SPRINGER BRIEFS IN ECONOMICS
KOBE UNIVERSITY SOCIAL SCIENCE RESEARCH SERIES

Munehiko Itoh · Atsumi Kato
Yoshitaka Shimono · Yasuhiko Haraguchi
Park Taehoon

Automobile Industry Supply Chain in Thailand

Springer

SpringerBriefs in Economics

Kobe University Social Science Research Series

The Kobe University Social Science Research Series has been established as a subseries of the SpringerBrief in Economics Series, but in fact this exciting interdisciplinary collection encompasses scholarly research not only in the economics but also in law, political science, business and management, accounting, international relations, and other subdisciplines within the social sciences. As a national university with a special strength in the social sciences, Kobe University actively promotes interdisciplinary research. This series is not limited only to research emerging from Kobe University's faculties of social sciences but also welcomes cross-disciplinary research that integrates studies in the arts and sciences.

Kobe University, founded in 1902, is the second oldest national higher education institution for commerce in Japan and is now a preeminent institution for social science research and education in the country. Currently, the social sciences section includes four faculties—Law, Economics, Business Administration, and International Cooperation Studies—and the Research Institute for Economics and Business Administration (RIEB). There are some 230-plus researchers who belong to these faculties and conduct joint research through the Center for Social Systems Innovation and the Organization for Advanced and Integrated Research, Kobe University.

This book series comprises academic works by researchers in the social sciences at Kobe University as well as their collaborators at affiliated institutions, Kobe University alumni and their colleagues, and renowned scholars from around the world who have worked with academic staff at Kobe University. Although traditionally the research of Japanese scholars has been publicized mainly in the Japanese language, Kobe University strives to promote publication and dissemination of works in English in order to further contribute to the global academic community.

More information about this series at http://www.springer.com/series/15423

Munehiko Itoh · Atsumi Kato
Yoshitaka Shimono · Yasuhiko Haraguchi
Park Taehoon

Automobile Industry Supply Chain in Thailand

Springer

Munehiko Itoh
Kobe University
Kobe, Hyogo, Japan

Atsumi Kato
Hiroshima Univesity
Hiroshima, Japan

Yoshitaka Shimono
Nagoya City University
Nagoya, Aichi, Japan

Yasuhiko Haraguchi
Tokyo Keizai University
Tokyo, Japan

Park Taehoon
Kansai University
Osaka, Japan

ISSN 2191-5504 ISSN 2191-5512 (electronic)
SpringerBriefs in Economics
ISSN 2520-1697 ISSN 2520-1700 (electronic)
Kobe University Social Science Research Series
ISBN 978-981-13-2359-1 ISBN 978-981-13-2360-7 (eBook)
https://doi.org/10.1007/978-981-13-2360-7

Library of Congress Control Number: 2018952883

This Springer imprint is published by the registered company Springer Nature Singapore Pte Ltd.
The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore

Preface

This research focuses on the process of growth in the automobile industries in the ASEAN region. ASEAN is drawing attention both from the vantage point of its position as an automobile-producing region and as a potential automobile market. Thailand in particular has long treated automobile production as a national strategy, and this research puts considerable focus on Thailand's initiatives. Beginning in 2012, the authors have been carrying out on-site surveys and visited many of the suppliers that form the local automobile industry; this research represents a summary of those findings. The fields of specialty of this paper's respective authors differ, so analyses have been made from a range of vectors. In particular, we focused on the supply chain in what are generally referred to as "KEIRETSU".

The objectives of this research are closely related to examine the construction pattern of the supply chain of automobiles in ASEAN which development has been remarkable, and its effective management there. Specifically, by focusing on the business relationships in the supply chain in the automobile industry, we are conducting our examination from the three perspectives given below: (1) To shed light not only on the production aspect but also on the collaborations in the supply chain from the perspective of sales and service; (2) to shed light on the localization process of the supply chain; and (3) to elucidate the trading practices within the supply chain. (4) To identify the factors affecting to the employees' behaviors in automobile industry. Currently, the expansion of ASEAN automobile market is producing major changes in the supply chain construction of automobile companies, including Japanese companies. Based on the results of the survey on the supply chain of the automobile industry in Thailand and Indonesia, the major automobile-producing countries even among ASEAN, we are conducting more in-depth discussions on the management in those countries.

Aiming to acquire a practical understanding of an extremely complex industrial structure called an automobile, this study will be useful not only for students and researchers but also for practitioners. Moreover, from the viewpoint of research on

the developmental process of mega-companies in areas with extremely high growth potential called ASEAN, it will also provide useful suggestions for attracting industries and planning industrial policies.

Kobe, Japan — Munehiko Itoh
Hiroshima, Japan — Atsumi Kato
Nagoya, Japan — Yoshitaka Shimono
Tokyo, Japan — Yasuhiko Haraguchi
Osaka, Japan — Park Taehoon

Acknowledgements

The authors visited many Thai Automobile companies and suppliers in writing the book and are grateful to the Thai companies, accepted our visit and investigation. The authors would also like to express a special gratitude to Tadao Kagono at the Konan University and to the anonymous referee of this research for the many instructive comments. This research was supported by JSPS KAKENHI (grant no: 24402026 and 15H05184). The views expressed in this book are entirely the authors' and not those of the institutions described above. The author is responsible for any remaining errors.

Contents

About the Authors

Munehiko Itoh is a Professor at the Research Institute for Economics and Business Administration (RIEB), Kobe University, Japan.

Atsumi Kato is a Professor of the Graduate School of Social Sciences, Hiroshima University.

Yoshitaka Shimono is an Associate Professor of the Graduate School of Economics, Nagoya City University.

Yasuhiko Haraguchi is a Professor of the Faculty of Business Administration, Tokyo Keizai University.

Park Taehoon is a Professor of the Faculty of Commerce, Kansai University.

Chapter 1
Outline of Automobile Production in Thailand

Abstract This study investigates the competitiveness of Japanese automobile makers by focusing on how supply chains are constructed. Recently, out of rapidly growing automobile market in ASEAN members, analysis was done on Japanese automobile makers' supply chain in Thailand, which is also the biggest market. From the analysis, it was discovered that Japanese automobile makers not only localize automobile manufacturers but also train the local suppliers in order to increase the quality and productivity. Furthermore, investigation was done on multi-supplier companies, who despite being KEIRETSU still provided parts for other automobile makers.

