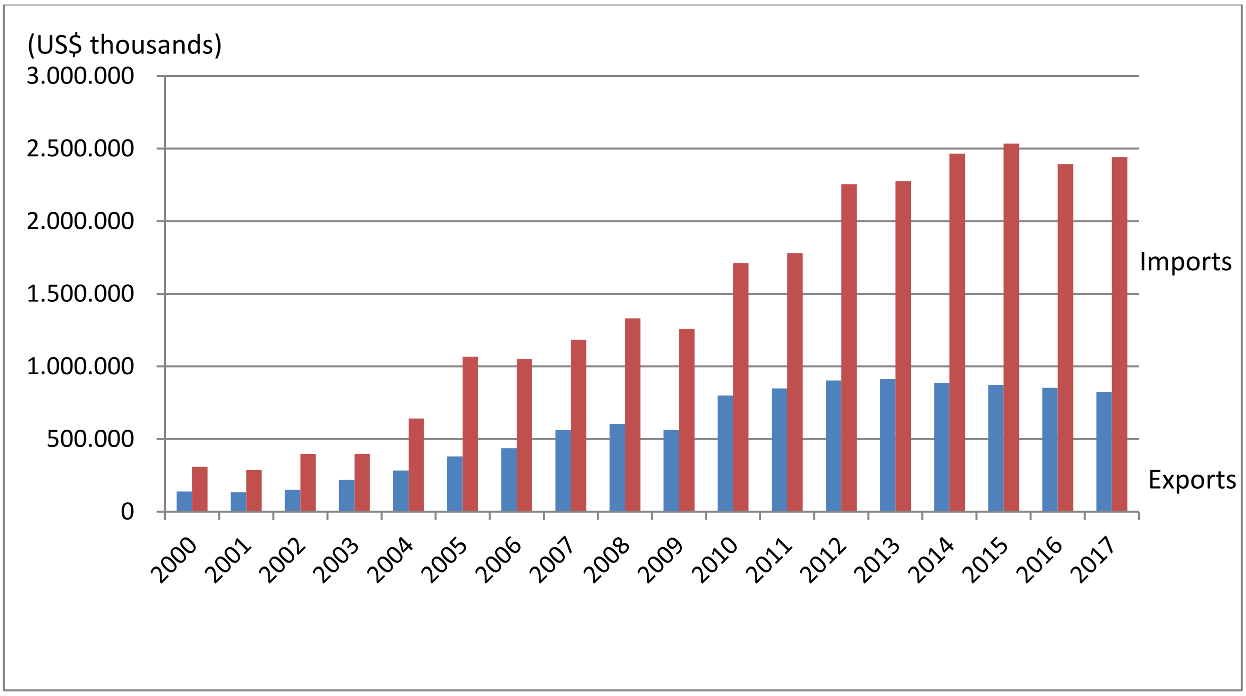
Source: United Nations, Comtrade Database (http://comtrade.un.org.; accessed 19 December 2019).

Figure 3.4. Exports and Imports of Commercial Vehicles



Source: United Nations, Comtrade Database (http://comtrade.un.org.; accessed 19 December 2019).

Figure 3.5. Exports and Imports of Parts and Components



Source: United Nations, Comtrade Database (http://comtrade.un.org.; accessed 19 December 2019).

For Malaysia, Japan has been the largest exporter of commercial vehicles for many years. Imports of commercial vehicles from Thailand increased from 2010, and Thailand became the largest exporter of commercial vehicles to Malaysia in 2012. In 2017, imports of commercial vehicles from Thailand comprised 50.7% of total imports, followed by Japan at 36.0%. Since the domestic market for commercial vehicles is rather small in Malaysia, the major Japanese car producers preferred to supply from Japan and Thailand. Under AFTA and the AEC, some amount of exports from Japan were replaced by commercial vehicles produced by Japanese companies in Thailand.

The trade deficits for parts and components are not as large as those for passenger cars and commercial vehicles. The exporting markets for Malaysian auto parts manufacturers are diversified. For instance, the largest exporting market, China, comprised 10.7% of total exports in 2017, followed by Thailand at 9.8%, Singapore at 8.9%, Indonesia at 7.4%, and Japan at 7.0%. According to the census of the manufacturing sector in 2015, 167 companies out of 525 parts manufacturers were engaged in exports with a total export ratio for the sector of 27.7%.

Because of the small domestic market in Malaysia, some foreign parts producers, mainly from Japan and some from Germany, supply both domestic and foreign markets to enjoy the scale merits. In particular, Japanese companies, which have a long history of mutual trading in parts and components under the Brand to Brand Complementation (BBC) scheme within ASEAN since the 1980s, have already built up the supply chains in ASEAN. Free trade under AFTA and the AEC further accelerated mutual trade in parts and components in the ASEAN region.

As was explained in the previous section, subsidiaries of Toyota have been exporting steering wheel parts to other ASEAN countries. Denso has factories in ASEAN-4 and each subsidiary specialises in specific parts and exports them to each other. Honda has been producing constant velocity universal joints and exports to major Honda factories all over the world.

Imports of parts and components increased from 2004 when Malaysia decreased its import duties. Except for Proton and Perodua, other Malaysian car producers are involved in CKD production. Major parts and components are imported from other countries. In 2017, Thailand was the largest exporter to Malaysia, since Thailand is the largest production base in Asia for most of the Japanese car manufacturers. Imports from Thailand comprised 33.7% of total imports in 2017. However, its share in total imports had been decreasing. This was the same for the case of imports from Japan, which had a share of 21.0% in the same year. On the other hand, the figures for China and Germany have been increasing and reached 13.9% and 11.5%, respectively. The diversification of parts imports is related to the supply chain management of major manufacturers. Many Japanese parts manufacturers established subsidiaries in China and can produce some parts and components at lower prices. We cannot deny the possibility that Chinese products have been replacing Japanese products under the new Asian supply chain.

1.4. Research and development

The actual situation of research and development (R&D) in the automotive industry is different from company to company. Nevertheless, an overall picture can be gleaned from the census of manufacturing sector published by the Department of Statistics. Total R&D expenditure of automotive manufacturers in 2015 was RM134.5 million, which corresponded to 0.4% of the total sales value. Total R&D expenditure of automotive parts manufacturers amounted to RM190.4 million, comprising 0.9% of their total sales amount.

R&D expenditure depends on the individual company, and we must be careful when generalising a trend. For the automotive industry as a whole, total R&D expenditure is still not large. Most of the automotive manufacturers in Malaysia that originate from developed countries tend to depend on their parent companies for their R&D functions. Hence, it is not usual for foreign automotive subsidiaries in Malaysia to have their own R&D facilities. As for national car manufacturers, the R&D of both Proton and Perodua is mainly undertaken in cooperation with foreign partners.

1.5. The automotive parts industry

As stated previously, there are 525 companies in the automotive parts in the automotive parts industry. According to the manufacturing census, production was valued at RM24,339 million with a workforce of 49,677 employees in 2015. In terms of exports, foreign-owned companies showed a higher export ratio, and local parts companies are less active in exporting their products. There are 167 exporting companies in total, and the export ratio in the industry as a whole is 27.78%. In some cases, automotive manufacturers, such as Perodua and Honda, have been exporting some auto parts. Toyota is also exporting parts produced by its parts manufacturing subsidiaries in the same group.

As mentioned in Section 1, all the automotive manufacturers employed CKD production systems during the 1960s and 1970s. Some local parts manufacturers complemented or supplied to the aftermarket. However, this situation changed with the establishment of Proton. Under the national car project, Proton not moved towards the integration of the production of passenger cars but also proceeded to the localisation of parts. Most of the members of the Malaysia Parts and Components Manufacturers Association (MAPCMA), some of which had formally produced parts before Proton's establishment, became major suppliers for Proton. Some foreign companies also set up new subsidiaries to correspond with the parts localisation in Malaysia. Also, some Bumiputera companies entered the auto parts industry to enjoy the new business opportunities for them under the NEP.

One of Proton's additional and unique roles as a national car manufacturer was to develop local parts manufacturers, especially Bumiputera vendors, it was actively involved in this direction from 1998. The government also provided financial support to Bumiputera vendors in order to develop the supporting industry. Proton provided various support, as mentioned before, and purchased parts from Bumiputera companies. As a result, many Bumiputera companies entered the parts industry, and some of them relied heavily on business with Proton.

According to a study of Proton vendors, vendors can be divided into three groups based on their need for support from Proton, their business size, running year, and local and foreign equity share (Anazawa, 1998). These groups are the foreign-owned companies, Malaysian Chinese companies, and Bumiputera companies. The Bumiputera companies were less competitive than the Malaysian Chinese companies, but they improved their technology levels with support from Proton or Perodua or through technical assistance from Japanese companies. Some Bumiputera companies with such improvement strategies became first-tier vendors, and some exported their products or entered into overseas production. In addition, there was a polarisation amongst Bumiputera vendors. Some grew larger and caught up to the level of the existing Malaysian Chinese vendors, but others remained small and continued to depend heavily on the national car manufacturers.

The polarisation was accelerated by introducing modularity from Proton. There was no differentiation amongst vendors in the beginning stages, in that the first- and second-tier vendors delivered directly to Proton from their respective companies. In the case of modularity, however, the delivery system then changed whereby only the first-tier vendors delivered directly to Proton, whilst the rest delivered to the first-tier vendors. The selection of the first- and second-tier vendors was reflected in the capabilities of the vendors. Harder competition from AFTA and the EPA with Japan encouraged Proton to introduce this kind of selection. More detailed observation revealed that the first-tier vendors could also sometimes become second-tier vendors based on the car type and model.

In Malaysia, there are vendor associations that function like those in Japan, to organise activities for the vendors. The Proton Vendor Association, which was established in 1992 and is the oldest, started organising briefings for all the vendors. It implemented some programme for association members, such as company visits and training. Proton, Perodua, and Toyota have an institutionalised vendor association of their own, whilst Honda and NAZA also have similar kinds of associations but of an unofficial kind.

Currently, the members of the Proton Vendor Association number around 150 companies. The Perodua Vendor Association has 125 member companies[5] and Toyota has around 40–50 companies.[6] It is common for some parts manufacturers to have multiple memberships of various vendor associations. It is noted that about 60% of vendors are members of both the Proton and Perodua vendor associations. Besides these vendor associations, there are also industry-based associations, such as the MAPCMA. Originally, many foreign-owned companies and Malaysian Chinese companies were members of the MAPCMA, but Bumiputera companies have also increased in number and, currently, there are 97 companies to date that have joined the MAPCMA.

2. National Car Projects

2.1 Proton

Proton was established as the first national car manufacturer in 1983. It is closely related to industrial policies and government involvement in the automotive industry in Malaysia. Even though there are five national car manufacturers in Malaysia, people pay more attention to Proton than others since the government was the major shareholder of Proton until 2012. Details of the company's development to date are stated below, including the merger and acquisitions exercise by DRB-HICOM in 2012 and the merger by Geely in 2017.

Proton started commercial production in 1985 and introduced the Proton Saga, a prototype based on the Mitsubishi Lancer model. At that time, Malaysia was in an economic recession. Worse, the country also experienced a negative economic growth ratio for the first time after independence. Therefore, the sales volume of automobiles was also in a slump. It was a challenging time for Proton. Fortunately, together with the economic recovery, the sales volume increased and the company reached a 73% market share in 1988. Although the market share again experienced a drop to as low as 60%, it later took an upturn and grew to 74% in 1993.

