

Production Shifts and Upgrading in ASEAN Automotive Production Network: Case on Toyota-led Regional Value Chains

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Abstract

The study aims at exploring the phenomenon of regional production network in ASEAN (Association of Southeast Asian Nations) automotive sector/industry by employing a firm as well as macro-level analysis of data gathered through combining techniques between desk-study and a series of fieldwork. It examines patterns of production and manufacturing activities of leading Japanese automotive firms and their upgrading strategies as showcased by Toyota in an endeavor to cast the much-aspired ASEAN Regional Value Chains (RVCs). Production shifts have been apparent as indicated in the trade patterns and trends in value added of key automotive products traded between Japan and its ASEAN partners during the past 25 years. The shifts have resulted in deepened localization of production and manufacturing activities of Japanese automotive lead firms in ASEAN countries. Such dynamic shifts, as shown especially in passenger cars and automotive parts and accessories, have further prompted upgrading efforts by the lead firms (along with their suppliers, subsidiaries, and local partners) which suggest the functioning RVCs. The upgrading embraces areas of upstream (on research, development, and design or RD&D), midstream (on production, manufacturing, and assembly) as well as downstream (on sales, marketing, and after-market) activities. Future policy outlook lays on the ability of firms and other related stakeholders in the region's automotive sector/industry to team up in the upgrading activities and hence capture the value-added. ASEAN-Japan long and strong historical relations facilitate the enhanced collaborative automotive industrial development, particularly in the areas of technical capacity formation and supporting industries.

Keywords: Regional Value Chains, Production Shifts, Upgrading, ASEAN Automotive Production Network

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Introduction

The expansion of production networks in ASEAN manufacturing sectors is embedded in the operations of global firms, their local affiliates and partners, and suppliers within their regional production and supply chains. As early as the 1970s, companies (particularly in the textile and clothing [T&C] and electronics and electrical [E&E] industries) began to shift production out of the United States and other developed countries and tap in four key countries: Indonesia, Malaysia, the Philippines, and Thailand (Kuroiwa & Heng, 2008). The T&C and E&E sectors were followed by the automotive sector in the 1990s when several leading companies (mostly from Japan) decided to move their manufacturing facilities to the region in light of the 1988 ASEAN "brand to brand complementation" (BBC) agreement and the anticipated lowering of costs of auto assembly/production due to more efficient supply chains, logistics, delivery, and procurement.

Toyota Motor Corporation (TMC) was one of the Japanese automotive companies that initiated such a strategic move. At the end of 1990s, TMC began to utilise its manufacturing plants in Thailand as a production hub serving local, regional and global markets through its IMV (Innovative International Multipurpose Vehicle) Project, despite the ongoing effects of the 1997–98 Asian monetary crisis. The move resulted in locally designed and manufactured vehicles, i.e. one-ton Pickup trucks in Thailand and small multipurpose vehicles (MPVs) in Indonesia by the year of 2004 (TMC 1, 2017). These vehicle types are based on Toyota's ASEAN IMV platform, which has become a key part of the Toyota New Global Architecture (TNGA) strategy (Takeno, 2017).

ASEAN scholars and members of policy circles alike have had particular concern for how integrated production networks (as exemplified here by TMC) at certain points foster regional economic integration (ASEAN Secretariat and World Bank, 2015). More specifically, this is a question of how firms engage in activities that reinforce the regional economic integration scheme envisaged under the ASEAN Economic Community (AEC).¹ As suggested in this paper, it is a question on how this engagement has been driven by firms' upgrading efforts as a result of increased localisation of production/manufacturing activities. This particular question is addressed here by exploring the historical engagement of TMC and its operations in its ASEAN automotive production network.

In addition to a case study of TMC, this research employs both macro and micro analytical methods. At the macro level, trade patterns and trends in Japanese and ASEAN automotive products are presented through statistical data analysis using the UN Comtrade Database (i.e. on products categorised HS 87-motor vehicles other than railway and tramway) and the OECD-WTO Trade in Value Added (TiVA) Database (i.e. on products categorised SITC C34T35-transport equipment). At the micro level, exploration and assessment of production shifts and companies' upgrading strategies are presented by focusing on TMC operations in key ASEAN countries (i.e. Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam).

Previous works examining automotive regional production networks (particularly in East Asia and ASEAN) have emphasised the mechanics, organisational structures, and factors behind expansion (Kimura, 2007; Kuroiwa & Heng, 2008; Ando & Kimura, 2009; Soejachmoen, 2016). In line with major works on global production networks (GPN) and global value chains (GVC), those works share a common understanding that product fragmentation has led to the vertical integration of production and manufacturing activities.

As in GPN and GVC conceptualisation and theorisation (such as that offered by Gereffi, 1995; Humphrey & Schmitz, 2000), a regional production network operates within a regional value chain, as in the case of the ASEAN automotive industry, in which Japanese companies, their subsidiaries, local partners, and suppliers network play a leading role in business and production expansion. Observed from an international relations and/or international political economy perspective, regional production networks and value chains (RPNs and RVCs) play an important part in overall regional economic integration due to their integrative nature.

This paper intends, hence, to investigate the role of ASEAN automotive RPNs and RVCs (most of which involve leading Japanese original equipment manufacturers [OEMs]) in fostering regional economic integration. The case of TMC, as well as the production shifts and upgrading resulting from its increased localisation of production, is a notable one among Japanese automotive OEMs. As such, Toyota-led RVCs are presented to showcase measures taken by TMC (and other OEMs) that reflect accumulating processes of localised production and regional supply chains. The processes span across value chains and are undertaken through a combination of direct foreign investment (both green and brownfield) for production facility

expansion and maintenance, enhanced regional procurement and supply chains, locally developed RD&D (research, development, and design) centres, and reinforced subsidiaries and local partnerships.

To date, TMC's production strategies have predominantly featured a basic, generic, and general understanding of the company's renowned Toyota Production System (TPS), including Ohno's classic *Toyota seisan hoshiki* (1978). This work was soon followed by scholars such as Cusumano (1985), who compares Toyota and Nissan's production systems; Womack, Jones and Roos (1990) who equates and explores TPS as a lean production; Monden (2012), who gives a detailed description of TPS as a just-in-time (JIT) production process; Liker (2004) and Liker and Hoseus (2008), who illuminate the Toyota Way and TPS' derivative management concepts and practices. Such a basic understanding offers a conceptual framework for the actual operations of Toyota-led RVCs, which in turn is essential for assessing the contributions of TMC and other automotive OEMs in regional economic integration.

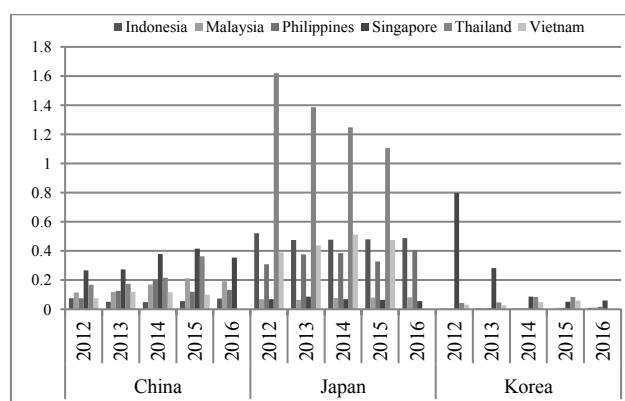
The next part of this paper (Findings and Discussion) presents the major results of my research and is outlined as follows. To present the general setting of TMC and other Japanese OEMs' operations through their regional production networks in Southeast Asia, the first section offers a review of patterns and trends in the trade of automotive products between Japan and ASEAN, with specific reference to two key automotive products: passenger cars (HS 8703) and auto parts and accessories (HS 8708). The second section showcases TMC's involvement in the ASEAN automotive production network, i.e. its structural organisation/spatial linkages, upgrading, and value chains. It describes TMC's position and role as a leading automotive company, as well as how the firm links to its first-tier suppliers, local partners and subsidiaries, as well as other related stakeholders. The third section elaborates on Toyota-led value chains in ASEAN and the transfer of products, parts, and components within TMC's production network. Elucidation of TMC production shifts in ASEAN is aimed at examining the company's upgrading efforts as it deepens localisation of production and accumulation of localised technical capacity and knowledge transfers.