Keywords ASEAN · Automobile · Supply chain management
Industrial park

1.1 Outline of Thailand's Automobile Production

Thailand, out of members of ASEAN, has a second biggest economy after Indonesia and GDP per capita was 5550 US dollar (2014). Along with population of 68 million, from income level point of view, criteria for car ownership to spread are met. ASEAN nation is originally known for two-wheeled vehicle production, but Thailand is only the third biggest producer after Indonesia and Vietnam. On the other hand, Thailand is the biggest producer of four-wheeled vehicles. Although facing economic crisis and political instability, Thailand's automobile production saw stable expansion from early 1990s and by 2015 it surpassed a standard of 2 million cars produced a year. Figure 1.1 shows transition Thailand's automobile production over the years; solid line shows the total production volume while broken line shows the volume of automobiles exported. Figure shows the successful expansion of production from 2002 to 2006, and this was also years where Thai government led first master plan had started under the slogan "Detroit of Asia" with

Work by Munehiko Itoh.

M. Itoh et al., *Automobile Industry Supply Chain in Thailand*,
Kobe University Social Science Research Series,
https://doi.org/10.1007/978-981-13-2360-7_1

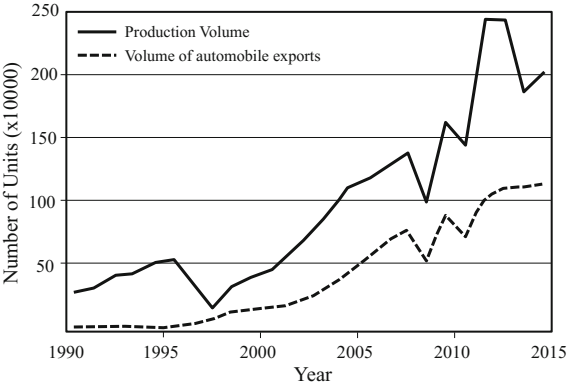

Fig. 1.1 Thailand's automotive products units. *Source* Prepared by the author on the basis of Fourin (2015)

a goal to reach annual production up 1 million. Due to outstanding expansion of production in 2005, goal was achieved ahead of schedule. Throughout 2007 to 2011s, master plan was promoted and export toward the global market was expanded. As a result of expanded export, this was the time when Thailand's domestic parts makers started to stabilize their base of production. For goal of persistent expansion of automobile industry, 2012–2016, third master plan was conducted and by 2021 production of around 3 million vehicles per year as well as base for eco-friendly car production is anticipated.

In Fig. 1.1, 2012 and 2013 have a spike in production and this is because Thai government from September 2011 to December 2012 had "First Car Policy" where excise tax was mitigated when one bought first brand new car. Due to the reaction of this policy, in 2014, it can be seen that production has decreased by 500 thousand cars. Current brand share cars owned in Thailand are shown in Fig. 1.2. In

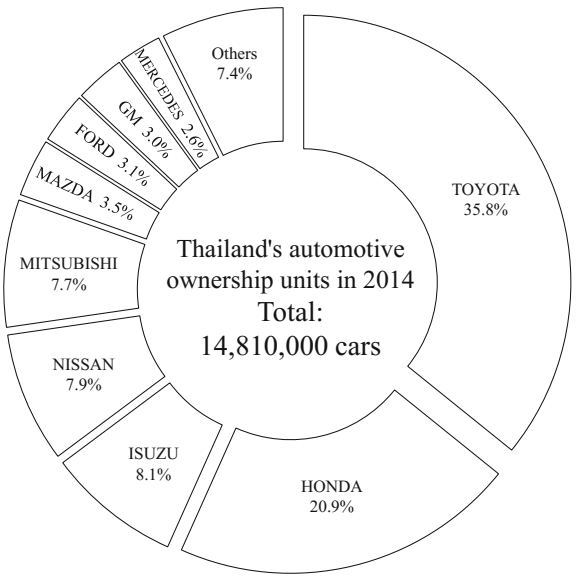

Fig. 1.2 Thailand's automobile ownership units shear. *Source* Prepared by the author on the basis of Fourin (2015)

Thailand, there are already over 15 million cars and it is estimated that it will continue to increase. Brand wise, it is in order of Toyota, Honda, Isuzu, Nissan, Mitsubishi, and Matsuda, and just with Japanese companies it reaches 80%. Like these, Japanese companies have very important role in Thailand's automobile industry and by evaluating Japanese companies' trend, outline of Thailand's automobile industry essentially becomes clear.

1.2 What This Research Wants to Clarify

One of the reasons behind the ability to produce over 2 million cars in Thailand is the construction of original supply chain. Japanese automobile makers increased and expanded production through original method of KEIRETSU. On the other hand, non-Japanese automobile producers constructed supply chain mainly through major parts makers called global supplier and then are Japanese automobile makers in Thailand grouping and systemizing suppliers just like in Japan. If so, in what way is supply chain in Thailand different from Japan? Backdrop behind consciousness to these problems is the third automobile industry master plan, also known as "Master Plan for Automobile Industry 2012–2016", announced by Thai government in 2012. Furthermore, "Vision 2021" was introduced, which aims to make Thailand into global production center for eco-friendly automobiles, further tough and

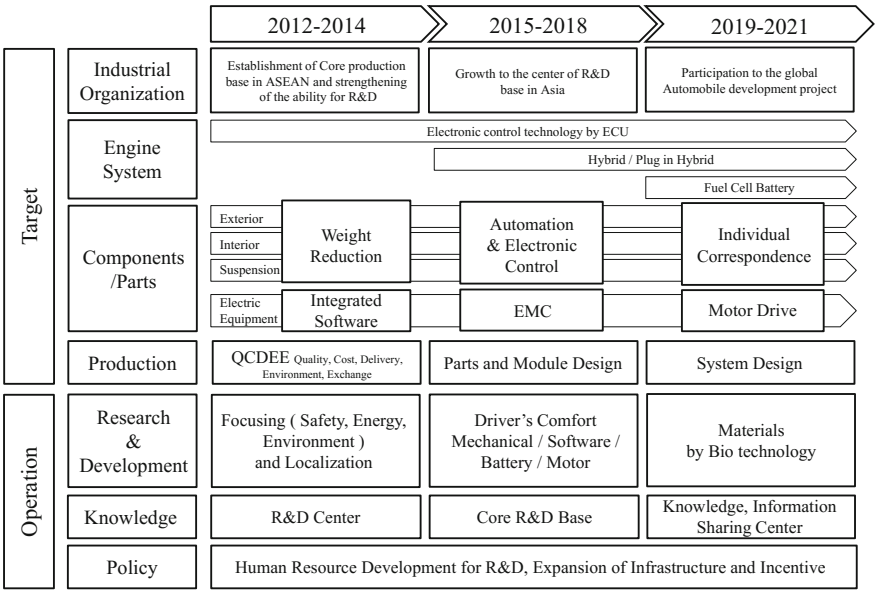

Fig. 1.3 Roadmap of Thailand's automobile industry. *Source* Prepared by the author on the basis of Fourin (2015)