Proton is a national company that was established under the strong leadership of Dr. Mahathir Mohamad, Malaysia's former prime minister. Proton's role was to assume the responsibilities of:

(1) The rational development of the automotive industry in Malaysia by obtaining and improving

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[5] The number of Proton and Perodua members is according to the member lists of their associations.
[6] Interview with Perodua vendor association member company.

technology, skills, and know-how, as well as the development of the automotive-related or supporting industries;

(2) Providing cars with self-developed models that could fulfil the needs of the Malaysian market at a reasonable price; and

(3) Enabling the participation of the Bumiputera community in the automotive industry.[7]

There were multiple purposes for the birth of the national car project. It was not only to enhance the national reputation by producing national cars and realising the restructuring and concentration of the automotive industry documented in the IMP. Equally important was to also train and support the industry along with business facilitation for the Bumiputera. The first main shareholder of Proton was HICOM, which was a government-linked company that promoted heavy industrialisation and operated in line with the government. Therefore, the Malaysian government offered its full support to Proton.

In its early stage of establishment, Proton employed a large number of Bumiputera operators and trained Bumiputera engineers. It also developed parts manufacturers of Bumiputera origin. Many of the operators and engineers were sent to Japan for training before starting commercial production. Many Japanese employees of Mitsubishi Motors were sent to Malaysia in order to provide on-the-job training to engineers in Proton.

The enhancement of the national reputation may be achieved if national car manufacturers are able to produce cars with a high local content with self-developed designs. Therefore, vendor development was necessary so to respond to the government's targets for the localisation of parts (60% in passenger cars and 45% for commercial cars by 1996). This direction was in line with Malaysia's protectionism towards local automotive manufacturers whereby tariffs were imposed on imported parts that could have been produced or localised within the country. Coupled with the strong appreciation of the Japanese yen after 1985, Proton was pushed to assume the in-house production of parts through a subsidiary of Proton to reduce the production cost by replacing the parts imported from Japan.

Proton's vendor development programme, as a part of the government vendor development programme for small and medium-sized enterprises, started in 1988, and at that time it was called the Proton Component Scheme.[8] Proton sent its engineers to its vendors, also government subsidies were given to vendors through Proton. Besides these activities, Proton introduced the single sourcing of parts and components to maintain a high enough volume of orders to facilitate the vendors' production. It also tried to improve the competitiveness of vendors by promoting technical alliances through match-making with mainly Japanese companies.

Figure 3.6 shows the sales volume and market share of Proton. At the beginning of its establishment, the economic recession created a slump in both production and sales. Following economic recovery, Proton expanded its market share rapidly to occupy the domestic market (including passenger cars and commercial cars) by up to 60% in 1988. Prior to the establishment of Perodua, the second national car project, Proton occupied more than half of the domestic market. With the improvement of consumers' income levels due to economic growth, their needs became diversified, thus causing stagnation in Proton's market share.

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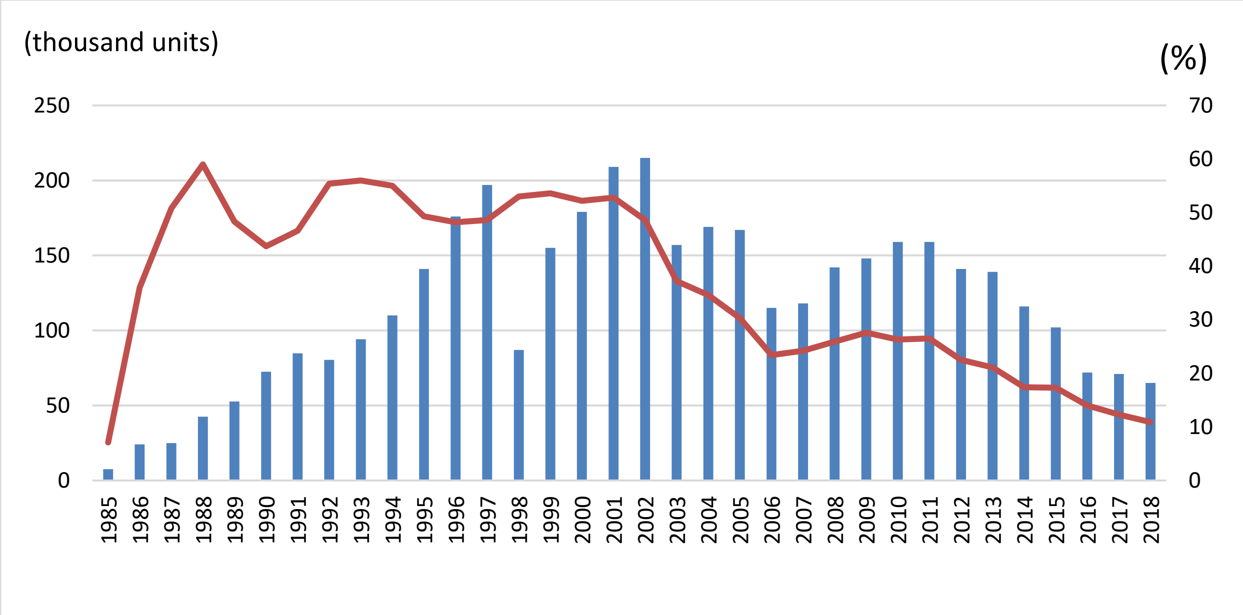
7 According to corporate data by Proton.

8 Please refer to Kawabe (1995) regarding the vendor development programme.

Figure 3.6. Sales and Market Share of Proton



Note: Blue bars denote the number of units; red lines the percentage of market share.
Source: Proton company data obtained by the author.

When Perodua entered the market, the potential demand for cars was developed again in Malaysia. It increased Proton's production and sales to reach almost 200,000 units in 1997, just before the economic downturn hit Asia. The Asian financial crisis in 1998 temporarily slowed the consumption of automobiles. After 1999, the economy recovered and Proton hit record sales of 215,000 units in 2002. Unfortunately, this positive turn did not last for long, and Proton's market share later dropped. One of the main reasons could have been the rising market share of Perodua.

Circumstances completely changed with the announcement in 2003 that the import duties for fully assembled vehicles would be lowered from 2004 onwards. There was some restraint amongst consumers in buying new cars as they wanted to benefit from such a policy, which then affected Proton. In the same period, Proton also experienced a loss of customers. Increasingly, consumers started to consider other choices than Proton cars because Proton had not been able to introduce new cars that satisfied customers. Despite the plan to increase production capacity through the opening of a second factory in Tanjong Malim, Perak in March 2004, Proton's sales dropped and the company could not leverage the additional production capacity.

From the late 1990s, Proton shifted to in-house development. It gradually reduced its dependency on Mitsubishi Motors for R&D. Proton's gradual reduction in dependency on Mitsubishi Motors was deliberate since Proton made use of Lotus from the United Kingdom to remain active in R&D. Lotus was acquired by Proton in 1996 as a subsidiary and became a wholly owned subsidiary of Proton in 2002. New engines for selected car models were made available since the end of 2003. This was a result of co-development between Proton and Lotus. In terms of equity share, the role of the Mitsubishi group was getting smaller. Mitsubishi Motors sold Proton's equities in March 2004 to strengthen its financial position. In January 2005, Mitsubishi Corporation sold Proton's equities, which marked the end of the capital relationship of more than 20 years between Proton and the Mitsubishi group.[9]

Currently, Proton has about 150 vendor companies that support its supply chains. It was identified that around 10 local vendors are competitive globally. There were no distinctions between first-tier and second-tier vendors in the past. However, in the process of producing the new models, second-tier vendors deliver parts and components to the first-tier vendors.

Although Proton is one of the member companies of DRB-HICOM and no longer has an equity shareholding by the government, Proton still pursues the government's policy as a national car manufacturer. Proton will follow the directions shown in NAPs.

In 2017, the Chinese car manufacturer Geely acquired a 49.9% equity share in Proton. Geely sent a managing director and other managers to control the management of Proton, and Proton started to import Geely's sport utility vehicles to cultivate the new domestic market.

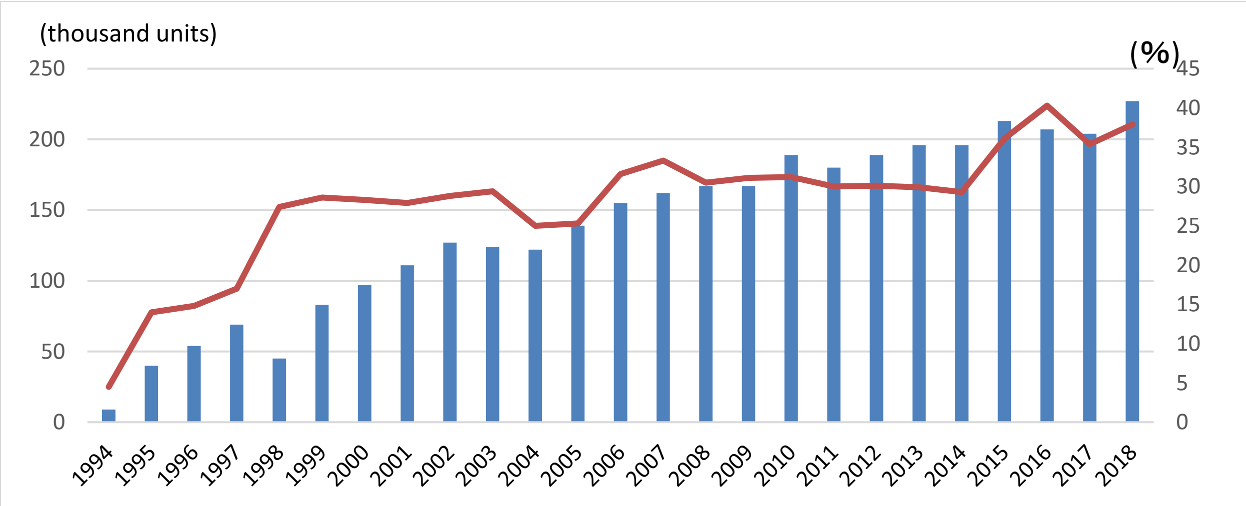
2.2. Perodua

Perodua is the second national car manufacturer and a joint venture with Daihatsu. It was established in 1993 and started its production in 1994. First, the company introduced the Kancil model to the market, which was based on the Mira, an old model of Daihatsu. Whilst Proton produced passenger cars for the over-1300 cylinder capacity class, Perodua produced smaller classes to accelerate motorisation in Malaysia. The introduction of the Kancil model gave people who usually used a motorcycle the opportunity to purchase a car.

Initially, Perodua was invested in by local companies together with Japanese companies. The local companies were UMV (38%), MBM (20%), and PNB (10%), respectively. The Japanese companies in this venture were Daihatsu (7%) and Mitsui Corporation (5%). Subsequently, in 2001, they established a subsidiary for production with shareholding by Perodua (49%), Daihatsu (41%) and Mitsui Corporation (10%) (Japanese Chamber of Commerce in Malaysia, 2011: 357). Furthermore, they also have other group companies.

[9] Please refer to Anazawa (2006) for more details.

Figure 3.7. Sales and Market Share or Perodua



Note: Blue bars denote the number of units; red lines the percentage of market share.
Source: Perodua company data obtained by the author.

Figure 3.7 shows Perodua's sales volume and market share over the years. From starting production in 1994, Perodua rapidly expanded its market share until 1997. As a result of the Asian economic crisis, the company's sales volume decreased in the overall shrinking market in 1998. However, by 2003, its market share expanded to over 25%. In 2004 and 2005, the market share temporarily dropped to around 25% due to the effect of the abolishment of import duties in ASEAN. After 2006, Perodua retained a market share of more than 30% and surged ahead of Proton to become number one in terms of market share. Perodua's competitiveness was based on having popular models, such as the Myvi and the Viva, which occupied the top ranks for each of their classes.