Research Findings

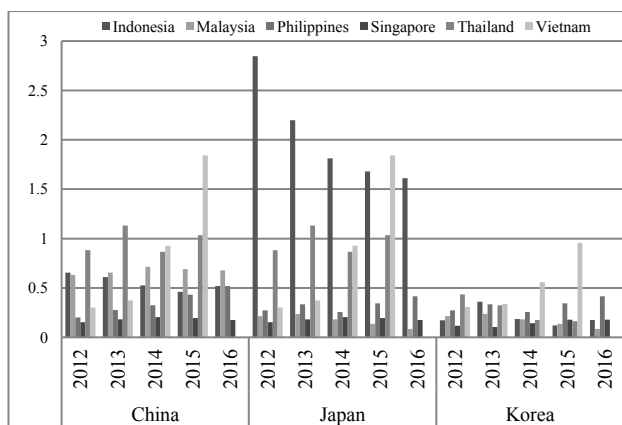
As indicated earlier, the key findings of the study are presented and discussed in three sections, focusing on: (1) Trade Setting (in the trade of automotive products between Japan and ASEAN, with a focus on HS 87 and SITC C34T35); (2) Showcasing TMC's involvement in ASEAN automotive production networks; (3) Toyota Value Chains (for production shifts and upgrading).

Trade Setting

In 2016, Japan's trade of products under HS 87 (motor vehicles other than railway and tramway) with its key ASEAN partners (hereafter ASEAN6, consisting of Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam) represents USD 13.16 billion or 7.2% of its total trade with ASEAN6 (of USD 182.2 billions). The total value of its exports to ASEAN6 in products under HS 87 is USD 10.76 billion, while its imports are valued at USD 2.39 billion, resulting in a surplus of USD 8.37 billion. Thailand is Japan's most important partner in its HS 87 trade with a total value worth of USD 4.3 billion (about 2.3% of the total value Japan–ASEAN6 trade) as of 2016. Indonesia, the Philippines, and Malaysia come next, with total trade values of USD 2.2 billion, USD 2 billion, and USD 1.89 billion as of 2016 respectively. Singapore and Vietnam, meanwhile, respectively account for total values of USD 1.41 billion and USD 1.36 billion as of 2016 (UN Comtrade, 2017).



Exports



Imports

Diagram 1. ASEAN6 Exports to and Imports from East Asian Countries, HS 87 Products (USD billions, 2012–2016)
(Source: UN Comtrade Database, 2017)

Note: 2016 data for Thailand and Vietnam are not available

Compared to its closest competitors in the region (i.e. China and Korea), Japan has become dominant in the ASEAN6 trade in HS 87 products. The following diagrams reveal that this has occurred over the past five years (2012–2016) despite the emergence of China as a major origin of HS 87 imports, particularly to Singapore and Vietnam. Despite its position having weakened since 2012, Thailand remains the leading exporter of HS 87 products to Japan (as shown in Diagram 1) and Indonesia remains the leading importer of HS 87 products from Japan (as shown in Diagram 2).

Since the end of the 1980s, i.e. for more than 25 years, ASEAN countries' trade with Japan in HS 87 products has been characterised by ebbs and flows. As shown in Diagram 2, showing Japan's trade with the two leading ASEAN countries (i.e. Thailand and Indonesia), Japan experienced its first boom exports in 1995 (with exports to Thailand reaching a record USD 3.7 billion), though this soon burst as the 1997 Asian monetary crises hit the two countries. In its aftermath, however, the uptrend returned promptly. It started gaining momentum in 2004 and peaked once again in 2012, despite a brief downturn in 2009 as a result of the 2008 global financial crisis.

Products (USD millions, 1988–2016)

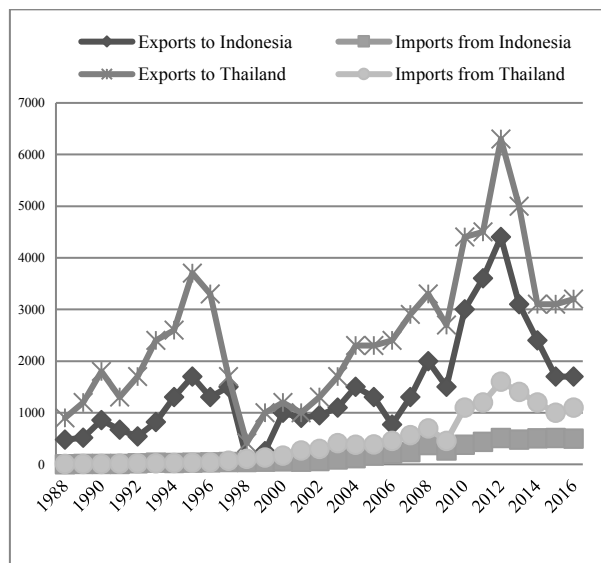


Diagram 2. Japan's Exports to and Imports from Thailand and Indonesia, HS 87 (Source: UN Comtrade Database, 2017)

Breaking down the HS 87 trade between Japan and these two countries (i.e. Thailand and Indonesia), with main imported products being motor vehicle parts and accessories (HS 8708) and the main exported products primarily being passenger cars (HS 8703). In HS 8708 trade, Thailand was Japan's third partner in 2014 capturing 8% of the country's total export value of HS 8708 products (USD 31.8 billion) and 9% of its total import value of products in the same category (USD 7.08 billion). Meanwhile, for HS 8703 products, Thailand captured 3% of Japan's total import value as of 2014, while Indonesia took 4% of both Japan's total HS 8708 exports and imports (as of 2014). Other ASEAN countries with significant share in Japan's HS 8708 exports and imports are Singapore, Vietnam, and the Philippines. Singapore took 1% of Japan's total HS 8708 exports, and Vietnam took 4% of Japan's total HS 8708 imports (as of 2014) (UN Comtrade Database, 2017).

Since 1988, in terms of value, Japan's HS 8703 (passenger cars) trade with Indonesia, Thailand, and Malaysia is about a quarter of that of HS 8708 (parts and accessories) trade. In 2012, Japan's export of passenger cars to Malaysia peaked at USD 1.2 billion, while its parts and accessories exports reached a value of more than USD 4 billion. This indicates that Japan's automotive trade with these three ASEAN countries has been much less dependent on automobile exports and shifted to trade in automobile parts and accessories, confirming significant production shifts in

Japanese automotive companies' intra-industry trade and regional production networks.

In single-year data from 2012, 2005 and 1993 (i.e. when Japan trade performance with those three ASEAN countries peaked), it is observed that Japan's automobile exports have relied on HS 870323 (vehicles with spark-ignition internal combustion reciprocating piston engines and cylinder capacity of over 1500cc but not over 3000cc). Such medium to large-size automobiles are the most frequently exported to Malaysia (2005 and 2012) and Thailand (1993). Nevertheless, trade value from the import of gasoline (under 1000 cc) automobiles from Thailand has grown significantly, reaching USD 200 million in 2012 – a sharp increase from its value of less than USD 14,000 in 1993. This indicates the growing significance of small-type cars in Japan-ASEAN automotive trade.