valuable supply chain. Figure 1.3 shows road map of automobile industry development by Thai government. At the moment (2016), it is at second part and the main issues are the growth into base for R&D in Asia and increase in design ability for parts and modules. Thailand now has the capacity to produce over 2 million cars but this research aims to find out and clarify the following points; what is the supply chain like? Is the supply chain different from Japanese ones? Is there uniqueness to supply chain in Thailand? At the moment (2016), it is at second part and the main issues are the growth into base for R&D in Asia and increase in design ability for parts and modules. Thailand now has the capacity to produce over 2 million cars but this research aims to find out and clarify the following points; what is the supply chain like? Is the supply chain different from Japanese ones? Is there uniqueness to supply chain in Thailand?

1.3 Analysis of Supply Chain

Database for 582 automobile-related companies in Thailand was made from company data from major industrial area obtained locally, documents from Japanese research companies, and data collected from visiting the companies. This investigation analyzes transaction between the factories instead of ones between the companies. This means that if one company is producing in several different factories, analysis was done for each one. Figure 1.4 shows the breakdown of companies that were surveyed.

Organizations of investigation targets are the following: 13 Japanese companies and 6 non-Japanese companies with total of 19 automobile makers, 278 Japanese companies and 98 local capital companies with total of 376 companies that are tier 1 suppliers which directly provide automobile makers with parts and modules, and 135 Japanese companies and 71 local capitals with total of 206 companies which provide parts for tier 1 suppliers and are called tier 2 suppliers. Analysis was done

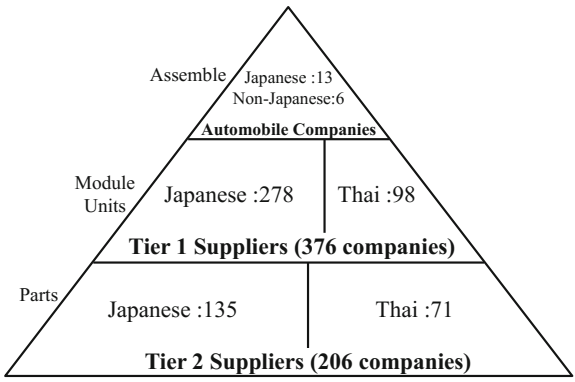

Fig. 1.4 Structure of automobile suppliers in Thailand

on viewpoints of the years of operation in Thailand, investment ratio, industrial area where the factory is located, acquired technology, and where factory supplies too. Results of each point of analysis are below.

1.3.1 Number of Operation Years for Automobile Parts Supplier in Thailand

Figure 1.5 shows the research result of operating status of 582 supplier companies stated in the previous paragraph. In the figure, black box shows operating years of the companies with Japanese capital, while the white box shows the operating years of the companies with Thai capital. Vertical axis shows the number of operating factories and horizontal axis shows number of years' suppliers operating as of 2016. Looking at the table, it is obvious that Thailand's automobile industry suppliers started to operate 21–25 years ago (1991–1996). It can be seen that before 1995, most of the companies in automobile industry in Thailand had local capital, but around 1995 Japanese suppliers began to operate in Thailand. As it can clearly be seen in Fig. 1.1, after 1995, Thailand's domestic automobile sale and foreign export are increasing swiftly. After this, even though the amount of new companies is decreasing, Japanese suppliers are continuing to expand.

Now then, let us look at the history of Japanese automobile makers' expansion into Thailand. Japanese makers' expansion into Thailand began in 1957 when Toyota automobile sets up sales operation in Bangkok. In 1960, Thai government passed new industry investment promotion law and furthermore, in 1962 Thai government decreased import tax by half for cars that were produced under

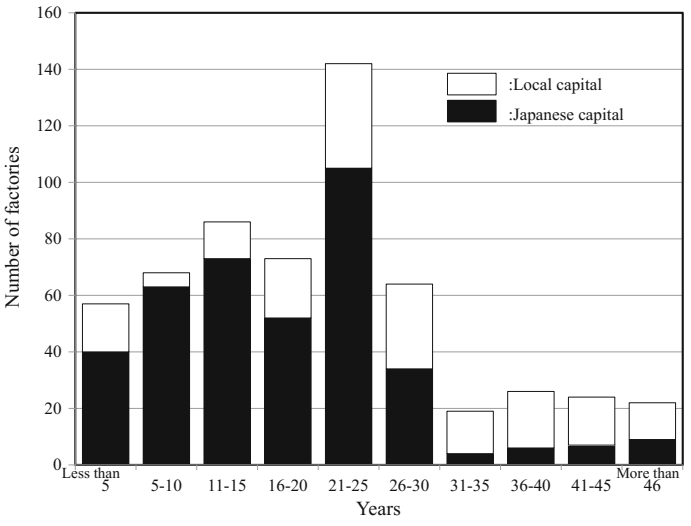

Fig. 1.5 Number of years of operation of automobile parts suppliers in Thailand

knockdown method. However, effort to increase income from corporate tax and employment creation within Thailand and later decision to have parts import tax helped boost in local Thai parts makers. Toyota and Nissan in 1962, Isuzu in 1966 opened a production base in Thailand and in 1965 Honda also started motorcycle production in Thailand. As a result, after 1960s Japanese makers played a huge role in Thailand's automobile industry. In the 1970s, Thai government in order to promote domestic production on automobile parts, in 1975 policy, was made to use at least 25% of domestically produced parts. In Fig. 1.5, "more than 46 years" or after 1970s one can see the effect of policy as many Thai capital suppliers joined around that time. From 1970s, Thailand automobile industry grew steadily and this period was also the time when Japanese suppliers expanded in Thailand.