The current production capacity of Perodua is 230,000 units per year (two-shift system), leaving some space for an increase in production. Apart from increasing production, Perodua will focus on the expansion of exports of completed vehicles and engine parts. The in-house production of parts will be also accelerated (Fourin, 2011: 241).

In order to enhance competitiveness, Perodua has been paying more attention to production, products, R&D, and consumer satisfaction since 2011. With increasing production and sales, Perodua has been eager to invest to enlarge its production capacity, and in 2014, it built a new factory to produce energy-efficient vehicles (EEVs). A new engine factory was also built in the state of Negeri Sembilan, located to the south of Kuala Lumpur. Perodua established a subsidiary that produces plastic parts near the main factory.

Currently, Perodua has around 130 local vendors. As was explained, Proton was eager to develop local vendors in the past. However, once Mitsubishi withdrew its investment in Proton, it became difficult for Proton to continue special support to its vendors by itself. On the other hand, Perodua has been trying hard to upgrade the capabilities of its vendors, especially Bumiputera vendors. Perodua has been sending engineers to its vendors and sometimes Perodua engineers stay in those vendors to work to improve quality and productivity. Perodua also has its training centre, which is open to all the vendors.

The productivity of Perodua's new factory is almost the same as that in Japan. Perodua sent some engineers to Japan for training. In the new factory, operators are required to be multi-skilled workers, and for this purpose, a special training programme was also introduced.

2.3. Other national car manufacturers

Other than Proton and Perodua, MTB is another national car manufacturer that was established in 1994 to produce trucks. Production commenced in 1997, with a production volume of trucks ranging from 3,000 to 5,000 units. Currently, MTB is under the DRB-HICOM group.

There is also Inokom, which was established in 1993. It formed a joint venture with the Berjaya group, a local company, Renault (French), and Hyundai (Korean) in 1996 to produce commercial vehicles. Currently, it is under the Sime Darby group and has a production volume of between 1,000 and 1,500 units, which is an indication of its lower competitiveness in comparison with other companies.

The NAZA Group, which was established in 1974, was appointed as another national car manufacturer in 2003. It started to produce multi-purpose vans in cooperation with KIA of the Republic of Korea. Fifteen companies exist within this automotive-related group company. They produce and sell KIA and Peugeot vehicles.

The production volumes and market shares of these three companies – MBT, Inokom, and the NAZA Group – are far below the levels of Proton and Perodua. These three companies have not had a significant influence on the overall automotive industry compared to Proton and Perodua.

2.4 The third national car project

In the national election of the Lower House in 2018, the opposition parties won by keeping majority seats in the Lower House. Former prime minister Dr. Mahathir returned to his role again to lead the Malaysian politics and the economy. He tried to establish a third national car project and gain access to some Japanese companies. Unfortunately, the project was not successful in finding a Japanese partner. In 2019, DreamEdge, a local engineering service provider, was appointed as an anchor company to be in charge of the third national car project. Since DreamEdge does not have any production facilities, it has to cooperate with existing car manufacturers for production. Currently, the project is still ongoing, and the details of the project have not been released yet. So far, it has been announced that production will start in 2023.

3. The Policy of the Automotive Industry in Malaysia

3.1 Industrialisation policy[10]

Malaysia's long-term economic policy has been shown in the Outline Perspective Plans (OPPs). Every five years, the government also publishes the Malaysia Plan. In the first OPP in 1971, the government

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[10] Please refer to Anazawa (2010b) for more details.

introduced the NEP, which had some targets to be achieved by 1990. Thereafter, they implemented the National Development Policy, which regulated the Malaysian economy for 10 years from 1991 to 2000. It was then replaced by the National Vision Policy, which became the source of regulation for another 10 years, from 2001 to 2010. In 2011, the Economic Transformation Plan (2011–2020) was introduced, and the 11th Malaysia Plan (2016–2020) is ongoing. In addition, Malaysia plans to achieve the developed country status by 2020, which is known as Vision 2020.

Apart from these, Malaysia has industry master plans that regulate, in particular, the manufacturing industry. There was the IMP from 1986 to 1995, the IMP2 from 1996 to 2005, and the most recent IMP3, which provides direction from 2006 to 2020. The IMP issued separate volumes by industry, and there were independent chapters regarding the main industries in IMP2 and IMP3 that described the transportation equipment industry, including the automotive industry. The policies in the automotive industry have up to now been implemented in line with IMP, IMP2, and IMP3.

The IMP roughly divided the manufacturing industry into export-oriented sectors and domestic market-oriented sectors, and the automotive industry was regarded as a domestic-oriented market. Since Proton had just started its commercial production at the time of the first IMP, there was no quantitative target for the automotive industry. However, the general notion was to enhance the national reputation by having a national car. Proton was also established to restructure and integrate the automotive industry with a focus on a national car. The plan also included the establishment of other national car manufacturers in commercial vehicles. It was expected for Proton to develop Bumiputera vendors in the IMP.

The defining characteristic of the IMP2 was of its direction for developing a cluster-based industry. The manufacturing industry was divided into three categories: internationally linked, resource-based, and policy-driven. The automotive industry was policy-driven and it was a strategic industry for the government.

Looking back to the period of the IMP, it was analysed that Proton developed the parts industry, strengthened its competitiveness, introduced the latest technology, and conducted the in-house production of components. Moreover, the IMP2 also provided future direction for the automotive industry, including strengthening its R&D capabilities, manpower development, and overseas expansion, in conjunction with the CEPT scheme under AFTA, which had already been commenced.

In order to progress in the era of globalisation, IMP2 provided the direction that was needed to create high-quality technology and high value-added to become more effective. The IMP3 was implemented after NAP was completed. Hence, every policy related to the automotive industry was described under NAP. The main theme of IMP3 was international competitiveness.

3.2 National Automotive Policy

3-2-1 NAP 2006

IMP focused on the establishment of the national car. Meanwhile, the automotive industry was positioned as a policy-driven industry in IMP2. The IMP2 also showed plans to prepare for trade liberalisation under AFTA. With regard to the automotive industry, the IMP3 first analysed the current situation of the industry, then showed NAP, which was announced in March 2006.

In October 2005, the government announced the 'framework of NAP', due to a delay in the actual plan that was supposed to be announced in June of the same year. However, its contents differed slightly from the NAP that was finally officially announced in March 2006.[11]

The purpose of NAP was summarised as follows:[12]

(1) Promoting a competitive and viable domestic automotive sector, in particular, the national car manufacturers;

(2) Promoting Malaysia as a regional automotive hub, focusing on niche areas;

(3) Promoting a sustainable level of economic value-added and enhancing domestic capabilities;

(4) Promoting a higher level of exports of vehicles, parts, and components that are competitive in the global market;

(5) Promoting competitive and broad-based Bumiputera participation in the automotive sector; and

(6) Safeguarding the interests of consumers.

In order to achieve these targets, the government has nine strategies:

(1) Providing government support based on sustainable economic contribution;

(2) Increasing the scale of operations through rationalisation to enhance the competitiveness of the automotive sector;

(3) Promoting strategic linkages with international partners;

(4) Developing Malaysia as a regional hub, focusing on niche areas;

(5) Promoting investments in growth areas, such as fuel-efficient engines;

(6) Intensifying skill upgrading through training;

(7) Strengthening institutional support for the automotive sector;

(8) Encouraging and promoting the participation of the automotive sector in regional and global supply chains, including new exports; and

(9) Enhancing the competitiveness of the manufacturers of parts and components through M&A and joint ventures and other measures.

3-2-2 NAP 2009

The Malaysian government reviewed the above NAP in October 2009 and announced NAP 2009, which has been implemented since January 2010. This was intended to make more effective use of the existing NAP within changing circumstances. The key term in the NAP Review is 'People First', and its

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[11] Please refer to Anazawa (2007) for more details.

[12] See MITI (2006: 358–359).

objectives are summarised as follows:

(1) Ensuring the development and long-term competitiveness and capability of the automotive industry under market liberalisation;

(2) Creating a conducive environment to attract new investment and expand opportunities;

(3) Enhancing the competitiveness of the national car manufacturers through partnerships;

(4) Fostering the development of the latest technology;

(5) Developing high value-added manufacturing in niche areas;

(6) Enhancing Bumiputera participation;

(7) Improving safety standards and promoting environmentally friendly opportunities; and

(8) Enhancing the implementation of the current NAP.

NAP 2009 showed policies that might improve competitiveness in trade liberalisation. It also included the production of hybrid cars and electronics vehicles to address current concerns regarding environmental issues. On the other hand, the policy also continued to offer protection to national car manufacturers and Bumiputera companies. It noted strategic alliances with foreign companies for the survival of the national car manufacturers and the expansion in participation of Bumiputera companies. The details of the specific policies with the aim to achieve the abovementioned targets are summarised as follows:

A Manufacturing licence

・The new policy will lift the freeze of new manufacturing licences for luxury cars, pick-up trucks, and hybrid and electric cars.

・There will be no equity conditions imposed on manufacturing licences.

B Tax/Duties

・Tax will be exempted based on the value of the increased exports of cars and parts.

・Import duty will be removed or reduced in compliance with trade agreements.

・Import and excise duties for completed built-up and complete knocked-down vehicles will be maintained.

・Gazette price will be introduced for imported used cars.

C Technology (high-value and green technology)

・Better incentives will be provided for critical and high value-added parts and components.

・Incentives for hybrid cars, electronics cars, and related infrastructure improvement.

D Soft loans/grants

Soft loans and/or grants will be provided to improve the competitiveness of parts and component manufacturers.

E Standards (increased safety)

・Full implementation of vehicle-type approval will be introduced by the Ministry of Transport.

・The Ministry of Science, Technology, and Innovation will introduce and enforce mandatory standards for parts and components.

・Gradually, imports of used parts and components will be prohibited.

・Gradually, imported used commercial vehicles will be prohibited.

・The Ministry of Natural Resources and Environment will establish a clear roadmap for fuel standards.

・Gradually, a vehicle end-of-life policy will be introduced by the Ministry of Transport.

F Approved permit system

・Approved permit system of importing vehicles will be terminated.

G A strategic partnership for Proton

A new strategic partnership between Proton and globally established manufacturers will enhance the competitiveness of Proton.

3-2-3 NAP 2014

In January 2014, MITI and the Malaysia Automotive Institute (MAI) published NAP 2014. The main purposes of NAP 2014 are as follows:

Development of a competitive local automotive industry;

Making Malaysia a hub for EEVs in the region;

Development of local capability with enhanced value-added;

Increased exports of vehicles and parts and components;

Enhancement of the participation of competitive Bumiputera companies in the auto industry and aftermarket; and

Enhancement of the benefit to consumers by supplying safe and high-quality products at competitive prices.

For these purposes, NAP 2014 contains three main directions – investment, technology and engineering, and market expansion – as well as three main strategies – human capital development, supply chain development, and safety, security, and environment.

Each of these directions and strategies includes many policy-related issues to establish a competitive automotive industry in Malaysia. The key issues are EEVs and the environment. We will review these directions and strategies.

Under NAP 2014, some fiscal incentives (exemptions from corporate tax), such as the Investment Tax Allowance and Pioneer Status were maintained.

Investment

The Malaysian government is aiming to be a regional hub for EEVs through strategic investments.

EEVs include fuel-efficient internal combustion engine (ICE) vehicles, hybrid vehicles, and electric vehicles.

So far, Proton and Perodua have been trying to upgrade the energy efficiency of ICE vehicles. The government has been providing fiscal incentives to attract strategic investments to develop EEVs and enhance the automotive ecosystem.

Technology and engineering

Key strategic sectors in this field include major parts, dies and moulds, materials, and design engineering. The introduction of green technology has been emphasised to enhance R&D and engineering capabilities and provide the relevant infrastructure.