Diagram 3 illustrates the shifting patterns in Japan's trade with Indonesia, Malaysia, and Thailand in passenger cars.

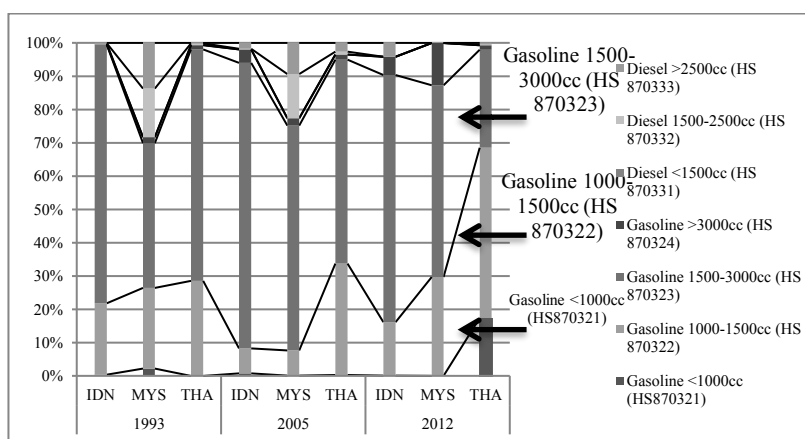


Diagram 3. Shifting Patterns in Passenger Cars Trade between Japan and Selected ASEAN Countries (% of Total Trade Value for HS 8703 in Each ASEAN Country, 1993, 2005 and 2012)
(Source: UN Comtrade Database, 2017)

This reveals each product category's share in the total Japan HS 8703 trade value in three ASEAN countries. As shown above, trade has shifted generally towards cars with smaller engine capacity. In Indonesia and Malaysia, trade has shifted towards gasoline automobiles of 1000–1500 cc (HS 870322), whereas in Thailand the growing importance of gasoline-type automobiles under 1000 cc has been apparent since 2012.

In terms of value-added trade, Japan and its major regional partners have shared dynamic trends for products traded under SITC C34T35 (transport equipment). The following two diagrams (Diagram 5 and 6) visualise the trends by utilising the OECD-WTO TiVA indicators of the foreign final demand domestic value added (FFD-DVA) and domestic final demand-foreign value added (DFD-FVA). FFD-DVA value indicates forward trends in trade (i.e. a country's domestic value-added exports going into exports of other countries), whereas DFD-FVA suggests backward trade linkages (i.e. foreign value added in gross exports) (Banga, 2013). Diagram 4 and 5 present trends in FFD-DVA and DFD-FVA, respectively, in Japan's trade of SITC C34T35 products with selected key partners in the region.

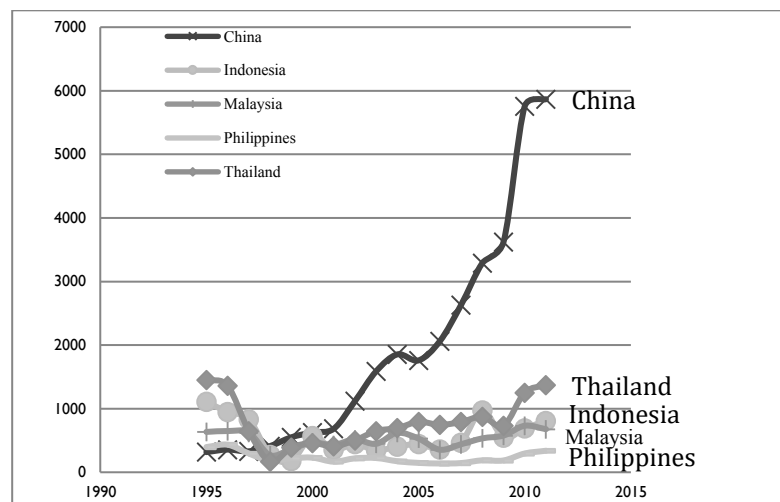


Diagram 4. Japan's FFD-DVA in SITC C34T35 Trade with Selected Regional Partners (USD millions, 1995–2011)
(Source: OECD-WTO TiVA Database, 2017)

Despite having much lower value compared to that created with China, Japan's FFD-DVA in its trade with several key ASEAN countries (Thailand, Indonesia, Malaysia and Philippines)—as shown in Diagram 4—has experienced an upward trend since its sharp decline in 1998; in 2011, Japan's FFD-DVA in its trade with Thailand and Indonesia caught up to 1994 levels. This indicates that the export activities and values of Japanese automotive companies operating in these two key ASEAN countries have returned to regular capacity. Japan has captured less DFD-FVA value than its FFD-DVA value, which suggests that the production shifts of most of its lead companies' manufacturing facilities to the region have developed towards a full automotive production hub, particularly in Thailand (and later Indonesia). On

average, Japan's FFD-DVA value is about a third of its DFD-FVA value.

Diagram 5 below illustrates trends in Japan's DFD-FVA value created in trade with selected partners in the region. China—not shown in the diagram—are reached USD 2,286.4 million (2011) and USD 1,183.6 million (2006). Similar to Japan's DFD-FVA with China, the country's trade with ASEAN countries created about one third of its FFD-DVA value on average over time (1995–2011). This particular trend (where the FFD-DVA value is higher than its DFD-FVA) suggests that the value captured by Japanese trade in the region (for SITC C34T35 products) has originated mostly from Japanese OEMs activities and their operating networks in the host countries.