From late 1970s to 1980s, Thai government launched policies to industrialize automobile industry related export, increase in import tax for finished car, and ratio of domestically produced parts from 30% in 1979 to 65% in 1988. From Fig. 1.5, one can see that 26–30 years ago, in other words, 1985 to 1990 expansion of Japanese suppliers have become full scale. After 1990s, Thai government's automobile industry had a major shift toward encouraging export. In 1991, parts import tax was decreased from 112 to 20% and tax for finished car under 2300 cc also increased drastically from 180 to 60%. Also, in 1993, ban for new automobile maker entrance was lifted and tax incentive system for exports of finished cars (decrease of tax rate from 20 to 2%) was passed, and therefore resulted in abolishment of regulation regarding automobile industry. These preferential policies to automobile industry developed into continuous construction of new factories for Japanese automobile makers such as Toyota and Honda, and demand toward automobile parts suppliers increased immensely. It is obvious from looking at Fig. 1.5 that from 1995 (In the figure, it is operation years of 21–25) participation automobile parts suppliers reached its peak. As a result, comparing it to Fig. 1.1, production has increased from 310,000 cars from 1990 to 560,000 cars in 1996. However, during the Asian financial crisis during 1997, the production went down to 250,000 cars, but this lead to increase in automobile quality especially for Japanese automobile parts suppliers and later on export was back up and production number again was steadily growing. Like this, by having many globally competitive Japanese makers expand into Thailand, training for both local and Japanese automobile parts makers has advanced. Result of this is that after 2000s (Fig. 1.5, years 11–15), entry of tier 2 suppliers is increasing. As one can see from this history, along with Japanese parts makers, Thailand also has local parts makers with high skill level labor force and steady production which solidified the position of the nation as hub for automobile production.

This was the overview of automobile parts supplier in Thailand. History is quite long and is over 60 years, and Japanese automobile makers have close interaction with it. Until 1985 under Thai government's policy automobile production industry developed and after 1995, it was developed under Japanese supplier and throughout both times car production number continued to grow greatly.

1.3.2 Accumulation of Automobile Parts Companies in Thailand

What is the current accumulation of automobile industry in Thailand? In Thailand, huge concentrated industrial land is spread across the nation and automobile specific parts are being produced at each one of the industrial areas. On the other hand, automobile makers are focused around Bangkok area. Figure 1.6 plots down the industrial areas and automobile makers in Thailand. First, in the figure, automobile makers are shown in black characters inside the white box. From the top, Prachinburi and Ayutthaya have Honda's automobile assembly factories. Around the Bangkok areas, which are Chachoengsao and Samutprakarn, factories of Toyota, Nissan, and Isuzu are operating. In the southwest Thailand, specifically

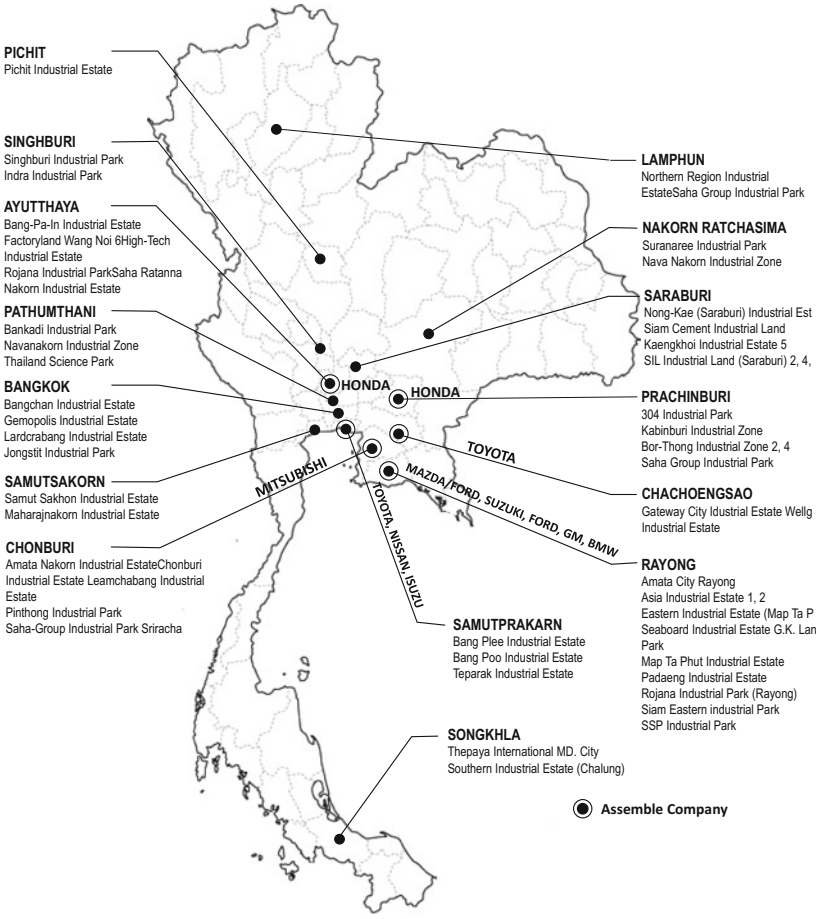

Fig. 1.6 Automobile manufacturing area in Thailand

around Chonburi and Rayong operates Japanese automobile companies Mitsubishi, Matsuda, and Suzuki and non-Japanese makers such as Ford and BMW. As one can see, automobile makers are spread out toward north and southwest from Bangkok.

Now then, how are parts makers spread out? Thailand has many industrial areas and many automobile makers are located within them. In Thailand, there is a system called milk-run logistics in order to support logistics for automobile parts. Milk-run logistics is a method where automobile makers can pick up the needed parts in specific time period from the supplier's factory. Objective of milk-run logistics is to enable automobile makers to efficiently gather the parts resulting in decrease in cost by separating the base cost and transportation fee. Furthermore, this logistics makes it where demanded amount can be procured at needed time. However, in reality, operation of milk-run logistics is not effortless at all.

1.3.3 Acquired Technologies of the Automobile Parts Companies

It is said that parts for automobile are about 30,000 pieces but many of these are made using metal and plastic. Also, depending on required parts, part processing technology demanded differs. Here, required technologies for building automobile parts are consolidated into seven groups which are press processing technology, precision casting technology, precise forging technology, precise cutting technology, screws and springs, plastic molding, harness, and electronic equipment. To begin with, these are explanations for these technologies.

1.3.3.1 Press Processing Technology

Within the press processing technology, there are shearing processes for separating the material and also the bending, molding, and squeezing of sheet material. Production is done using a combination of these depending on required precision, material, and shape. For automobiles, this technology is used to process metal material such as iron and aluminum.