Policies under technology and engineering include the exemption of import tax and excise duties for CKD hybrid vehicles and electric vehicles, as well as other fiscal incentives and soft loans provided for the development of infrastructure of hybrid and electric vehicles and new technology employed by parts suppliers.

Market expansion

It is expected to expand exports, especially parts and components to ASEAN and other countries, under the free trade agreements.

Policy issues are to organise the Automotive Parts and Components International Market Expansion programme and to establish the Distribution Infrastructure Network.

Supply chain development

NAP 2014 will focus on improvements in the quality management system, operational management system, business management system, and testing and validation capabilities.

Policies directed at soft loans for developing new tooling and developing capabilities through automation, consolidation, and so forth.

Human capital development

NAP 2014 will pay attention to enhancing skills and capability in the areas of leadership, management, engineering, quality, design, and cost management. It is also expected to reduce the number of foreign workers in the automotive industry.

Policies in this area include funding for dispatching experts to parts manufacturers, lean production systems, leadership skills, and so forth.

Safety, security, and environment

In order to reduce carbon intensity by 40% by 2020, the government will assist in reducing carbon emissions, increasing fuel efficiency, preserving the environment, and conversing natural resources. For this purpose, a voluntary vehicle inspection programme (VVIP) will be introduced.

Policies related to this area consist of the development of the Malaysian Standard for Safety, VVIP for passenger cars aged over five years, and the adoption of the 3Rs (reduce, reuse, recycle).

In addition to the abovementioned six directions and strategies, NAP 2014 refers to Bumiputera participation and national projects. The government's measures to create globally competitive Bumiputera entrepreneurs are stated in relation to Bumiputera participation. Funding for increasing the competitiveness of Bumiputera companies will be provided. The government will also encourage Bumiputera companies to enter the automotive industry.

The Malaysian government will provide incentives for the success of the national projects, recognising that Proton, Perodua, and Modenas (motorcycles) contributed to the development of the domestic automotive industry.

NAP 2014 was the first time for MITI and MAI to settle on targets, and the following targets for 2020 were introduced.

Production and exports

Total production volume of 1.35 million units of motor vehicles, including 1.15 million units of EEVs per year.

Total volume of 1 million passenger vehicles and 100,000 units of commercial vehicles per year.

Exports of 250,000 units vehicles per year.

Export value of more than RM10 billion for automotive components per year.

Employment opportunities

80,000 new job opportunities in manufacturing.

70,000 new job opportunities in the aftersales service sector.

Reduction of foreign workers

By 2020, local skilled and semi-skilled workers will replace 80% of the foreign workers.

Development of global standard vendors

To upgrade 180 vendors to achieve level five capability according to the global definition.

To upgrade 150 vendors to achieve level four capability according to the global definition.

To upgrade 100 vendors to achieve level three capability according to the global definition.

These targets seem too difficult to achieve if we review the data we discussed in Section 1. For instance, the total production of motor vehicles was less than 600,000 units in 2018. However, it is still meaningful to show these targets in relation to the policies.

3-2-4 NAP 2019

Currently, the MAI,[13] which was inaugurated by the Ministry of International Trade and Industry in June 2010, is in charge of preparing a policy regarding the automotive industry. MITI announced that NAP 2019 would be revealed by the end of 2019. However, unfortunately, so far NAP 2019 is not ready to be published.

Some news sources have reported that NAP 2019 will have three phases up to 2030. During the first phase up to 2023–2024, the main policies will be a continuation of NAP 2014, such as EEV production and the development of car batteries, management systems, and charging stations. The second and third phases will focus on technological improvements, such as 5G, next-generation vehicles, and mobility as a service.

NAP 2006 and NAP 2009 mainly showed the way forward for the automotive industry under the changing environment, especially the implementation of AFTA. Malaysia had to reduce its import duties and began to prepare for trade liberalisation. NAP 2014 had to react to the new trend of green technology. The introduction of EEVs and hybrid and electric vehicles are keen issues for Malaysia. However, technological dependency on foreign companies has made it difficult for Malaysian companies to develop green technology by themselves. Sometimes, foreign partners are reluctant to transfer the latest technology. On the other hand, Malaysian companies are not ready to receive the new technology.

All of the NAPs referred to the special treatment of national car producers. Bumiputera participation is also a key issue picked up in the NAPs, and the NAPs had to pay attention both to competitiveness and protection at the same time.

NAP 2019 will continue to pave the way for environmental issues and the changing circumstances of the automotive industry in the world. Malaysian car manufacturers will have a hard time coping with the next generation of vehicles and mobility as a service. Even in developed countries, large car producers have to invest a lot for new technology, infrastructure, and services. The national car producers will cooperate with their partners to gain the latest technologies.

4. Conclusion

During the 1980s, mainly Japanese companies were producing automobiles for CKD production as joint ventures with local companies in the ASEAN region. Hence, the announcement of the national car project by Malaysia in the early 1980s had a great impact on the industrial policies in neighbouring countries and other developing countries as well.

However, the automotive industry in Malaysia, which had been protected for many years, is facing many problems with trade liberalisation under AFTA and the EPA between Japan and Malaysia.[14] The issues described in the IMP3 are summarised as follows:

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[13] Recently the MAI was re-organised as the Malaysia Automotive, Robotics & IoT Institute, which is in charge of not only of automotive policymaking but also robotics and IoT-related issues.

[14] MITI (2006: 355–58).

・Global and regional competition;

・Lack of economies of scale;

・Dependence on the domestic market;

・Technology development;

・Limited R&D;

・Testing capabilities;

・Compliance with global standards;

・Lack of skilled workers; and

・Poor linkages.

In order to overcome these issues, the Malaysian government has to enhance the competitiveness of the automotive and automotive parts industries, as outlined in the NAP 2006, 2009, and 2014. As can be seen in the current trade data, it seems difficult to strengthen the competitiveness of the automotive and parts industries within a short period, although it is expected by the government. Basically, the small domestic market does not allow car manufacturers to enjoy scale economies. Malaysia has been protecting the national car manufacturers and Bumiputera vendors for many years, and they are not only less competitive but also less outward-looking, even in the era of trade liberalisation. Some local parts manufacturers have already established their subsidiaries overseas to correspond with the economic integration and trade liberalisation in ASEAN.

Proton is now a part of the DRB-HICOM group and its new partner, Geely, has sent a managing director and other managers to Proton. Geely will try to control Proton and a new strategy will be introduced to catch up with Perodua and Honda. Perodua has been maintaining the largest market share and been involved in the exports of vehicles and parts under the regional strategy of Daihatsu and Toyota. A third national car project was revealed and local engineering company DreamEdge was appointed as an anchor company. The future vision of the third national car project is still not open to the public.

The changing environment for the automotive industry, such as green technology, electric vehicles, self-driving, and mobility as a service, will force all of the car manufacturers to be more active in adjusting to the changes. Strategic alliances and cooperation with partner companies will be necessary for Malaysian manufacturers, especially the national car producers, to survive.

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CHAPTER 4

THE CURRENT STATE AND FUTURE OF THE AUTOMOTIVE PARTS INDUSTRY IN VIET NAM: ANALYSING THE PRODUCTION PROCESS SPECIALISATION OF SUPPLIER FIRMS

Hideo Kobayashi, Akiko Ishioka, and Martin Schröder

Introduction

Viet Nam attracted significant attention in 2019 as a result of the proliferation of businesses transferring production from China to Viet Nam in the midst of the China–United States (US) trade war. The scope of such a transfer has extended from the electrical, general goods, and textile sectors to the automotive sector. Accordingly, Viet Nam is rapidly increasing its industrial production as an assembly base. Local businesses, as represented by VinFast, are also newly entering into automobile production. The carmaker also intends to produce electric vehicles (EVs) from 2021. However, whether one is engaged in conversion to EV production or gasoline-powered automobile production, given the characteristics of the automotive parts industry – which produces over 10,000 parts – not all automotive parts can be procured from overseas; in particular, for large and heavy automotive parts, there is no choice but to wait for local production, and for less technically advanced automotive parts, relying on local procurement gives a cost advantage. Whilst there are those who think that the necessary automotive parts can be imported, when one considers the fact that automobiles are composed of various parts, the expansion of the automotive industry in a given country is predicated upon having a fully developed automotive parts industry.

On the transportation industry in Viet Nam, one can refer to Ueda (2003), Fujita (2006), and Mishima (2010) for discussion of the motorcycle industry; when it comes to the automotive industry there are limited sources, including T. Kobayashi (2015), H. Kobayashi (2015, 2016), and Jin (2016); there are even fewer contributions to the discussion that focus on the automotive parts industry, with only H. Kobayashi (2015, 2016) and Schröder (2017). Therefore, this study examines the current state of the motorcycle and automotive parts enterprises in Viet Nam and discuss challenges to the future of the Vietnamese automotive parts industry.

1. Method

1.1. Data source on manufacturing-related enterprises in Viet Nam

To understand a detailed picture of the automotive parts industry in Viet Nam, it is essential to obtain a dataset that covers the production capabilities of parts suppliers. Research reports from the Japan External Trade Organization (JETRO) Hanoi and Ho Chi Minh offices are useful in this endeavour. The JETRO Hanoi office has created local and foreign-affiliated (excluding Japan), and Japan-affiliated parts supplier lists, called *The Excellent Vietnamese Companies in Northern and Central Vietnam* since 2009, *Northern Vietnam Foreign Investment Supplier List* since 2013, and *Northern and Central Vietnam Supplier Directory for Japanese Manufacturing Industry and Related Trading Companies* since 2014. The JETRO Ho Chi Minh office has maintained the list *The Potential Vietnamese Companies in Southern Vietnam*[1] since 2008 and has created *Southern Viet Nam Japanese and Foreign Supplier List* in 2018. As a result of these research, it emerges that there are 661 manufacturing-related enterprises in Viet Nam, and outlines of these enterprises are also provided. Therefore, it allows for a narrow snapshot of the production capabilities of enterprises active in the supply of parts based on these data. The number of enterprises in each report is as follows[2]:

- JETRO Hanoi (October 2018), The Excellent Vietnamese Companies in Northern and Central Vietnam – 263 enterprises
- JETRO Hanoi (September 2017), Northern Viet Nam Foreign Investment Supplier List – 92 enterprises
- JETRO Hanoi (July 2018), Northern and Central Viet Nam Supplier Directory for Japanese Manufacturing Industry and Related Trading Companies – 86 enterprises
- JETRO Ho Chi Minh (October 2018), The Potential Vietnamese Companies in Southern

[1] This is the official English title chosen by JETRO for the publication, which is, however, entirely written in Japanese. A more fitting translation may be 'Promising Vietnamese firms in Southern Viet Nam.

[2] Some of the following data have been updated, but in this paper, we analysed using the latest data at the time of drafting.

Vietnam – 165 enterprises

- JETRO Ho Chi Minh (March 2018), Southern Viet Nam Japanese and Foreign Supplier List – 55 enterprises

Schröder's (2017) analysis includes automotive parts enterprises from the Republic of Korea (henceforth, Korea) and Europe but the responding enterprises to the JETRO research above are mostly limited to Vietnamese, Japanese, and other Asian enterprises, meaning that US and European enterprises are underrepresented, these collected data are not representative of the whole manufacturing industry or whole automotive parts industry. Because the data are obtained through JETRO research, the responding enterprises are either local, Japanese, or have some business connection to Japan.