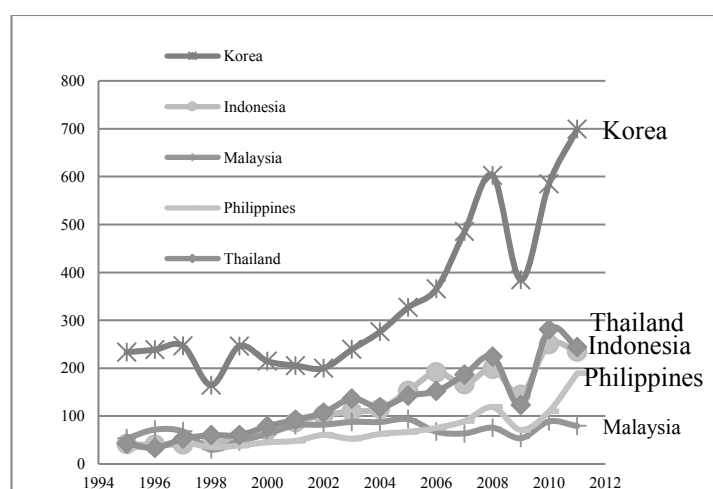
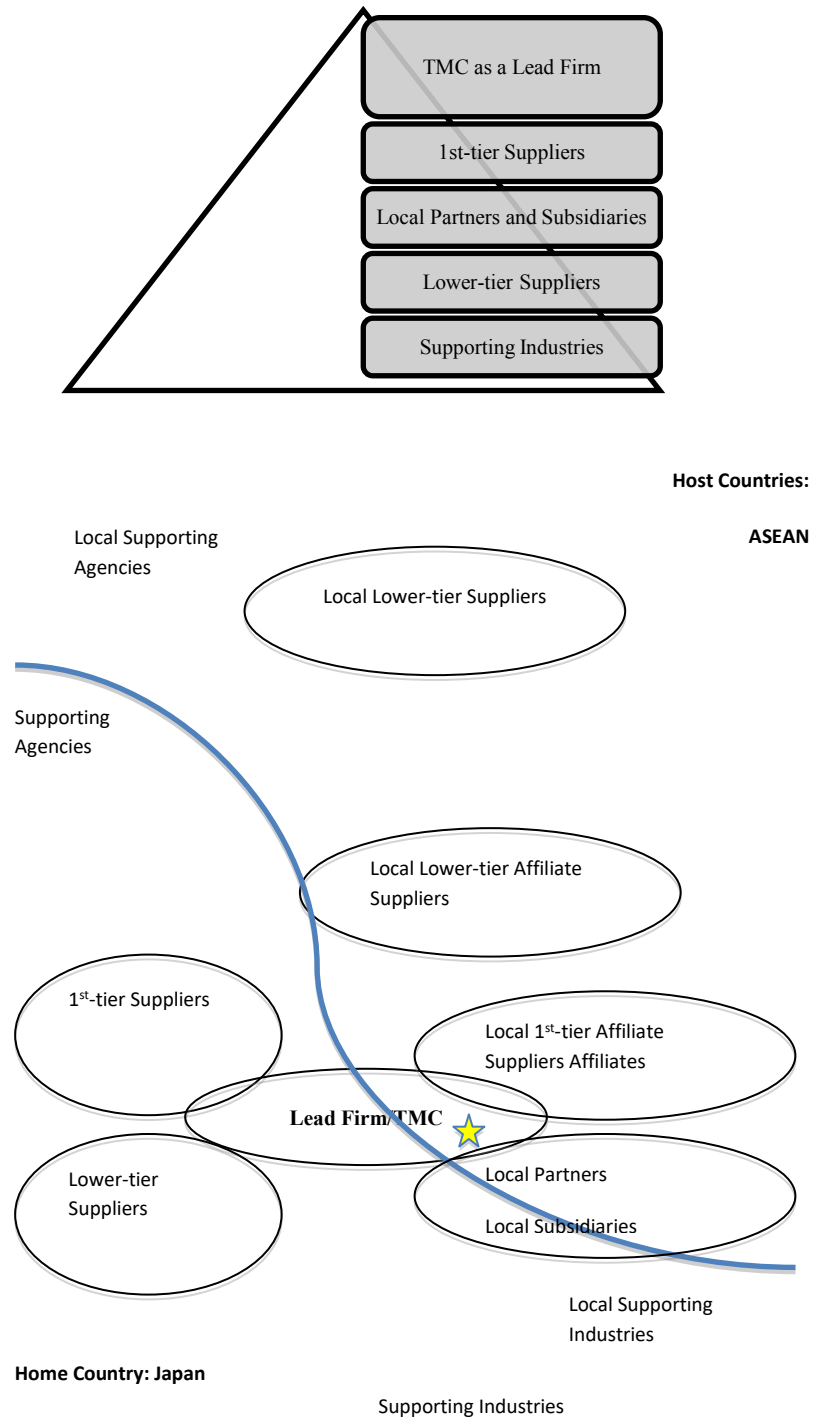


Diagram 5. Japan's DFD-FVA in SITC C34T35 Trade with Selected Regional Partners (USD millions, 1995–2011)
(Source: OECD-WTO TiVA Database, 2017)

As of 2011, Japan's trade with four selected ASEAN partners has created an FFD-DVA value of USD 1,399.9 million (for Thailand), USD 807.1 million (for Indonesia), USD 678 million (for Malaysia) and USD 338.9 million (for the Philippines). This is about five times higher than Japan's DFD-FVA trade values with the same countries, indicating that value-added creation in Japan's automotive trade with ASEAN countries is most likely to occur locally (as a result of localised production and manufacturing activity) than internationally (as part of export/import activities). This phenomenon reflects stronger backward linkages than forward linkages in Japan's trade with ASEAN in automotive products. The next two sections are therefore intended to elucidate the phenomenon using micro-level analysis and a company-level case study of Toyota.

Showcasing TMC

As a firm leading a production network, TMC maintains the following structure: the lead company (TMC), first tier suppliers (mostly based in Japan, with affiliates in local host countries), local partners (mostly joint ventures with local companies) and subsidiaries or affiliates in host countries, lower-tier suppliers (mostly in host countries), and local and home country supporting industries:



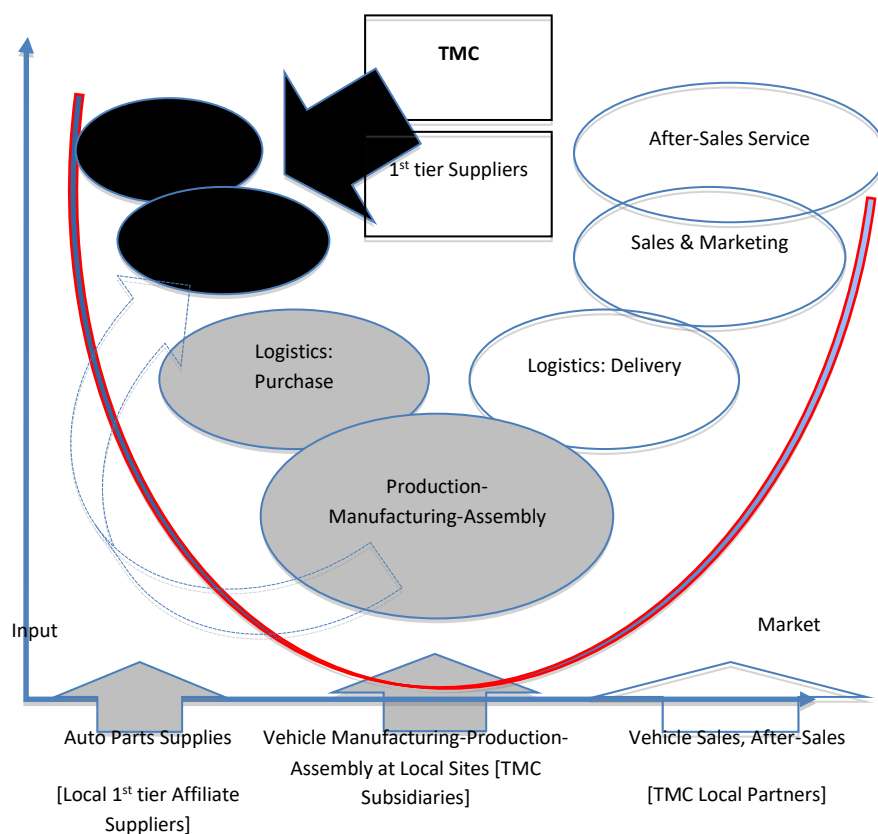
Notes and remarks: (1) as a leading company, TMC is a global company consisting of automotive and non-automotive companies, mainly based in Toyota City (Aichi), Tokyo, and Osaka in Japan; (2) First tier suppliers consist of companies (members of Toyota Group and non-members) directly supplying auto parts and components to TMC; (3) In Southeast Asia, major local partners and subsidiaries or affiliates are based in Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam,ⁱⁱ whereas TMC's affiliate in Singapore is a procurement centre that serves as regional operational headquarters (OHQ), visualised as

Diagram 6. Structure and Spatial Linkages of TMC's Production Network in Southeast Asia

(Source: Author's assessment referring conceptually to Kuroiwa & Heng, 2008)

Toyota Value Chains

With the structure and spatial linkages described above, TMC and its suppliers, local partners, and subsidiaries have endeavoured to add value during pre-production (i.e. RD&D), production (i.e. logistical procurement and supply of parts and components, manufacturing, and assembly) and post-production (i.e. final products logistics and delivery, sales and marketing, after-sales services) stages. The following diagram offers a smiling curve depiction of processes in the case of TMC's production networks and business operations in Southeast Asia:



Notes/remarks, legends:



A list of TMC subsidiaries/local partners is available in the endnotes.