1.3.3.2 Precise Casting Technology

Casting is a construction method where molten metal is poured onto a mold. Die-cast is one method of casting. In a usual method of casting, liquefied metal is poured onto the mold as it is but in die-cast, as the liquefied metal is poured, and pressure is added. Through die-cast, large quantity of high-quality casted item can be produced. With sand mold casting, every time item is required to be produced, and mold also needs to be made but die-casting mold can be used repeatedly

therefore making it perfect for mass production. Die-cast is used a lot for parts such as engine and transmission.

1.3.3.3 Precise Forging Technology

Forging is often used to make parts for power transmission mechanism and important parts for suspension system such as engine, transmission, and differential. Forging compared to press processing has high deformation rate making the product strength incomparably high. Hot forging heats up the material to high temperature, but cold forging forges the material close to normal temperature. Cold forging makes it easy for producing accurate shape and sized product as well as making a clean surface finish but, due to the fact that forging is done at normal temperature, tremendous amount of power is required. Because of this when manufacturing complicated or large parts, hot foraging done under high temperature is advantageous. However, hot molding also has a downside as forging is done at over 1000 °C; it is hard to get accurate shape and size, and life spam of mold used is quite short.

1.3.3.4 Precise Cutting Technology

Precise cutting technology is a technology that uses tool (blades) to shave off metal, producing a high-quality processing technology. Highly dimensionally precise processing compared to usual lathe or press processing is called precise machining, and achieving precise machining through cutting is called precise cutting. Advantages of cutting processing are that it is highly precise and it is also able to create different shapes. Furthermore, the more the technological ability one has, usage and adaptation of this technology increase, enabling production of complicated automobile parts. However, compared to production processing that uses mold, this method is much more expensive and as of recent, many automobile parts use method where mold is used to produce the base of the parts and then precise cutting process is used for parts where high precision is required.

1.3.3.5 Screws and Springs

Screws and springs used for automobile are made up from many different materials and results are quite diverse. For example, spring material can be either wire or plate material and molding method of said material can be hot forming which will heat the material or cold forming where processing is done at normal temperature. Both screws and springs have long history and no way is it a new technology but in the automobile industry, “sharing of parts” is very important undertaking. In reality, there are few cases where several car models from one automobile maker using standardized parts but standardization of parts in between the automobile makers

are unheard of. This is a task that needs to be considered in the near future. In Japanese automobile industry depending on maker and car model, vastly different parts are used. On the contrary, in Europe, cutting method was changed to a method called screw cutting and start of cold foraging method resulted in mass production of highly compatible and exceptional screws. Standardization of screw was started and encouraged in United States and in 1968 Seller's screw became the standard United States screw. Also in Japan, in 1949 Japan Industrial Standards (JIS) formed standardization for screws. Moreover, global standardization of screw was decided by ISO but it is not used in North America or Australia. In Japan, inch screws used to be major screw but now screws use JIS standards which follow the global standard set by ISO and inch screws a hardly used now. Finally, automobile industry also tends to follow standardization and communication.

1.3.3.6 Plastic Molding

Within automobile industry, there is a huge need for technology such as hybrid cars and Electric Vehicle (EV) to lighten the weight of the car for better fuel usage. On the other hand, trade-offs of weight saving are low cost and freedom for new design, and achieving these along with weight loss is a huge issue. Out of automobile parts, areas that use most amount of plastic are modules such as front end and back door and outside parts such as panorama roof. One method for decreasing the weight of the body is to use plastic but there are many important requirements that need to be solved. For example, modules such as front end and back door need to have rigidness and toughness like the metal counterparts. Furthermore, exterior parts relate deeply to car design, easiness to shape, and color the parts are also required. For that reason, brand new technologies are required for making a precise mold and processing. However, plastic parts with low cost and freedom for design are thought to increase from now on.

1.3.3.7 Harness and Electronic Equipment

Due to technological innovation, new electronic systems are introduced into Thai's automobile industry. To name few examples of new technology and system that are introduced, for engine control system is Variable Valve Timing System, for chassis Antilock Brake System (ABS) and Electronic Stability Control (ESC) for safety and comfort system are airbags, and for information system car navigation. Due to increasing amount and complexity of object that required being electronically controlled, car-mounted LAN are starting to be used which also means it requires even more complex harness. From now on in Thailand, it is highly likely that hybrid cars will be produced, which means that technology for electronics and harness will be demanded even more.

1.3.4 Analysis Results

So far, all the necessary processing technology for producing automobile was stated. Now then, how are these technologies being used to produce automobile in Thailand? In Fig. 1.7, ratio for obtained technology among automobile-related companies in Thailand that were surveyed is shown. 582 companies were surveyed and investigated but some companies have several processions, and therefore these were counted several times resulting in total number of 738 companies. One thing that can be found out from Fig. 1.7 is that plastic molding technology is the most acquired technology in automobile-related companies in Thailand at 37.5%.

Next highest was press processing technology, and after this it was followed by precise casting technology, precise forging technology, harness, and electronic technology. Along with ratio of company numbers, various findings can be made.

Next, assuming that companies who supply for companies who are not part of KEIRETSU are multi-supplier, analysis was done to find out what kind of companies are multi-supplier. This was done by setting each company's number of transaction with another company as dependent variable while operation years and number of employees as explanatory variable. Also, multiple analyses were done by separating delivered parts into engine, chassis, and body/accessories while control variable was set for acquired technology, which are press processing technology, precise casting technology, precise forging technology, precise cutting technology, screws and springs, plastics and ceramic molding, and harness and electronic equipment. Results of these analyses are shown in Table 1.1. The result of this shows that many of the companies that supply to non-KEIRETSU companies, also