However, this bias in the data does not mean that it can only be used in a limited way as a case study of a group of parts enterprises related to Japanese enterprises. Rather, since it is a group of enterprises that 'have a high possibility of supplying parts of the quality level required by Japanese enterprises (JETRO Hanoi 2018a; 2018b)', in the point of that they are expected to play a role in development of manufacturing industry, the JETRO reports can be regarded as a data source that is in line with the purpose of this study. Therefore, this data source can be positively utilised as an indication of the development gaps and potential of the automobile parts industry in Viet Nam.

1.2. Dataset of motorcycle and automotive parts enterprises in Viet Nam

The enterprises in industry types with no direct involvement in manufacturing or production activities relating to motorcycles and automobiles – that is to say, enterprises in the producer goods, equipment, plant, construction, packing, furniture and fixtures, or materials industries, as well as trading enterprises – are excluded from the 661 enterprises mentioned above. Of course, the industry types listed above engage in transactions relating to motorcycles and automobiles, but they are identified as vendors undertaking commercial activities with a large number of enterprises of unspecified types, these enterprises comprised as many as 447 of the total 661. Therefore, we use the dataset of 214 (of which 102 (47.7%) are local and 112 (52.3%) are foreign-affiliated) motorcycle and automobile parts enterprises in this study.

We conduct an analysis that classifies enterprises by time of establishment, capital source (local, foreign (non-Japanese or Japanese)), county of origin, firm location (northern, central, or southern Viet Nam), scale of firm (large-sized, medium-sized, small-sized, or micro), industry type (stamping, resin, and so on), supplier ranking (Tier 1, Tier 1 candidate, Tier 2, or Tier 3 suppliers), and main product (motorcycles, motorcycles and automobiles, motorcycles, automobiles, and other, or automobiles).

2. The Situation of Motorcycle and Automotive Parts Enterprises in Viet Nam

2.1. Founding and transformation of motorcycle and automotive enterprises

Given the fact that the automotive parts industry in Viet Nam started from motorcycle production, let us organise the trends in motorcycle and automotive parts enterprises by dividing everything into three phases, following Mishima (2010) (see Table 4.1). First is Phase I, in which the motorcycle parts industry emerged, a 13-year period from the beginning of the Doi Moi Policy in 1986 to Viet Nam's entry into the Association of Southeast Asian Nations (ASEAN) in 1995 and up to 1999. Motorcycle production began in this period, Chinfon Group (Taiwan) entered Viet Nam in 1992, Honda (Japan) in 1995, and Yamaha (Japan) in 1998. Automotive production also began at around the same time, promoted by the Doi Moi Policy with the entry into Viet Nam of many businesses all at once in 1993, starting with Daewoo (Korea) and including Mitsubishi (Japan), Toyota (Japan), Isuzu (Japan), Suzuki (Japan), Mercedes-Benz (Germany), and Ford (US). However, in this period, completely knocked-down (CKD) production, involving the assembly of parts imported from overseas, was taking place for both motorcycles and automobiles.

2.2. Distribution of capital sources for motorcycle and automotive parts enterprises established by year

Parts enterprises were focused on the production of motorcycle parts and, 20 (10.1%) of all motorcycle and automotive parts enterprises were established in Phase I, looking at the composition of these parts enterprises, 17 (9%) of the 20 (10.1%) enterprises were local. There were 11 motorcycle and automotive parts enterprises (10 local, 1 foreign (1 non-Japanese)) established before 1986 already in operation, so if these are included that makes a total of 27 local enterprises and 4 foreign-affiliated enterprises (4 non-Japanese), meaning that local enterprises comprised the overwhelming majority (see Table 4.1).

In Phase II, as imports of sets of parts made in China for low-cost motorcycles increased rapidly, the market share of Chinese motorcycles quickly rose, and in this period the motorcycle market in Japan surged all at once from 5 million units to 15 million units. Further, this was also the period when the Japanese motorcycle manufacturer Honda launched the Wave, a low-priced motorcycle made to Southeast Asian specifications with the aim of catching up with the competition. Around this period, it was predominantly motorcycle parts enterprises that started to increase in number. That 7 motorcycle and automotive parts enterprises were established in 1999 (see Figure 1), the final year of Phase I, and a total 18 (9%) motorcycle and automotive parts enterprises were established in the three-year period of Phase II speaks to these increases. Moreover, looking at the source of capital, 11 (5.5%) foreign-affiliated enterprises (non-Japanese (7; 3.5%), Japanese (4; 2%)) also started to increase along with 7 (3.5%) local enterprises (see Table 4.1).

During Phase III the numbers of local and foreign-affiliated enterprises established with the objective of supplying motorcycle parts increased. In Phase III, 161 enterprises were founded, meaning that 80.9% of all motorcycle and automotive parts enterprises established in Viet Nam were concentrated in Phase III. If one looks at the distribution by source of capital, the establishment of 67 (33.7%) local enterprises and 94 (47.2%) foreign-affiliated enterprises (non-Japanese (47; 23.6%), Japanese (47; 23.6%)) was concentrated in this period (see Table 4.1). During Phase III, Japanese and Taiwanese motorcycle manufacturers were increasing their number of units produced as well as the proportion of local procurement, in addition to which exports to ASEAN countries were beginning, all of which led to requirements for motorcycle parts enterprises to enhance quality. Demand for the supply of automobile parts also began to increase at this time.

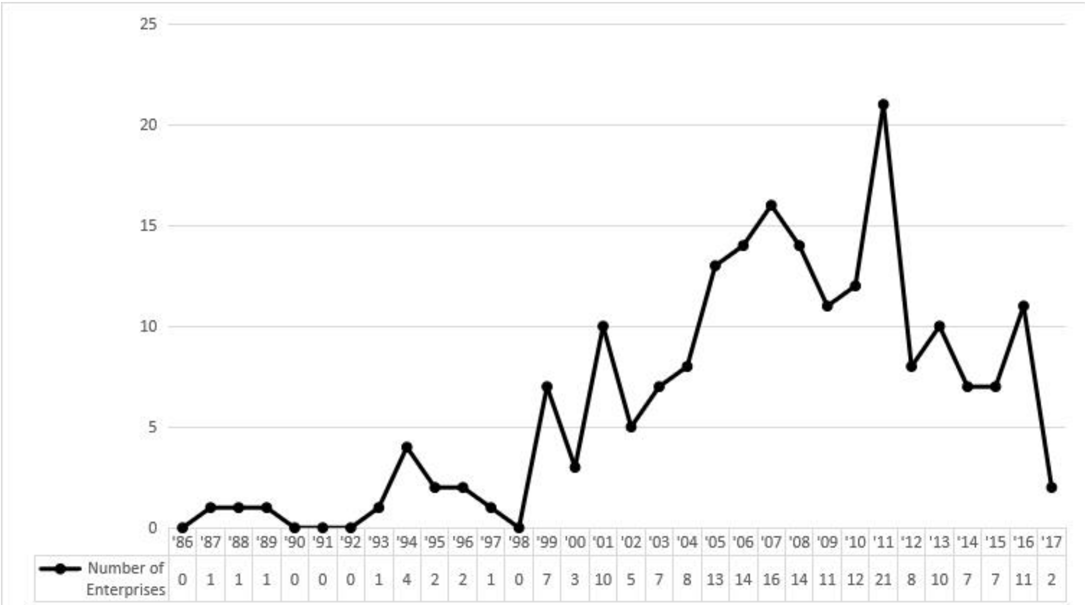
If we now look at the number of enterprises by source of capital in all periods with reference to Table 4.1, the majority is foreign-affiliated enterprises (108 (56 non-Japanese, 52 Japanese)), 54.2% (28.1% non-Japanese, 26.1% Japanese)), the local enterprises are less than half (91; 45.7%).

Table 4.1: Capital Sources for Motorcycle and Automotive Parts Enterprises Established by Year

	Local Enterprises		Foreign-affiliated Enterprises				Total	
			non-Japanese		Japanese			
Phase I (1986-1999)	17	8.5%	2	1.0%	1	0.5%	20	10.1%
Phase II (2000-2002)	7	3.5%	7	3.5%	4	2.0%	18	9.0%
Phase III (2003 onwards)	67	33.7%	47	23.6%	47	23.6%	161	80.9%
Total	91	45.7%	56	28.1%	52	26.1%	199	100.0%

Notes: Phase I: 1986–1999; Phase II: 2000–2002; Phase III: 2003 onwards. Information is unavailable for 1 local enterprise and 3 foreign-affiliated enterprises. There were 10 local enterprises and 1 foreign-affiliated enterprise prior to 1986.
Sources: JETRO Hanoi (2017; 2018a; 2018b) and JETRO Ho Chi Minh (2018a; 2018b).

Figure 4.1. Number of Motorcycle and Automotive Parts Enterprises Established by Year and Motorcycle and Automotive Manufacturers Established by Year



	Automobile Manufacturer	Country of Origin	Motorcycle Manufacturer	Country of Origin
'86				
'87				
'88				
'89				
'90				
'91	Mekong	Viet Nam		
'92				
'93	GM	United States		
'94	Mitsubishi	Japan		
'95	Toyota/Ford/Mercedes-Benz	Japan/United States/Germany	Suzuki	Japan
'96	Isuzu/Hino	Japan/Japan	Honda	Japan
'97	THACO	Viet Nam		
'98			Yamaha/Dothanh	Japan/Viet Nam
'99				
'00				
'01				
'02				
'03				
'04	Samco	Viet Nam		
'05	Daewoo	Republic of Korea		
'06				
'07			SYM	Taiwan
'08				
'09	Hyundai	Republic of Korea	Piaggio	Italy
'10				
'11				
'12				
'13	Peugeot	France		
'14				
'15				
'16				
'17				
'18				
'19	VinFast	Viet Nam	Kawasaki	Japan

Notes: Information is unavailable for 1 local enterprise and 3 foreign-affiliated enterprises. There were 10 local enterprises and 1 foreign-affiliated enterprise prior to 1986.
Sources: JETRO Hanoi (2017; 2018a; 2018b) and JETRO Ho Chi Minh (2018a; 2018b).

2.3. Distribution of capital source for motorcycle and automotive parts enterprises by firm location

Let us look at the distribution of capital sources for motorcycle and automotive parts enterprises by firm locations to Table 4.2. When one looks at the distribution by region, 160 (74.8%) enterprises are concentrated in northern Viet Nam. This tendency is a characteristic shared by local and foreign-affiliated enterprises, but the number of foreign-affiliated enterprises in northern Viet Nam is particularly high, at 89 (41.6%) (non-Japanese (54; 25.2%), Japanese (35; 16.4%)). After northern Viet Nam comes southern Viet Nam with 24 (11.2%) enterprises, and central Viet Nam has the lowest number of enterprises, at 7 (3.3%). The cultivation of motorcycle and automotive parts enterprises in central and southern Viet Nam is a task to be tackled in the future. It should be added that this imbalance may also be due to the particular sources used in this study since the more encompassing work of Schröder (2017) reports few enterprises in central Viet Nam but a more balanced distribution of enterprises between northern and southern Viet Nam.

Table 4.2. Capital Source of Motorcycle and Automobile Parts Enterprises by Firm Location

	Local Enterprises		Foreign-affiliated Enterprises				Total	
			Non-Japanese		Japanese			
Northern Viet Nam	71	33.2%	54	25.2%	35	16.4%	160	74.8%
Central Viet Nam	7	3.3%	0	0.0%	1	0.5%	8	3.7%
Southern Viet Nam	24	11.2%	6	2.8%	16	7.5%	46	21.5%
Total	102	47.7%	60	28.0%	52	24.3%	214	100.0%

Note: Japan Bank for International Cooperation (2019) was used for the classification of the regions.
Sources: JETRO Hanoi (2017; 2018a; 2018b) and JETRO Ho Chi Minh (2018a; 2018b).