Diagram 7. A Smiling Curve of Toyota Value Chains in Southeast Asia
(Source: Author's assessment, adapted from Shih, 1996; Gereffi, 2016; Mundambi, 2008; Rabellotti, 2014; Ye et al., 2015)

As shown in Diagram 7, Toyota value chains cover the three main stages of pre-production, production, and post-production. The pre-production stage is occupied mainly by TMC and its first-tier suppliers as it involves capital-intensive RD&D activities with significant accumulated knowledge, technical know-how, and technology. Several local production sites, however, have facilities for limited and localised RD&D activities. Such trends (symbolised by a dashed-line moving upwards from production to pre-production in Diagram 7) have been among the highlighted features in TNGA application at local manufacturing sites.

Referring to the above smiley curve, the actual production stage conceptually offers the least value-added compared to pre-production and post-production stages. However, in the case of Toyota, this stage represents a series of core tasks undertaken by a large number of TMC companies, specialised divisions, first tier suppliers, local partners (along with local networks), subsidiaries/affiliates, and lower-tier suppliers. TPS has been at the heart of such long production processes and is the main reference for optimising manufacturing costs, lead time, and production (Just in Time/JIT on pull system, continuous flow processing, takt time). In TPS, therefore, value added is incurred in efforts to reduce unnecessary work/waste (*muda*), instability and fluctuation (*mura*), and overload/overburden/overwork (*muri*) (Takeno, 2017; Tangkas, 2009).

Post-production activities, meanwhile, have been mostly undertaken collaboratively under the Toyota global strategy by TMC, local partners, and subsidiaries/affiliates. This stage covers a wide range of activities, from logistical delivery, marketing and sales of final and after-market products, to after-market services (including advertising and various brand awareness programmes, as well as consumer and public relations). Local partners and subsidiaries/affiliates play a crucial role in formulating, initiating, executing, and more importantly maintaining

such activities. TMC's lengthy and robust relations have contributed to value being created and captured in this particular stage. The following sub-sections discuss Toyota's value chains from the two main elements: production shifts and upgrading. The sub-section on production shifts explores the movement or transfer of products, parts, and components within TMC's production network and supply chains, while the sub-section on upgrading assesses activities undertaken within the value chains by TMC and its suppliers, local partners, and subsidiaries.

Production Shifts

Starting its operations as early as the 1960s, in the 1990s TMC outlined its expansion plan for production networks in Southeast Asia through its Toyota IMV project, with its debut products officially launched in 2004. With a current total annual production capacity of more than 1 million units, the Toyota Group's manufacturing activities in the region have the following features:

Table 1. *Toyota in Southeast Asia, Production Features*

Host	Major Features	Remarks
THAILAND (THA)	<ul style="list-style-type: none"> ▪ IMV Project: Production of Hilux pickup trucks and Fortuner SUVs (Sport Utility Vehicles) ▪ Development of a compact car platform: Production of Yaris hatchback and Vios sedan (until 2013) ▪ Production of Camry and the mid-level sedan Corolla ▪ Establishment of RD&D facility (in 2003) 	<ul style="list-style-type: none"> ▪ Developed based on a similar platform and directed at emerging markets (ASEAN and the Middle East), but Hilux is also exported to Europe and Australia ▪ Directed at emerging countries; using this platform, versions for Europe, North America, and Japan have slight differences in design and specifications ▪ Only exported within ASEAN ▪ Local engineers develop solutions for tough road conditions in ASEAN and other emerging countries
INDONESIA (IDN)	<p>Under Toyota Brand</p> <ul style="list-style-type: none"> ▪ Production of IMV models: Fortuner SUV and Innova MPV ▪ Production of all Vios models <hr/> <p>Under Daihatsu Brand</p> <ul style="list-style-type: none"> ▪ Production of popular compact MPV Xenia and its sister model, Toyota Avanza. 	<ul style="list-style-type: none"> ▪ Exported within ASEAN and to the Middle East ▪ Used to be imported from Thailand <hr/> <ul style="list-style-type: none"> ▪ With the exception of the brand logo, these two models are identical; Avanza is exported to ASEAN, South Africa, and some

Production Shifts and Upgrading in ASEAN Automotive Production Network

	<ul style="list-style-type: none"> ▪ Production of compact sedan Ayla and its sister model Toyota Agya (since 2013) ▪ Assembly of Terios SUV and the rebadged version of Toyota Rush 	<ul style="list-style-type: none"> ▪ countries in the Middle East ▪ These two vehicles are also identical, and Agya is exported to the Philippines (from February 2014); both vehicles conform to the Indonesian government LCGC (low cost green car) policy ▪ Daihatsu trails Toyota in terms of market share, but because it is part of the Toyota group, Daihatsu produces and sells its models in cooperation with Toyota
MALAYSIA (MYS)	Under Daihatsu Brand <ul style="list-style-type: none"> ▪ Co-production with Perodua (Daihatsu rebadged sedan) 	<ul style="list-style-type: none"> ▪ Sold domestically for Malaysian market
PHILIPPINES (PHI)	<ul style="list-style-type: none"> ▪ Production of Vios and Innova MPV 	<ul style="list-style-type: none"> ▪ Much smaller scale (than in Thailand and Indonesia), sold for domestic market only
VIET NAM (VNM)	CKD assembly for IMV models and Corolla, Camry, and Vios	Mainly for domestic market

(Source: Kobayashi, 2014; TMC 2, 2017)

With such production features, Toyota has taken a leading position in both production and market share in key ASEAN countries (except Malaysia, due to the legacy of its "national car" policy). Table 2 offers detailed information on Toyota's production and market shares in ASEAN5 countries (Indonesia, Malaysia, the Philippines, Thailand, and Vietnam).

Table 2. Toyota Production and Market Shares in ASEAN5

Host	Production Share	Market Share
THA	21.5% (as of 2015) of total domestic vehicle production capacity (3.66 million units) or actual production (1.92 million units) [Rank: #1]	35.2% (as of 2015) of total domestic passenger vehicles sales (0.299 million units), 32% (as of 2015) of total domestic commercial vehicles sales (0.112 million units) [Rank: #1]
IDN	45.6% (as of 2016) of total domestic vehicle production (1.29 million units) [Rank: #1]	35% (as of 2016) of total domestic vehicle sales (1.21 million units) [Rank: #1]
MYS	10.3% (as of 2016) of total domestic vehicle production (0.545 million units) [Rank: #3, extrapolated from Natsuda et al.,	8.7% (as of 2016) of total domestic passenger vehicles sales (0.515 million units) [Rank: #4], 29.2% (as of 2016) of total domestic commercial