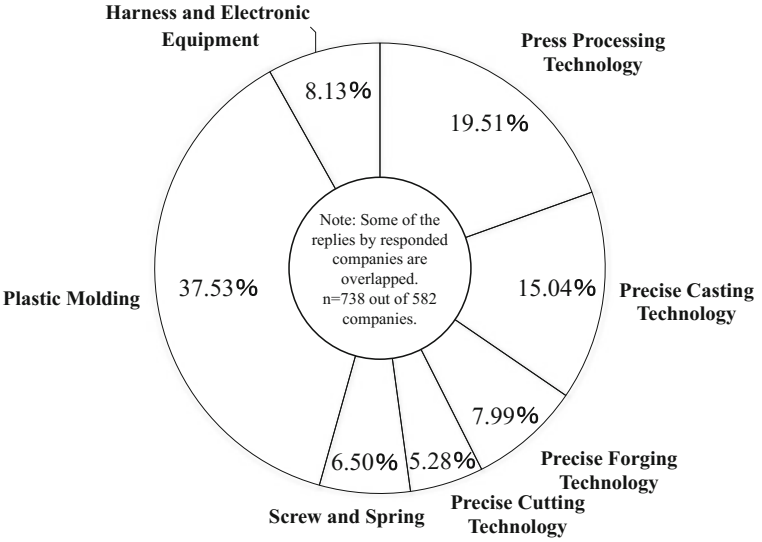

Fig. 1.7 Possession technologies of the Thai automobile parts suppliers

Table 1.1 Multiple regression analysis result

Explanatory variables		Number of customers	
		β	r
Operation years		0.244	0.281**
Number of employees (in thousands)		0.191	0.274**
Engine		0.128	0.070*
Chassis		0.076	0.03
Body and accessories		0.106	0.056*
Press processing technology		0.104	0.034*
Precise casting technology		0.06	−0.033
Precise forging technology		0.011	−0.076
Precise cutting technology		−0.035	−0.082
Screw and spring		0.094	0.089*
Plastic and ceramic molding		0.146	0.084**
Harness and electronic equipment		−0.029	−0.028
Adjusted	R	0.439	
	R-square	0.193	
	N	548	

r Pearson's correlation coefficient
**p-value < 0.01, *p-value < 0.05

known as multi-supplier company, have larger numbers of workers and longer years of operation. As for automobile parts being produced by these multi-supplier companies, engine and body/accessories were most significant and as for acquired technology, press processing technology and screws and springs were around 5% followed by plastic and ceramic molding which was around 1%. This was the chapter where analysis was done for relationship between acquired technology of automobile parts supplier and company it supplies to in Thailand. An especially characteristic for multi-supplier in Thai who supplies non-KEIRETSU automobile makers was noticed and is listed below.

Conclusion 1. In order to have transactions with multiple automobile makers, a company needs to have somewhat of operation years in Thailand. This in fact means that multi-supplier companies once entered Thai industry from Japan as a KEIRETSU supplier then after gaining experience for production in Thailand formed new relationships.

Conclusion 2. Companies that produce parts related to engine body and accessories are more likely to become multi-supplier. This is because engine, which is core function of automobile, requires high levels of technical capabilities and reliability for its parts. Furthermore, body and accessories require fuel-saving performance,

which means that special molds are needed for aluminum and ultra-high tensile strength steel. As a result of this, concentration of orders toward suppliers with high levels of processing technology can be seen.

Conclusion 3. For technological area, companies with press processing technology, screws and springs, and plastic and ceramic molding tend to become multi-supplier companies. This is because automobiles use a great deal of screws and springs as well as fact that standardization of screws and springs can be easily made between different car models and car types. Also, press processing technology and plastic and ceramic molding are fields of technology that is already well developed and due to this it is easy to fulfill the demand from both within and in between the automobile companies to generalize and modulate the parts. From this, one is able to see that unlike in Japan, in Thai's automobile industry there are suppliers called multi-suppliers who supply several automobile makers without being bound to KEIRETSU. Becoming multi-supplier is important as it enables the supplier to increase production levels, stabilize the company, and improvement of technology. However, on the other end, scheme for standardizing parts for several automobile makers also exists and various demands are made by the affiliated KEIRETSU automobile maker that also cannot be denied. It is obvious from analysis in Table 1.1 that technologies such as precise casting and precise forging that produce specific items and require high levels of technology form negative correlation with the number of suppliers. This is showing that companies with these kinds of technology cannot easily have transaction with automobile makers outside the KEIRETSU, which means that it is hard for these companies to become multi-supplier.

1.4 Summary

Analysis was done for supply chain for automobile industry in Thailand. Supply chain for automobile industry is extremely diverse, and many suppliers exist. Japanese automobile makers' production is called lean manufacturing method due to KEIRETSU. In Japan, production method was built along producing high-quality automobile in short period but in Thai and other Southeast Asian areas using Japanese companies as base of operation, production has been expanding for over 50 years. Almost all of Japanese automobile makers have already expanded into Thailand, and analysis was done on what these supply chains are like. Automobile industry inside Japan, long lasting vertical relationship between supplier and automobile maker called KEIRETSU is the norm. In these kinds of transaction relationship, multiple suppliers will accumulate equipment and technology depending on what the automobile maker demands. Also, automobile maker thought of suppliers as part of supply chain that has technology and equipment to produce original cars of the automobile maker.

In this research, after examination was done for automobile supplier in Thailand, it was found out that vertical network of relationship is changing. Automobile

makers now choose supplier depending on the technology they have and how cheap they can produce, while suppliers are starting to supply parts to automobile makers outside their KEIRETSU. From these movements, one of the conclusions this research can make is that advancement toward multi-supplier is happening. However, this does not mean that all kinds of suppliers are becoming multi-supplier. This research has shown that in Thailand many industrial areas exist and in each area there is concentration of automobile supplier and these are forming network with automobile makers. Furthermore, material processing technology acquired by the supplier shows that parts are being standardized and research has shown that suppliers with more versatile technologies are becoming multi-suppliers.

In Thailand, diverse amount of suppliers with material processing technology exists but examples show that even small companies are able to increase the amount of workers by becoming multi-supplier. For many suppliers, producing in Thailand can cause increase in technology and expansion in employment in Japan.

Reference

Fourin (2015) ASEAN Jidosha sangyo 2015(ASEAN Automobile Industry 2015) (in Japanese)

Chapter 2
Review of Preceding Studies

Abstract In the previous chapter, we gave an overview of the formation of automobile supply chain in ASEAN, particularly in Thailand. In this chapter, we will analyze the characteristics of automobile supply chain in ASEAN. In this analysis, we will focus on the characteristics of Japanese automotive industry and special attributes of ASEAN region. Specifically, we will analyze the relationship between automobile manufacturers and their parts suppliers, particularly on a special relationship called "KEIRETSU". Beyond just providing technical guidance, a wide range of relationships such as human resource training has been constructed in KEIRETSU. In this chapter, we will review related preceding studies in conducting this analysis.

Keywords ASEAN · Automobile industry · Supply chain management
Industrial park

2.1 Introduction

In general, reasons for overseas expansion include accessibility toward consumption area, ease of material/parts procurement, ease of securing human resources, preferential treatment policies of invested country's government, high local scientific and technological standard, low wages, and reduction of trade costs (Kuemmerle 1999; Dunning 2009). When these conditions are met, a typical company would start investing overseas and start raising the level of localization through a gradual process (Dunning 1993).

Work by Munehiko Itoh, Atsumi Kato, Yoshitaka Shimono, Yasuhiko Haraguchi, and Park Taehoon.