2.4. Distribution of scale of firm for local motorcycle and automotive parts enterprises by firm location

Let us narrow our focus to local motorcycle and automotive enterprises and look at the distribution of scale of firm by firm locations, with reference to Table 4.3. Enterprises were classified as large, medium, or small in accordance with the Vietnamese government's standards of the scale of firm. The number of medium-sized enterprises is most numerous and comprise nearly half of the local enterprises (46; 46.9%), followed by small-sized enterprises (30; 30.6%) and large-sized enterprises (22; 22.4%). Further, looking at distribution by region, 67 of the enterprises, corresponding to 68.4% of the total, were concentrated in northern Viet Nam.

When one looks at the distribution by region, the number of medium-sized enterprises in northern Viet Nam is particularly high, at 32 (32.7%). After medium-sized enterprises comes small-sized enterprises with 19 (19.4%), and large-sized enterprises has the lowest number, at 16 (16.3%). This tendency is same as in southern Viet Nam. On the other hand, in central Viet Nam, the number of medium-sized enterprises is the highest, at 5 (5.1%).

Table 4.3. Scale of Firm of Local Motorcycle and Automotive Parts Enterprises by Firm Location

	Large-sized Enterprises		Medium-sized Enterprises		Small-sized Enterprises		Total	
Northern Viet Nam	16	16.3%	32	32.7%	19	19.4%	67	68.4%
Central Viet Nam	5	5.1%	2	2.0%	0	0.0%	7	7.1%
Southern Viet Nam	1	1.0%	12	12.2%	11	11.2%	24	24.5%
Total	22	22.4%	46	46.9%	30	30.6%	98	100.0%

Notes: According to 'DECREE NO. 39/2018/ND-CP' (Viet Nam Government, 2018a), the scale of firm can be classified into the following three categories, and large-sized enterprises are defined as larger than medium-sized enterprises in this study. Sources: JETRO Hanoi (2017; 2018a; 2018b); JETRO Ho Chi Minh (2018a; 2018b); and Government of Viet Nam (2018a; 2018b).

Micro-enterprise: annual average of ≤ 10 employees who make contributions to social insurance and total annual revenue ≤ D3 billion (approximately US$120 thousand) or total capital ≤ D3 billion (approximately US$120 thousand).

Small-sized enterprise: annual average of ≤ 100 employees who make contributions to social insurance and total annual revenue ≤ D50 billion (approximately US$2.1 million) or total capital ≤ D20 billion (approximately US$860 thousand).

Medium-sized enterprise: annual average of ≤ 200 employees who make contributions to social insurance and total annual revenue ≤ D200 billion (approximately US$8.6 million) or total capital ≤ D100 billion (approximately US$4.3 million).

Large-sized enterprise: annual average of > 200 employees who make contributions to social insurance and total annual revenue > D200 billion (approximately US$8.6 million) or total capital > D100 billion (approximately US$4.3 million).

As mentioned above, the scale of the enterprise is determined by annual average number of employees making social insurance contributions and the total annual revenue or the total capital. In 'DECREE NO. 143/2018/ND-CP' (Government of Viet Nam, 2018b), foreigners are also forced to take out social insurance, but, for example, internal transfers (expatriates, employees, seconded employees) are not eligible. Since there is no description of the contract status of employees in the JETRO data, we decided to exclude the number of employees from the conditions.

In addition, since 'DECREE NO. 39/2018/ND-CP' is a detailed enforcement regulation of some provisions of the SME Support Law, it is important to grasp the latest management conditions, but one purpose of this study is future prediction. Therefore, since it is in line with the purpose of this study to define the scale of the enterprise by the capital with little change rather than the revenue that reflect the change from year to year, it was classified into four scale from the capital, for convenience.

Japan Bank for International Cooperation (2019) was used for the classification of the regions (accessed 22 November 2020).

Information was unavailable for 4 enterprises.

2.5. Distribution of foreign-affiliated motorcycle and automotive parts enterprises by country of origin

Let us turn to foreign-affiliated motorcycle and automotive enterprises and look at the distribution of scale of firm by firm locations, with reference to Table 4.4. Of the total 112 foreign-affiliated enterprises, Japan-affiliated enterprises (52; 46.4%) and Taiwan-affiliated enterprises (33; 29.5%) account for 75.9% of foreign-affiliated enterprises. Most of those following Japan and Taiwan are all in Asia: Malaysia (6; 5.4%), China (5; 4.5%), Republic of Korea (4; 3.6%) and Thailand (4; 3.6%)

Table 4.4. Foreign-affiliated Motorcycle and Automotive Parts Enterprises by Country of Origin

	Quantity	Percentage
Japan	52	46.4%
Taiwan	33	29.5%
Malaysia	6	5.4%
China	5	4.5%
Republic of Korea	4	3.6%
Thailand	4	3.6%
Germany	1	0.9%
India and Italy	1	0.9%
Indonesia	1	0.9%
Singapore	1	0.9%
United Kingdom	1	0.9%
Malaysia and China	1	0.9%
Malaysia and Japan	1	0.9%
Malaysia and Republic of Korea	1	0.9%
Total	112	100.0%

Source: JETRO Hanoi (2017; 2018b); JETRO Ho Chi Minh (2018a).

2.6. Distribution of scale of firm for foreign-affiliated motorcycle and automotive parts enterprises by country of origin

Regarding foreign-affiliated motorcycle and automobile parts enterprises again, let us look at the distribution of country of origin for enterprises by scale of firm, with reference to Table 4.5. The number of medium-sized enterprises is most numerous (42; 39.6%), followed by large-sized enterprises (39; 36.8%), small-sized enterprises (23; 21.7%) and micro-sized enterprises (2; 1.9%). Next, let us look at the distribution of scale of firm by country of origin, the number of medium-sized enterprises in Japanese enterprises is the highest at 24 (22.6%). After medium-sized enterprises comes large-sized and small-sized enterprises with 12 (11.3%), and micro-enterprises with 1 (0.9%). On the other hand, in Taiwanese enterprises, the number of large-sized enterprises is the highest, at 18 (17%) followed by medium-sized enterprises (10; 9.4%), small-sized enterprises (2; 1.9%), and micro-enterprises with 1 (0.9%).

Table 4.5. Scale of Firm for Foreign-affiliated Motorcycle and Automotive Parts Enterprises by Country of Origin

	Large-sized Enterprises		Medium-sized Enterprises		Small-sized Enterprises		Micro-enterprises		Total	
Japan	12	11.3 %	24	22.6 %	12	11.3 %	1	0.9 %	49	46.2 %
Taiwan	18	17.0 %	10	9.4 %	2	1.9 %	1	0.9 %	31	29.2 %
Malaysia	2	1.9 %	1	0.9 %	2	1.9 %	0	0.0 %	5	4.7 %
China	1	0.9 %	1	0.9 %	3	2.8 %	0	0.0 %	5	4.7 %
Republic of Korea	2	1.9 %	1	0.9 %	1	0.9 %	0	0.0 %	4	3.8 %
Thailand	2	1.9 %	2	1.9 %	0	0.0 %	0	0.0 %	4	3.8 %
Germany	0	0.0 %	0	0.0 %	1	0.9 %	0	0.0 %	1	0.9 %
India and Italy	0	0.0 %	1	0.9 %	0	0.0 %	0	0.0 %	1	0.9 %
Indonesia	0	0.0 %	0	0.0 %	1	0.9 %	0	0.0 %	1	0.9 %
Malaysia and China	0	0.0 %	0	0.0 %	1	0.9 %	0	0.0 %	1	0.9 %
Malaysia and Japan	1	0.9 %	0	0.0 %	0	0.0 %	0	0.0 %	1	0.9 %
Malaysia and Republic of Korea	0	0.0 %	1	0.9 %	0	0.0 %	0	0.0 %	1	0.9 %
Singapore	1	0.9 %	0	0.0 %	0	0.0 %	0	0.0 %	1	0.9 %
United Kingdom	0	0.0 %	1	0.9 %	0	0.0 %	0	0.0 %	1	0.9 %
Total	39	36.8 %	42	39.6 %	23	21.7 %	2	1.9 %	106	100.0 %

Note: Information was unavailable for 3 Japan-affiliated enterprises, 2 Taiwan-affiliated enterprises and 1 Malaysia-affiliated enterprise.

Source: JETRO Hanoi (2017; 2018b); JETRO Ho Chi Minh (2018a).

2.7. Distribution of capital source for local and foreign-affiliated motorcycle and automotive parts enterprises by industry type

Let us now classify all 192 motorcycle and automotive parts enterprises (local enterprises (102; 53.1%), foreign-affiliated enterprises (90; 46.9% (non-Japanese (54; 28.1%), Japanese (36;

18.8%)) into 11 industry-types according to the parts departments essential for the production of motorcycles and automobiles – stamping, resin, forging, diecast, machining, precision machining, rubber moulding, metal moulding, assembly, surface treatment, and other – and observe how many enterprises by each of those industry-types (see Table 4.6).

First, looking at local motorcycle and automotive parts enterprises, there are many enterprises involved in the machining (27; 14.1%), stamping (16; 8.3%), resin (16; 8.3%), and metal moulding (13; 6.8%) industries and, other than precision machining, it could be said that there exists the full array of industry-types required for automotive production. Turning to foreign-affiliated motorcycle and automotive parts enterprises, this group has large numbers of enterprises involved in the assembly (16; 8.3%), resin (15; 7.8%), and other industries (15; 7.8%), and it is organised very similarly to the local enterprise group; foreign-affiliated motorcycle and automotive parts enterprises also resemble local motorcycle and automotive parts enterprises in terms of there being a lack of precision machining, and it could be said that local enterprises and foreign-affiliated enterprises are almost in line with one another. Many Japan-affiliated motorcycle and automotive parts enterprises are in the assembly (7; 3.6%), resin (6; 3.1%), and surface processing industries (5; 2.6%), and this group stands out in the fields of precision machining (where there are only Japan-affiliated enterprises).

Most of the stamping and machining industries are local enterprises, and the order of frequency for resin industry is local enterprises, non-Japanese enterprises, then Japanese enterprises. There are the same numbers of local enterprises and non-Japanese enterprises in the assembly and diecast industries, with both exceeding the numbers of Japanese enterprises in those areas. Metal moulding industry was most common amongst local enterprises, followed by non-Japanese enterprises, with none amongst Japanese enterprises; conversely, there was precision machining industry only in Japanese enterprises. Rubber moulding industries were fairly evenly distributed amongst local enterprises, non-Japanese enterprises, and Japanese enterprises, and surface treatment industries were most common amongst local enterprises, followed by Japanese enterprises and then non-Japanese enterprises. To summarise, it could be said that there are no significant differences amongst the three groups in terms of assembly, diecasting, rubber moulding, or forging industries; local enterprises have an advantage in machining, resin, stamping, and metal moulding industries; non-Japanese enterprises in resin and assembly industries; and Japanese enterprises in precision machining industry.

Table 4.6. Capital Source for Local and Foreign-affiliated Motorcycle and Automotive Parts Enterprises by Industry Type

	Local Enterprises		Foreign-affiliated Enterprises				Total	
			Non-Japanese		Japanese			
Machining	27	14.1%	4	2.1%	4	2.1%	35	18.2%
Resin	16	8.3%	9	4.7%	6	3.1%	31	16.1%
Assembly	9	4.7%	9	4.7%	7	3.6%	25	13.0%
Stamping	16	8.3%	4	2.1%	3	1.6%	23	12.0%
Other	3	1.6%	11	5.7%	4	2.1%	18	9.4%
Metal moulding	13	6.8%	3	1.6%	0	0.0%	16	8.3%
Surface treatment	8	4.2%	2	1.0%	5	2.6%	15	7.8%
Diecast	5	2.6%	5	2.6%	2	1.0%	12	6.3%
Rubber moulding	3	1.6%	4	2.1%	3	1.6%	10	5.2%
Forging	2	1.0%	3	1.6%	1	0.5%	6	3.1%
Precision machining	0	0.0%	0	0.0%	1	0.5%	1	0.5%
Total	102	53.1%	54	28.1%	36	18.8%	192	100.0%

Note: 22 foreign-affiliated enterprises in the south of Viet Nam were excluded from the analysis due to lack of information.