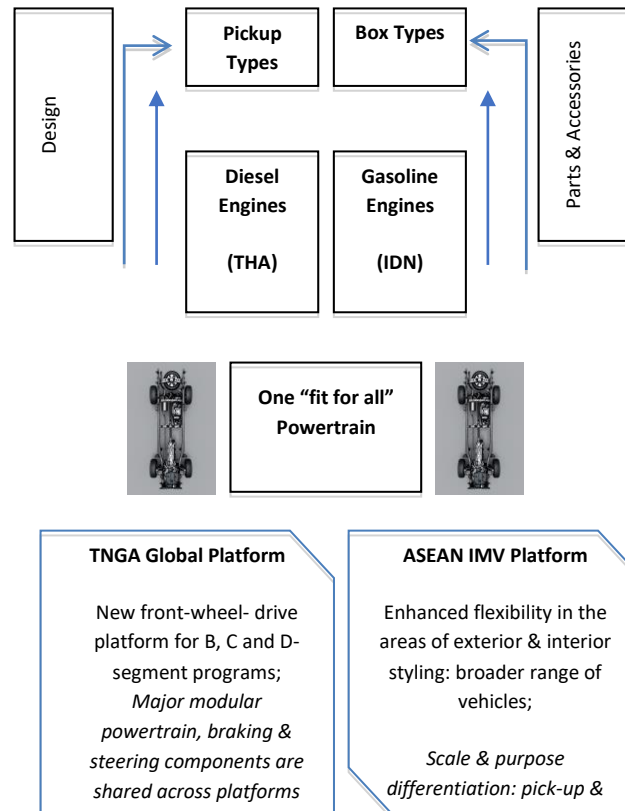
	2012]	vehicles sales (0.065 million units) [Rank: #1]
PHI	56.1% (as of 2016) of total domestic vehicle production (0.098 million units) [Rank: #1]	45.2% (as of 2016) of total domestic vehicle sales (0.350 million units) [Rank: #1]
VNM	22% (as of 2016) of total domestic vehicle production (0.236 million units) [Rank: #2]	28.14% (as of 2015) of total domestic vehicle sales (0.270 million units) [Rank: #1]

(Source: Yongpisanphob, 2016 for Thailand (THA); GAIKINDO, 2017 for Indonesia (IDN); Natsuda et al., 2012; MAA, 2017; Paultan, 2017 for Malaysia (MYS); TMP, 2017; APEC, 2016; Topgear Philippines, 2016 for the Philippines (PHI); AAF, 2016; Sundjojo, 2016; TMV, 2017 for Vietnam (VNM))

In addition to vehicle production, Toyota subsidiaries/affiliates in Southeast Asia also locally produce various major key automotive parts and components such as engines, propeller shafts, and casting parts (by STM in Thailand); engines, jigs, dies, and various components (by TMMIN in Indonesia); transmission components (by TAP in the Philippines); and engine computer components (by ASSB in Malaysia) (JAMA, 2007; TMMIN, 2017; STM, 2016; Asawachintachit, 2012; Takeno, 2017; Wesley Net ECAT, 2017; Cheewatrakoolpong, Sabhasri & Bunditwattanawong, 2013 as adapted from Dent, 2008).

Followed typical manufacturing orders and stages (car assembly, engine assembly, large scale casting of engine blocks, parts, and accessories), TMC operations in Southeast Asia have commonly also been preceded by the technical capacity and know-how accumulated at local manufacturing sites, i.e. by ensuring connectedness in the supply chains and the levelling of technological application among these sites. The Toyota IMV Project, hence, makes use of such accumulation and adds on a common platform for vehicle types specifically designed both for local (regional) and global markets (Takeno, 2017). The following diagram depicts the platform of the Toyota IMV Project applied in Southeast Asia:

Production Shifts and Upgrading in ASEAN Automotive Production Network



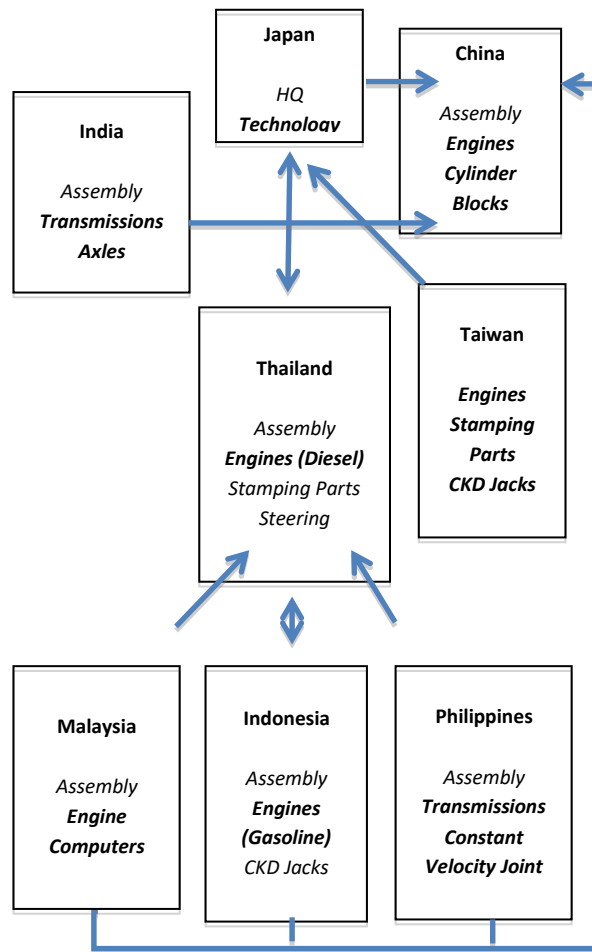
Remarks: (1) The image is a Toyota Fortuner powertrain, one MPV type based on IMV platform; (2) Toyota car segment programmes are in line with the Commission of the European Union's classification, with B referring to "small cars" (normal or small-size cars, e.g. Sienta, Probox, Vios, Etios, Vitz, Yaris, Starlet), C refers to "medium cars" (universal or small family cars, e.g. Corolla, Prius, Matrix), and D refers to "large cars" (larger family cars with a sufficient comfort level for rear passengers and improved driveability, e.g. Premio, Lexus IS). Meanwhile, the Toyota Fortuner is categorised J: "sport utility cars" or SUVs.

Diagram 8. Platform for Toyota IMV Project in Southeast Asia
 (Source: interpreted, adapted from & based on TMC 1, 2017; Seng, 2016; and Takeno, 2017)

The movement and transfer of major parts and components follow a pattern that is characterised by manufacturing specialisation; Toyota's Thai facilities concentrate on the production of diesel engines, its Indonesian facilities focus on gasoline engines, its Filipino facilities concentrate on transmission and constant velocity joints, and its Malaysian facilities focus on engine computers. As a result, major parts and components under the IMV project that were transferred between Toyota Thailand and Toyota Indonesia have shifted as two-way traffic has become increasingly complementary. The IMV platform has been applied for products commonly manufactured both in Thailand (TMT) and Indonesia (TMMIN), i.e. Innova

and Fortuner (MPVs) and Yaris and Vios (passenger cars). Particular platforms, thus, determine specific types of components and parts related to those products and their transfer between subsidiaries. With other vehicle types manufactured under the same platform, parts and components are also transferred correspondingly.

Diagram 9 illustrates the part and component transfers under the Toyota IMV platform in Southeast Asia and surrounding countries:



Note: (1) The highlighted (bold) activity in each box signifies each host country/host economy's specialisation in the production network at current condition (2017); (2) lines/arrows indicate the movement and transfer direction of components and parts.

Diagram 9: Part and Component Transfers under the Toyota IMV Project in Southeast Asia and its Surroundings

(Source: Cheewatrakoolpong, Sabhasri & Buditwattanawong, 2013; as adapted from Dent, 2008; FOURIN 2015 as quoted in JETRO, 2017; and Takeno, 2017)

With regards to procurement logistics and product delivery, Toyota Motor Asia Pacific Pte Ltd (TMAP-MS) (formerly known as Toyota Motor Management Service

Singapore Pte Ltd or TMSS) has been taken the role of Toyota's OHQ in the region. It plays a pivotal role by serving as a processing and procurement centre for major parts and components transferred among Toyota's subsidiaries in Southeast Asia. Diagram 10 shows the logistical processes and indicative volume of component and part transfers among Toyota subsidiaries in the region. Under such processes, delivery costs and other logistical costs are optimised by preventing double or multiple cost incurrences among subsidiaries. It ensures that the volume of certain outbound shipments is the same as inbound ones, both to and from Singapore. Shipments of diesel engines and other parts and components from Toyota Thailand (TMT) to other subsidiaries, for example, are the same volume as shipments of other components and parts from other subsidiaries. As a central logistical and procurement centre, TMAP-MS covers not only delivery products among Toyota Southeast Asian subsidiaries, but also between Southeast Asia and Japan, Taiwan, China, and sometimes India (Takeno, 2017).