M. Itoh et al., *Automobile Industry Supply Chain in Thailand*,
Kobe University Social Science Research Series,
https://doi.org/10.1007/978-981-13-2360-7_2

A multinational company tends to establish its production subsidiary in a local area during the initial phase of its overseas expansion. Once the management of the local production subsidiary gets on track, the company's headquarters will transfer the decision-making right on parts procurement to its subsidiary, and such a subsidiary will be transformed into an enterprise that has both sales department and production department. When several of these kinds of production bases start scattering throughout local area, the manufacturer would then set up a supervisory company that can oversee these bases. When the product brand becomes established in the local area, it becomes necessary for the manufacturer to start developing products that can cater closely to the local market in a prompt fashion. To meet these kinds of demands, the manufacturer will set up a technical center in local area and starts its product development process. Once the product development is localized, the manufacturer is able to expand a strategy where production and development are integrated on local basis (Asakawa 2003).

Although we examined the localization of product development above, we can further divide them into local improvement development and local self-development depending on the level of localization that development divisions can achieve (Ronstadt 1978). Local improvement development refers to a development that makes a minor improvement on the product made in home country to cater more to local circumstances. On the other hand, local self-development refers to a development where a local development center comes up with a drawing of the product on its own that is different from its home country. In recent years, we are seeing more and more cases of automobile manufacturers advancing their local self-development to respond to the change in local market needs promptly.

However, for all the efforts so far made by many automotive manufacturers in aggressively advancing such development, the current reality is that local self-development is not advancing as they would have hoped in line with their plan (Park 2012). Although we can think of various reasons as to why local self-development is not advancing, a lack of progress in local development of production technology that underpins the development technology can be cited as a potential significant factor.

If a manufacturer desires to advance self-development at local site, it obviously needs to start making prototypes locally. Needless to say, if the local production technology is at a substandard level, the manufacturer will have a difficult time producing high-precision prototypes at such a site, thus greatly constraining the progress of self-development.

Preceding studies attributed the lack of improvement in local production to the practice of production system where manufacturers would first procure parts and machines from Japan and then engage in processing and assembling at a local site.

Shintaku and Ohki (2012a, b) are advocating that real local procurement is achieved by improving the local production technology by procuring parts and machines on a local basis. In the 2015 interim report of Denso, it states that

localization of real production technology is achieved by the utilization of local parts and machines. Localization of real production will become possible by procuring parts and machines in local areas that would otherwise be imported from Japan.

However, when the previous studies discussed the real localization, it mainly focused on the local procurement aspect of parts and machines, and it did not adequately examine the impact the local procurement of molds has on real localization. Even if parts and machines are localized, it will be difficult to improve the production technology in a local area without localizing the production of molds which have a decisive influence over precision and production efficiency of a final product. In many cases, Japanese automotive manufacturers procured molds by first designing the molds used for global models in Japan, then sending its data to plants in Japan and local area, and finally making copied molds at these plants (Tanaka and Okamoto 2013). Although manufacturers can still procure molds by relying on exporting of copied molds or in-house production at a local area, etc., they will not be able to achieve the function where molds serve as the bridge between localization of production and localization of development. In other words, it will mean that they will not be able to achieve the goal of self-designing the development prototypes in a local area by improving the production technology, a role where molds will serve as the bridge between the localization of production and development.

Mold design is also directly connected to the localization of development, while simultaneously connected to the improvement of production technology. During the development process, a mold is required in creating a prototype based on the product drawing. In general, change in design is made during the production of prototypes since many design issues are discovered during this phase. When product design is changed, company is required to make frequent adjustments with the mold suppliers to make another prototype. Manufacturer will have a difficult time changing the design if the development of mold is not localized during this phase.

Even if manufacturers carry out product development locally, they will still need to return the mold back to Japan and repair it there in order to implement a design change as long as the mold supplier is located in Japan. This kind of mold repair process is one of the important factors behind why the period of product development is extended. In other words, since the mold significantly affects the delivery date of a prototype, if the mold supplier is located in Japan, such factor will greatly limit the localization of design development. Accordingly, in this study, we will regard real localization as achieving self-development in a local area through the localization of mold, and we will analyze the effective way to collaborate localization of molds and localization of product development to advance real localization further.

2.2 Supplier Development of Japanese Manufacturers

A number of studies have been conducted on the structure and functions of buyer–supplier relationship in the Japanese automobile industry (Itami 1988; Asanuma 1997; Fujimoto 1998; Dyer and Nobeoka 2000). Japan–U.S comparative studies also suggest that supplier systems constructed by Japanese automobile manufacturers have a competitive advantage (Cusumano and Takeishi 1991; Dyer 1996, 1997).

In particular, a certain study (Sako 2004) suggests that in identifying the characteristics of Japanese automotive manufacturers, one must note that they have been carrying out supplier development for a few decades (in other words, these automotive manufacturers have been carrying out activities to improve organizational capability of suppliers). Based on the comparative case study between three main automobiles manufactures—Honda, Nissan, and Toyota—Sako (2004) observed the factors that enabled automotive manufacturers to strengthen their suppliers' organizational capability, while simultaneously building a continuous long-term relationship with their suppliers. However, Sako (2004) suggests that Japanese automobile manufacturers will have a difficult time carrying out supplier development overseas for the following reasons: (1) Historical differences between countries, (2) Knowledge being communicated to suppliers from automotive manufacturers includes tacit knowledge and knowledge that is difficult to codify, and (3) The scope of supplier development is expanding (for example, ranging from production process in a plant to the entire company).

Furthermore, Dyer and Nobeoka (2000) have identified the productivity and comparative advantage of knowledge sharing network constructed by Toyota and its suppliers. In Toyota Group, explicit knowledge and tacit knowledge are transferred/shared within the network through the processes such as Toyota's operation management consulting division(OMCD) providing guidance to suppliers, loaning and dispatching Toyota employees to suppliers, activities of the cooperative committee consisting of the suppliers, and self-research activity (self-study) conducted by cooperative committee.

Reproduction of this type of knowledge sharing network was also conducted in the U.S. Specifically, this network was constructed through the following three steps: (1) Construction of weak ties between Toyota and its suppliers, (2) Construction of strong ties between Toyota and its suppliers, and (3) Construction of strong ties among its suppliers (participation in the cooperative committee).