Sources: JETRO Hanoi (2017; 2018a; 2018b) and JETRO Ho Chi Minh (2018b).

3. The Situation of Motorcycle and Automotive Parts Supplier Chain in Viet Nam

3.1. Criteria for classification of supplier ranking of motorcycle and automotive parts enterprises

Next, to structurally grasp the motorcycle and automobile parts industry in Viet Nam, we will rank the suppliers and discuss the supply chain. First, it is classified 214 motorcycle and automobile parts enterprises according to business relationships (business relationships; existence of products designed and developed in-house; membership or participation in manufacturers' associations) and technical level (existence of design and development systems; quality assessment systems (personnel, equipment); product form). Based on these data, the motorcycle and automobile parts enterprises were classified as supplier ranking (Tier 1, Tier 1 Candidates, Tier 2, and Tier 3 suppliers) in accordance with the standards set out below (see Table 4.7).

Table 4.7. Criteria for Classification of Supplier Ranking of Motorcycle and Automotive Parts Enterprises

			Supplier Lanking			
			Tier 1	Tier 1 Candidates	Tier 2	Tier 3
Business Relationships	1	Transact business relationships	Transact directly with automotive manufacturers	Transact with Tier 1 and some manufacturers	Transact with Tier 1	Transact with Tier 2
	2	Existence of products designed and developed in-house	Yes	No (outsourced production)	No (outsourced production)	No (outsourced production)
	3	Relation with community	Strong	Strong	Not so strong	Weak
Technical Level	1	Existence of design and development systems	Yes	No (but future establishment possible)	No	No
	2	Quality assessment systems (personnel, equipment)	Capable of guarantee of strength, defects and other functions	Capable of guarantee of strength, dimensional accuracy and other specifications	Capable of guarantee of dimensional accuracy and other specifications	Capable of guarantee of dimensional accuracy and other specifications
	3	Product form	Unit assembly integrated production	Sub-assembly and/or parts production	Parts production	Small lot parts production

Source: Compiled by authors based on various materials.

A summary of the supplier ranking follows.

Tier 1 suppliers

1. Essentially, these are parts enterprises that transact directly with an automotive manufacturer, apportioned responsibility for functional units of automobiles other than the engine (such as the suspension, transmission, or steering), or for key parts, from design and development to

production.

2. In terms of the technical level, these parts enterprises have their own products designed and developed in-house and maintain systems to assess the quality of these products and their in-vehicle performance.

Tier 1 Candidates suppliers

A similar scale of business to Tier 1 suppliers and is aiming to become Tier 1 suppliers in the future or currently has such potential; partner enterprises working proactively to enhance design and development and quality assurance systems.

Tier 2 suppliers

Medium-sized enterprises that cooperate with Tier 1 suppliers in outsourced production that takes advantage of their respective areas of strength and expertise.

Tier 3 suppliers

Generally speaking, these are small-sized enterprises involved in the automotive industry part-time, undertaking multi-product small lot production and inconsistent small lot part production for Tier 2 mass production facilities.

Two important thing should be explained before conducting the next analysis: above mentioned criteria represents the characteristics of general motorcycle and automotive parts suppliers, but the JETRO reports only contain part of information on each enterprises' customers, and do not contain the information on product development capability. Therefore, the following classification for supplier ranking is based on information about actual supply relations obtained from JETRO reports, but it is lacking information on product development capability (see Table 4.8 and Figure 4.2).

3.2. Distribution of capital source for motorcycle and automotive parts enterprises by supplier ranking

Let us now, in Table 4.8, classify the 192 motorcycle and automotive parts enterprises in Viet Nam (grouped by source of capital into supplier ranking) in accordance with the criteria in Table 4.7. Amongst local enterprises, there are 70 (36.5%) Tier 3 suppliers, making that the most common supplier, followed by 18 (9.5%) Tier 2 suppliers, 10 (5.2%) Tier 1 Candidates suppliers, and 4 (2.1%) Tier 1 suppliers. Amongst non-Japanese enterprises, the 23 (12%) Tier 3 suppliers are the most common, followed by 21 (10.9%) Tier 2 suppliers, 7 (3.6%) Tier 1 Candidates suppliers, and 3 (1.6%) Tier 1 suppliers. Turning to Japanese enterprises, Tier 3 is the most common with 19 (9.9%) suppliers, followed by 9 (4.7%) Tier 2 suppliers, 4 (2.1%) Tier 1 Candidates suppliers, and 4 (2.1%) Tier 1 suppliers. Regardless of the source of capital, Tier 3 is the most common, followed by Tier 2, Tier 1 Candidates, and Tier 1 suppliers. It is characteristic, and problematic, that Tier 1 suppliers are rare amongst local, non-Japanese, and Japanese enterprises. This is expressed in the figures, with 11 (5.7%) Tier 1 suppliers, 21 (10.9%) Tier 1 Candidates suppliers, 48 (25.0%) Tier 2 suppliers, and 112 (58.3%) Tier 3 suppliers when the totals for local, non-Japanese, and Japanese enterprises are calculated.

Table 4.8. Capital Source for Motorcycle and Automotive Parts Enterprises by Supplier Ranking

	Local Enterprises		Foreign-affiliated Enterprises				Total	
			Non-Japanese		Japanese			
Tier 1	4	2.1%	3	1.6%	4	2.1%	11	5.7%
Tier 1 Candidates	10	5.2%	7	3.6%	4	2.1%	21	10.9%
Tier 2	18	9.4%	21	10.9%	9	4.7%	48	25.0%
Tier 3	70	36.5%	23	12.0%	19	9.9%	112	58.3%
Total	102	53.1%	54	28.1%	36	18.8%	192	100.0%

Note: 22 foreign-affiliated enterprises in the South Viet Nam were excluded from the analysis due to lack of information.
Sources: JETRO Hanoi (2017; 2018a; 2018b) and JETRO Ho Chi Minh (2018b).

3.3. Supply chain of local and foreign-affiliated motorcycle and automotive parts

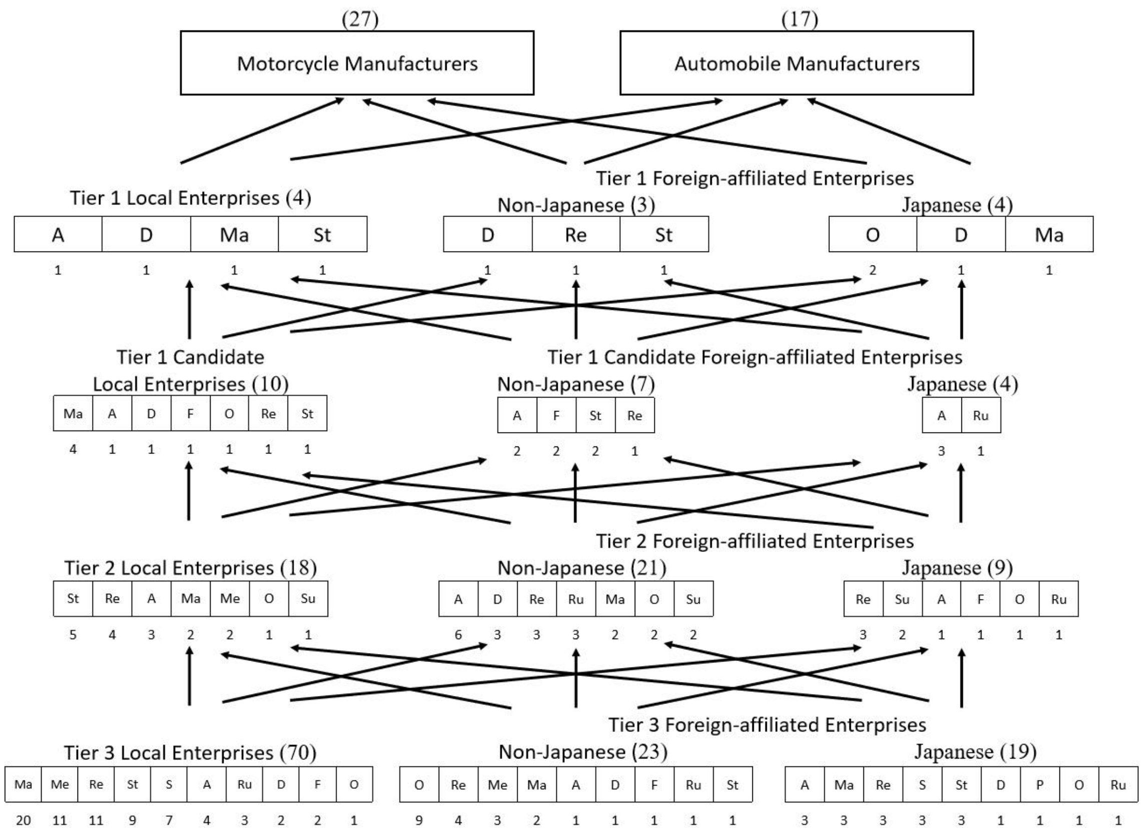
Figure 4.2 is a supply chain diagram of motorcycle and automotive parts in Viet Nam that adds motorcycle and automotive manufacturers to the information in Table 4.8. A total of 44 assembly manufacturers stand at the summit, including 27 motorcycle manufacturers and 17 automotive manufacturers. There is a total of 11 Tier 1 suppliers, comprising 4 local enterprises, 3 non-Japanese enterprises, and 4 Japanese enterprises. Then, there are 21 Tier 1 Candidates suppliers comprising 10 local enterprises, 7 non-Japanese enterprises, and 4 Japanese enterprises, followed by 48 Tier 2 suppliers comprising 18 local enterprises, 21 non-Japanese enterprises, and 9 Japanese enterprises, 112 Tier 3 suppliers comprising 70 local enterprises, 23 non-Japanese enterprises, and 19 Japanese enterprises.

Another characteristic of the motorcycle and automotive industrial agglomeration in Viet Nam is that there are few end-to-end production enterprises. This structure is different from motorcycle and automotive industrial agglomerations in Japan, Thailand, or Indonesia, which generally take a pyramid form; in Viet Nam, the motorcycle and automotive industrial agglomeration is gourd-shaped, with many assembly manufacturers, Tier 2, and Tier 3 suppliers, but few Tier 1 suppliers. The resulting challenge is to reduce the number of assembly manufacturers and increase the number of Tier 1 suppliers so that the industrial agglomeration in Viet Nam moves from its gourd shape towards a pyramid structure. This study shows a total of 21 Tier 1 Candidates suppliers from amongst Tier 2 suppliers, including 10 local enterprises, 7 non-Japanese enterprises, and 4 Japanese enterprises (see Figure 4.2). Nurturing these Tier 1 Candidates suppliers is a policy issue.

In contrast with the general structure of Japanese motorcycle and automotive parts enterprises, which undertake integrated operations from materials and through machining to surface treatment, with Vietnamese motorcycle and automotive parts enterprises, one sees a separation between materials and processing, and there is a structure whereby there is a flood of materials enterprises divided into narrow processes below Tier 1 suppliers. This suggests that local motorcycle and automotive parts enterprises lack what has been termed ‘process design capability’ (Akabane et al., 2017).