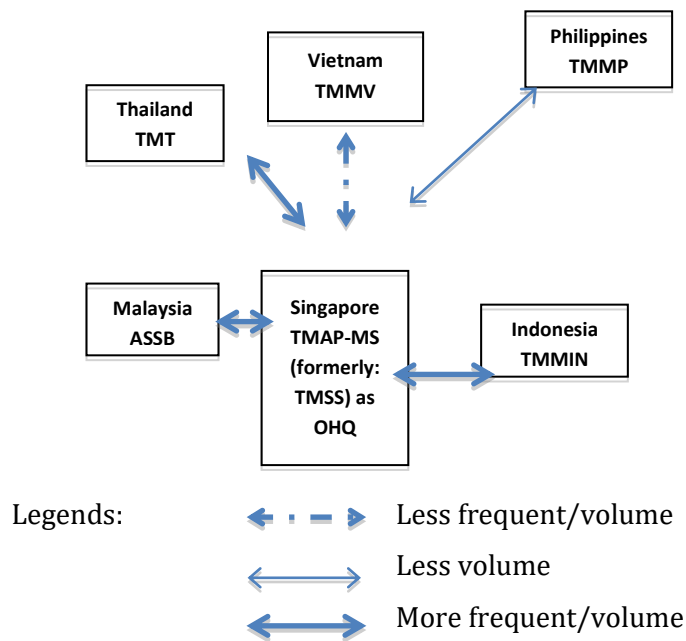


Diagram 10. Logistics Flow among Toyota Subsidiaries in Southeast Asia
(Source: Author's assessment, based on Takeno, 2017)

Upgrading

In Southeast Asia, TMC's overall upgrading strategy has been undertaken by and applied mainly within the domain of subsidiary companies, i.e. Toyota Motor Asia Pacific Pte Ltd (TMAP). Initially founded as TMSS in Singapore (May 1990),

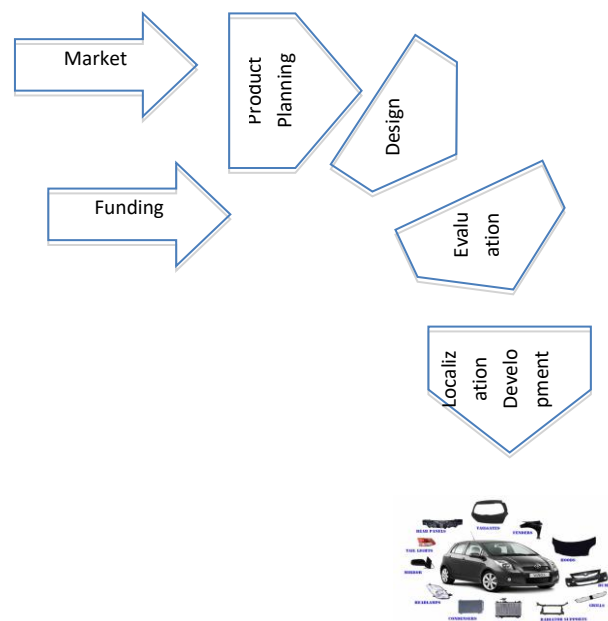
TMAP currently has two affiliate companies, i.e. TMAP-MS (which replaced TMSS in April 2001) and Toyota Motor Asia Pacific Engineering & Manufacturing Co. Ltd. (TMAP-EM) located and based in Bangkok (which changed its name to Toyota Daihatsu Engineering & Manufacturing [TDEM] on 3 April 2017). TMAP's organisational structure consists of a management team led by a chief executive officer who co-worked with a chief technical officer based in TMAP-MS in Singapore and aided by a deputy chief executive officer based in TMAP-EM (or now TDEM) in Bangkok. The management covers their work and responsible for two main areas: Asia (to which Southeast Asia belongs) and the Middle East and North Africa (including Central Asia) (TMAP, 2016; TDEM, 2017; Bloomberg, 2017; TMC 1, 2017).

Since 2001, i.e. following its organisational restructuring, TMAP has expanded its functions to cover not only operational processing and procurement, but also to support the application of TPS at local manufacturing sites, i.e. to support the design, development, and manufacturing of certain localised vehicle types. Fields of support include basic TPS management, production-related aspects, RD&D, and sales. These functions have been expanded gradually and follow these sequential stages overtime:

1. Modest sales function (1997–2000): logistics and commercial delivery of products are the main activity features (under TMSS)
2. Advanced sales function, involving assessment of product pricing, supply and demand, and customer service (since 2001, i.e. the restructuring of TMSS and TMAP-MS)
3. On top of those modest and advanced sales functions, RD&D activity commenced (in 2003-4) with the establishment of technical centres that became the embryo of TMAP-EM in Bangkok (founded in April 2007)
4. Full operation of TMAP-EM marked the start of production-related functions, i.e. in manufacturing techniques and procurement of parts and component, supply chains (since 2007), production support (since 2008) and planning (since 2009), vehicle project planning (since 2012), and "Z" feature support for the development of four-piston engine vehicles (since 2013–14).

In RD&D, undertaken mainly by TDEM's Technical Centre (formerly TMAP-EM), the main activity is vehicle engineering and evaluation (in 2003, still under TTCAP [Toyota Technical Center Asia Pacific] in Australia, but under TMAP-

EM/TDEM since 2007). Vehicle parts engineered and evaluated in the technical centre include Vigo C-Access Door (2008), Corolla CNG (2010), Vigo CNG (2012) and REVO (2015). Diagram 11 shows the flow of TC RD&D processes. It also demonstrates the technical capabilities of the centre. Upon assessment on the market and funding, the first stage is product planning, which involves managerial as well as technical expertise. The second stage is design, i.e. transforming product plans into product prototypes using detailed engineering drawings that meet technical aspects and other considerations. The third stage is evaluation, i.e. a post-design (and post-production) activity for evaluating the performance or results of designed (or manufactured) products. The fourth stage is localisation, where local manufacturing sites' capabilities for optimum usage of local parts and components, engineers, engineering techniques, and other managerial tasks.



*Diagram 11. RD&D Technical Capabilities and Flows at the TMAP/TDEM Technical Centre
(Source: TMAP, 2016)*

Referring to TMAP's business range and the wide geographical coverage of its activities (especially RD&D, under its Technical Centre), TMC's upgrading efforts in its Southeast Asian operations have focused mostly on "functional" and "inter-chains" upgrading.ⁱⁱⁱ These efforts co-exist with TMC's continuing endeavours to add value through the "product" and "process" upgrading embodied in the TPS/Toyota Way *-kaizen* (continuous improvement), *hansei* (relentless reflection), *genchi*

genbutsu (solving problems by seeing what is really going on). These two-layered upgrading efforts (as shown in Diagram 12) feature interconnectedness between TMC, its first-tier suppliers, local partners and regional subsidiaries during pre-production, production, and post-production activities.

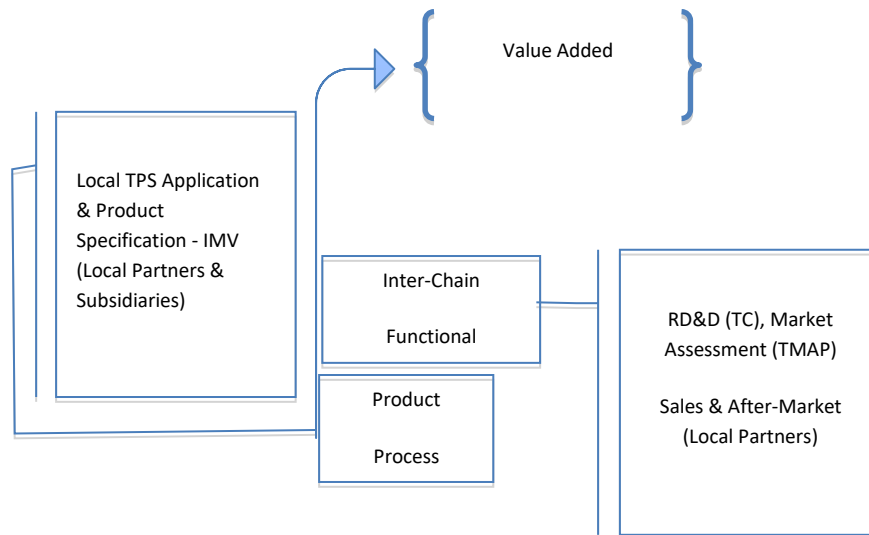


Diagram 12. TMC Two-layered Upgrading in Southeast Asia (Source: author's assessment)

Table 3 recapitulates details of activities undertaken by TMC and its production network in Southeast Asia that indicate upgrading efforts along its value chains. The assessment offers micro-level analysis of the upgrading strategy and other related measures used by the lead firm (TMC or Toyota Group), its first-tier suppliers, local partners, and subsidiaries/affiliates in the region.

Table 3. *Toyota Upgrading Activities in Southeast Asia*

	Features	Remarks
PROCESS UPGRADING	TPS application at local manufacturing sites: organisational scheme (TMC) (Hida, 2014; Watanabe, 2016) Low-cost automation (all local partners & subsidiaries) (Iwadare, 2016; Utomo, 2016) Robotic engineering and semi-automation machinery application (Sapta, 2016) Toyota supplier quality control (for 2 nd tier or lower): regular business meetings, audit/plant inspection,	Official organisational scheme is conducted via self-reliance division or development department to ensure quality and a standardised process of manufacturing. Flexibility in adapting to local manufacturing conditions and technology gives them the option of applying and utilising existing facilities with limited adjustment (case on Toyota Kijang) Full (robotic) and semi-automation are adopted when market demands require rapid expansion of facilities (as in the case of new plants in Indonesia and Thailand)

Production Shifts and Upgrading in ASEAN Automotive Production Network

	regular vocational training (Mizuta, 2016; Prasetyani, 2016)	Solid relations with suppliers are essential for full application of TPS at local manufacturing sites
PRODUCT UPGRADING	ASEAN IMV Project Platform Powertrain: 1 Ton Pickup Trucks, Small MPVs, LCGC (TMC, STM, TMMIN) (TMC 1, 2017; Takeno, 2017) Local consumer-driven products (Watanabe, 2016)	Despite using shared platform and powertrain in IMV models, product variety and specification must be considered to add product value Specific and unique additional features are installed in IMVs (e.g. mini refrigerators for Thai consumers, cup holders for US consumers in one-ton Pickup trucks)
FUNCTIONAL UPGRADING	RD&D and Market Assessment (TC TMAP) Local R&D centres (TDEM in Thailand and ADM in Indonesia): aim to develop small IMVs in collaboration with Daihatsu (TDEM, 2017; Hayato, 2016) In house R&D engineering centre (1 st tier Suppliers, Case of Denso Corporation)	TC TMAP takes a leading role in engineering development and market intelligence functions by regularly linking its work and business with those of other subsidiaries/affiliates, e.g. TMMIN regularly consult with TC TMAP for RD&D aspects of production (Sapta, 2016) ADM collaborates with an automotive research centre at Binus University
INTER-CHAIN UPGRADING	Sales, Marketing, and After-Market Services (TMC, TMAP and Local Partners/TAM, TMT, TMP, TMV) Active participation and engagement in activities, programmes, and events organised by local automobile assemblers or OEM associations, and automotive research institutes/centres (Jirathiyut, 2016)	Local partners are actively engaged in brand awareness campaigns and connect to local users and consumers through various Toyota Club activity (TAM, 2017; TMMIN, 2017; TMT, 2017; TMP, 2017; TMV, 2017) TMC local partners and subsidiaries regularly participate in major events, including automotive shows and annual conferences.

(Source: Author's assessment)

Conclusion

The production shifts and upgrading undertaken within Toyota's value chains in Southeast Asia have offered insights on regional economic integration. Toyota's ASEAN IMV project offers evidence that production shifts brings about the localisation of production through gradual accumulation of local manufacturing and production capabilities as well as engineering expertise. On the part of its local partners and subsidiaries, TMC has engaged in an overall upgrading strategy that covers upstream, midstream, and downstream business activities. This particular phenomenon (characterised by flexible movement in two essential production

factors: capital and goods) confirms the elementary success of AEC. However, free capital movement in the form of direct foreign investment does not always equate to successfully supporting local industrial development. Beyond the AEC's elementary success, TMC's engagement and practical experiences in RD&D have upgraded to link and pool regional engineering expertise within its value chains. Despite its limited coverage, it exemplifies freer trade in services in the region (a sector underachieving in the current application of the AEC scheme).

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Endnotes

ⁱ Under the AEC (which was formally established on December 31st 2015), the integration scheme has been developed under the AEC Blueprint 2025, which envisions an economic community that is highly integrated and cohesive; competitive, innovative and dynamic; with includes enhanced connectivity and sectoral cooperation; more resilient, inclusive, and people-oriented, people-centred service; and is integrated with the global economy (ASEAN Economic Integration Brief, June 2017). In regards to the region's growing importance of production networks, ASEAN has reiterated the importance of enhanced participation in global supply networks as a result of ASEAN's solid attachment to global value chains (GVCs), as evidenced in its manufacturing (including automotive) sectors. ASEAN member states need to focus increasingly on the availability, quality, and efficiency of standards and conformity assessment infrastructure, as well as in ensuring compliance capacity building among by the smaller economic actors – which are the main prerequisite for s of enhanced participation in GVCs (ASEAN Secretariate, 2015).

ⁱⁱ The list is as follows: PT Toyota Astra Motor (TAM), PT Toyota Motor Manufacturing Indonesia (TMMIN), PT Astra Daihatsu Motor (ADM), PT Sugity Creatives (PTSC), and PT Hino Motors Manufacturing Indonesia (HMMI) in Indonesia; United Motor Works Sdn Bhd (UMW), UMW Toyota Motor Sdn Bhd (UMWT), and Assembly Services Sdn Bhd (ASSB) in Malaysia; Toyota Motor Thailand Co Ltd (TMT), Siam Toyota Manufacturing Co Ltd (STM), and Toyota Auto Works Co Ltd (TAW) in Thailand; Toyota Motor Philippines Corporation (TMP) and Toyota Autoparts Philippines Incorporated (TAP) in the Philippines; and Toyota Motor Vietnam Co Ltd (TMV) in Vietnam.

ⁱⁱⁱ This upgrading typology (process, product, functional and inter-chain) is based on Humphrey and Schmitz (2002) where such process refers to efforts (by firms and other related stakeholders in the value chains) to add value by upgrading production processes; product upgrading signifies the upgraded product quality, performance, and variety of product; functional upgrading focuses on acquiring new functions and skills, and changing mix of activities balance; and inter-chain upgrading emphasizes on the creation and capturing of multi-diverse functions and skills. Process upgrading is typically undertaken in the upstream business activity, while inter-chain upgrading is generally on in its downstream side.