Process design capability is modelled as having six distinct but cumulative stages, of which the final is to integrate distinct processes into a production sequence. In their study on Tier 2 suppliers in Japan, Thailand, and China, Akabane et al. (2017) observed that only very few Chinese and Thai enterprises possess this capability, which may be regarded as a factor that explains the continuing success of Japanese lower-tier suppliers, which do not enjoy labour cost advantages. Regarding the competitiveness of Vietnamese automotive industry, increasing the number of automotive parts enterprises undertaking this end-to-end production will also be a task for Vietnamese industry to tackle going forward. Whilst the aforementioned study suggests that Chinese and Thai suppliers can survive without such process design capability, Viet Nam's automotive industry could hope to catch up faster to these competing economies if local automotive parts enterprises could overcome the narrow focus on single production processes.

Figure 4.2. Supply Chain of Local and Foreign-affiliated Motorcycle and Automotive Parts



Notes: 22 foreign-affiliated enterprises in the South Viet Nam were excluded from the analysis due to lack of information.

A = assembly, D = diecast, F = forging, Ma = machining, Me = metal moulding, P = precision machining, Re = resin, Ru = rubber moulding, St = stamping, Su= surface treatment.

The numbers in parentheses indicate the total number of enterprises.
Sources: JETRO Hanoi (2017; 2018a; 2018b) and JETRO Ho Chi Minh (2018b).

4. Challenges for the Automotive Parts Industry in Viet Nam

4.1. Necessity of cultivating the automotive parts industry

We have pointed out the actual situation of the motorcycle and automotive parts industry in Viet Nam and its structural weaknesses in the preceding section. Considered in terms of cost, it is not uncommon for it to be lower cost, as well as of more stable quality, to have certain parts supplied from Japan or Thailand rather than procure them from within Viet Nam. However, if a certain quantity is expected, it goes without saying that it is of a greater cost advantage to procure stamp- and resin-manufactured large and heavy parts and highly versatile smaller parts locally. Based on such circumstances, let us move to a discussion of the situation of automotive parts enterprises, and policies for their development.

4.2. Distribution of main product for motorcycle and automotive parts suppliers by capital source

The analysis so far has treated businesses in Viet Nam supplying parts for motorcycles and automobiles as a single group. However, to bring about the development of automobile parts suppliers in Viet Nam, the subject of this study, it is necessary to show the distribution of parts suppliers by source of capital (local, non-Japanese, or Japanese) and main product (motorcycles, motorcycles and automobiles, motorcycles, automobiles, and other, or automobiles) (see Table 4.9).

Of the 102 (53.1%) local enterprises, the number of enterprises supplying motorcycle manufacturers is 17 (8.9%), the number of enterprises supplying parts for both motorcycles and automobiles is 76 (39.5%), 55 (28.6%) enterprises that supply other manufacturers, such as electrical manufacturers as well as both motorcycle and automobile manufacturers, and only 9 (4.7%) enterprises exclusively supply parts for automobiles. Looking next at the 54 (28.1%) non-Japanese enterprises, 6 (3.1%) enterprises only supply parts for motorcycles, 47 (24.4%) enterprises supply parts for both motorcycles and automobiles, 31 (16.1%) enterprises that supply other manufacturers, such as electrical manufacturers as well as both motorcycle and automobile manufacturers, and only 1 (0.5%) enterprise exclusively supply parts for automobiles. Of the 36 (18.8%) Japanese enterprises, 4 (2.1%) enterprises only supply parts for motorcycles, 25 (13.0%) enterprises supply parts for both motorcycles and automobiles, 19 (9.9%) enterprises that supply other manufacturers, such as electrical manufacturers as well as both motorcycle and automobile manufacturers, and only 7 (3.6%) enterprises exclusively supply parts for automobiles.

Table 4.9. Main Product for Motorcycle and Automotive Parts Suppliers by Capital Source

		Motorcycle		Motorcycle and Automobile				Automobile		Total	
				Motorcycle and Automobile		Motorcycle, Automobile, and Other					
Local Enterprises		17	8.9%	21	10.9%	55	28.6%	9	4.7%	102	53.1%
Foreign-affiliated Enterprises	Non-Japanese	6	3.1%	16	8.3%	31	16.1%	1	0.5%	54	28.1%
	Japanese	4	2.1%	6	3.1%	19	9.9%	7	3.6%	36	18.8%
Total		27	14.1%	43	22.4%	105	54.7%	17	8.9%	192	100.0%

Notes: The 'motorcycle and automotive' category includes all enterprises in the 'motorcycle, automotive, and other' category.
22 foreign-affiliated enterprises in the south of Viet Nam were excluded from the analysis due to lack of information.
Sources: JETRO Hanoi (2017; 2018a; 2018b) and JETRO Ho Chi Minh (2018b).

Looking at the total figures for motorcycle and automotive parts enterprises, 27 (14.1%) enterprises supply parts for motorcycles, 43 (22.4%) enterprises supply parts for both motorcycles and automobiles, 105 (54.7%) enterprises supply other industries, such as electrical manufacturers as well as parts for both motorcycles and automobiles, and only 17 (8.9%) enterprises exclusively supply parts for automobiles. Overall, motorcycle and automotive parts enterprises in Viet Nam are concentrated in the supply of parts to motorcycle manufacturers, and supply to automotive manufacturers is a challenge that will need to be looked at going forward.

4.3. Differences between parts suppliers for motorcycles and automobiles

Where might there be differences between parts suppliers for motorcycles and automobiles? Both types of vehicle are similar inasmuch as they are transportation devices with the three functions of running, turning, and stopping; when looked at from the perspective of parts, however, these are two different types of vehicle. The level of precision required for each category differs so much that one could refer to motorcycles as bicycles with engines and automobiles as precision machines with engines – the former requires millimetre precision, whilst the latter micro-level precision. In terms of shape as well, motorcycles tend to be small and inexpensive, in contrast with automobiles, which tend to be large and expensive. Motorcycles require between 2,000 and 3,000 parts, whereas automobiles require 10 times that amount, at between 20,000 and 30,000 parts. Automobiles have a higher proportion of critical safety parts in addition to the engine when compared to motorcycles, for which the majority of parts other than the engine are external.

Although motorcycles and automobiles both belong to the same sector (transportation equipment), these areas could be thought of as different industry-types when it comes to the precision and quality required. Even so, the same level of precision and quality would be required for engine parts in both types of vehicle. Motorcycle engines may release a smaller volume of exhaust and be structurally smaller than those of automobiles, but there is no significant difference in terms of the required precision and quality levels on a technical level. Added to this is the fact that as it is technically difficult to make parts smaller, the larger parts become, the less difficult they are to produce, comparatively speaking. Accordingly, the fastest route to developing automotive parts industries in Viet Nam would be to select those motorcycle parts enterprises that focus on engine parts and have high levels of precision and accuracy and to intensively promote those enterprises.

4.4. Conditions and activities required for motorcycle parts suppliers to enter the automotive parts sector

Generally speaking, the automotive parts sector is characterised by strict quality and cost requirements. Compared to motorcycles, however, automobiles are not simply 'vehicles' but rather a high-growth industry closely connected to society and industry, and this is an industry of national strategic importance; once enterprises have managed to enter the sector, stable business management and the drawing of plans for future business development will become possible.

However, entry into the automotive parts sector is not easy. To supply the high-precision, high-functionality automotive parts required for these ‘moving precision machines’ with their various functions, manufacturing alone is not enough. It is necessary to acquire high-cost measuring and testing equipment to evaluate these automotive parts and to secure and train superb human resources to operate such equipment; achieving this task takes a minimum of 3 years. Meanwhile, the manufacturing itself takes at least 2 years, post-order, from the prototype and testing stages through to starting mass production, during which time large amounts of upfront investment will be necessary for securing manufacturing space, staffing, and equipment for manufacturing and quality assurance, which puts pressure on management. Accordingly, subsidies and favourable treatment from national and local governments become important in addition to each enterprise’s own efforts.

So, why should the automobiles be targeted if the environment is so difficult? Because, once enterprises have managed to enter the sector, stable and predictable profits can be secured as long as a given vehicle model is in production. Moreover, automobiles tend to have a model upgrade once every 4 to 5 years, giving rise to demand for upgrades to existing automotive parts as well as new parts; this provides enormous business opportunities for automotive parts enterprises to stride even further forward. A period of at least three to 5 years is required to begin the production of automotive parts, including a preparatory period. In that period one cannot expect any profit from automotive parts, meaning that separate means of revenue are needed. Accordingly, it will be important for enterprises planning to move into the automotive parts sector from the motorcycle parts sector to continue competing and securing earnings in the motorcycle sector whilst they make that transition.

4.5. Automotive parts industry development policies

It must be emphasised that it is important to develop a motorcycle parts supplier into an enterprise that supplies both motorcycles and automobiles, or only automobiles. However, entry into the automotive parts sector requires a large amount of capital, which cannot be covered by a firm itself, and government support is essential. Without political support, it cannot be expected the entry into the automotive parts sector to be attractive or very profitable.

First of all, when it comes to activities within parts enterprises, capital investment, human resource development, quality improvement, and productivity improvement are necessary. For example, the press department needs to install a press of the right size and remodel the building to withstand its weight. The plating department needs to expand the plating tank to improve processing capacity. In addition, precision measuring equipment will be introduced. And, to use this equipment, it costs money to create and participate in a human resources training programme. In addition, to win orders for automobile parts, it is necessary to mass-produce them while improving the accuracy of the parts. This requires firm-wide improvement efforts in terms of quality, cost, delivery time, and development. Moreover, it is essential to have an improvement programme in which everyone, from the president to lower class employees, participates.

Next, when it comes to market initiatives, we need to expand domestic and international demand. To increase the number of automobiles sold in Viet Nam, it is necessary to provide incentives and incentives based on tax law when purchasing automobiles. In addition, it is necessary to develop automotive parts as an export industry. Vietnamese motorcycle and motorcycle parts industry has developed into an export industry. Vietnamese motorcycle industry is growing rapidly, supported by its export ability. This successful precedent should also be used as a strong foundation for the development of auto parts firms.

The above-mentioned support for in-house activities and market initiatives might be widely applied to motivated firms. However, to strategically develop the automotive parts industry, select excellent parts enterprises from Tier 2 and intensively support them to develop them into enterprises that supply both motorcycles and automotive parts, or parts exclusively for automobiles. It is more effective and efficient.

Conclusion

This study examined the current state of the motorcycle and automotive parts enterprises in Viet Nam and discussed challenges to the future of the Vietnamese automotive parts industry. The motorcycle and automobile manufacturing industries in Viet Nam both began in the 1990s, at around the same time. Due to expanding domestic demand and its development into an export industry, the motorcycle industry was able to achieve growth, becoming one of the few exporting transport equipment industries in Viet Nam. The automotive industry in Viet Nam, by contrast, has remained sluggish as domestic demand has remained low. However, due to progress in economic growth in Viet Nam until 2019, automobile unit sales are starting to show an upward trend. As a result, conditions have emerged in Viet Nam to accelerate the conversion of motorcycle parts enterprises into automotive parts enterprises.

This study is a revised and amended version, with the addition of the dataset from JETRO, of the following paper:

Kobayashi, H. (2016), 'Betonamu Jidōsha Sangyō no Genjō to Tokuchō—'2-rin / 4-rin Konkō Buhin Seisan Taisei' kara 4-rin Seisan Taisei e no Ikō o Chūchin ni' [The Current State and Future of the Automotive Parts Industry in Viet Nam: A Focus on the Transition From a 'Mixed Motorcycle-Automotive Parts Industry System' to an Automotive Manufacturing System; in Japanese], *Journal of the Research Institute of Auto Parts Industries (RIAPI)*, Tokyo: Waseda University, No. 17, pp.7–23.

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