2.3 Formation of Supply Chains in ASEAN

Meanwhile, the preceding studies have not examined in sufficient detail the formation process of supply chain, supplier development, and localization of parts procurement in the ASEAN region, where Japanese automobile manufacturers have

been making a full-scale business development since 1990s. In particular, Japanese manufacturers are running into a cost problem originating in Japan called "Japan Cost" when procuring parts from Asia including ASEAN.

Shintaku and Ohki (2012a, b) have largely divided the localization of parts procurement into "superficial localization" and "real localization." The superficial localization refers to the case where a company switches over to procure parts from an invested country, but still ends up importing materials and production machines from Japan in actually manufacturing these parts. In other words, it refers to the case where on surface the company is achieving local procurement, but in reality is still facing the problem of Japan Cost. If all they do is to advance this kind of superficial localization, they may potentially not be able to compete against China, Korea, or ASEAN companies which are steadily improving their competitiveness.

On the other hand, when a manufacturer raises the genuine local procurement rate by actually climbing up to the upstream of supply chain (parts, materials, etc.), we call this "real localization." Advancement of real localization will not only raise the cost competitiveness but also lead to the preparation for risks such as natural disasters.

In order to build supply chain in developing countries where local technological base is nonexistent, companies need to improve the technological capability of local suppliers because it is taken for granted that automobile manufacturers assure the good quality of the product. As mentioned above, Japanese companies have been strengthening their supplier development, i.e., organizational capability of suppliers. They have been able to manufacture high-quality products at a low cost by wisely managing tacit knowledge that cannot be converted into explicit knowledge through organizational process and by wisely managing such knowledge between manufacturers and their suppliers, for example. Accordingly, in order for Japanese companies to build supply chain overseas, they need to transfer the know-how that they have cultivated in Japan to overseas subsidiaries and their suppliers, and they need to provide training such as improving workers' mindset (willingness to change the status quo) by providing instructors to improve cooperation within organization and between companies, instead of just providing technological procedures. If adequate training cannot be provided within the company, the customer company needs to provide technological support to overcome such shortfall.

This kind of close relationship between companies achieved through technological support is often seen between automobile manufacturers and their suppliers, commonly known as "KEIRETSU". In the academic field, "KEIRETSU" is regarded as a close relationship between companies, and only empirical studies regarding this close tie (capital, executive, transaction, and debt) have so far been conducted (Lincoln et al. 1996). However, in order to understand KEIRETSU of automobile industry, we need to focus on the management between organizations, instead of just looking at close relations in terms of capital, executives, and transactions. In light of this, in this study, we will examine how supply chain is

built in Thailand from the standpoint of automobile manufacturers fostering suppliers through technological support. As mentioned above, the preceding studies did not adequately examine how the relationship between automotive companies ("KEIRETSU") is formed overseas.

Since KEIRETSU-oriented relationship can advance localization through a close cooperation between automobile manufacturers and their suppliers irrespective of a link in terms of capital and people, technological support by automobile manufacturers with managerial vitality will have a significant impact.

2.4 Relation Between HRM, Corporate Performance, and Employee Behavior

2.4.1 Previous Studies on the Formation of HRM Relating to Firms' Overseas Expansion

The study of international comparisons regarding the development of HRM can be divided into two approaches: the individual approach that compares the development of individual policies and the approach that makes comparisons between systems by viewing HRM as one such system. There are many preceding studies that are categorized under the individual approach such as the difference between career length during the promotion process (Honda 1999), human resource fostering systems (Suzuki 2004), merit rating system comparison (Kimoto 1994), and results-based policy comparison. These studies have identified differences in HRM practices between countries.

In contrast to the accumulation of these kinds of individual approaches to HRM, there are also studies that attempt to compare the systemic aspect of HRM. In Japan, Aoki (1992) and Asanuma (1997), who attempted to draw comparisons from the standpoint of comparative regulation analysis, succeeded in explaining the rationale behind each HRM system. They succeeded by comparing Japanese and U.S. companies, viewing such companies as archetypes. Furthermore, by using a model that was derived deductively, Marsden (1999) conducted a comparative analysis of major countries in Europe (including the U.K., France, and Germany) that explained the rationale behind classifying, taking system diversification into account. Marsden (1999) also identified the fact that diversification of regulation is not just a rationality that exists on a certain point but is also being influenced by the existing employment practices shared throughout society; consequently, he suggested that HRM system of each country has been constrained by the social rules that have evolved through past events.

In other words, when a company in a certain country decides to invest in another country, the HRM of the company in the country where the investment is made will not only be affected by the HRM implemented in the home country, but also by the

social system of the foreign country. As a result, the HRM of such a company will show a difference in its development between its home country and the country in which it invests.

2.4.2 HRM Practices and Corporate Performance

Previous studies have identified that the development of HRM has an impact on the corporate financial outcomes that also serve as the performance indicators of SCM.

Guest (1997) proposed a six-step HRM flow model with elements ranging from HRM strategy to financial outcomes, suggesting that the model can capture organizational performance that contributes toward financial outcomes by applying HRM practices toward the company's strategy in a consistent manner. This model captures the following sequence as a series of flows and clearly indicates the area of HRM and organizes its input and results: HRM strategy (distinction, cost leadership, etc.) → HRM practices (general personnel measures, work design, etc.) → HRM outcomes (commitment, etc.) → behavior outcomes (motivation, behavior, etc.) → performance outcomes (productivity, turnover rate, etc.) → financial outcomes (profitability, ROI, etc.). Using this kind of HRM model as the theoretical basis, various empirical studies on HRM from the standpoint of strategic HRM were accumulated (Sun et al. 2007).

The attempt to identify the relation between HRM practices and corporate performance was conducted in numerous countries around the world, with the U.S. taking the initiative. For example, Delaney and Huselid (1996) investigated HRM practices and financial outcomes by targeting 590 U.S. companies. They found that employee training practices impact organizational performance in areas such as quality, new product development, and customer satisfaction, while staff selectivity methods impact market performance in areas such as market share and sales.

Outside the U.S., Vlachos (2008) conducted a survey by targeting 71 food manufacturing firms in Greece, and found that information sharing policies toward employees and careful operation of employee hiring processes impacted companies' financial outcomes. Gooderham et al. (2008) conducted a questionnaire survey by targeting personnel managers of 3200 companies in 16 Western European nations and found that clear implementation of evaluation/dealing of individual and group performance impacted financial outcomes. Furthermore, Fey and Björkman (2001) conducted a survey by targeting personnel managers of 101 companies from Finland, Sweden, the U.S., the U.K., and Germany with operations in Russia. They found that employee ability training, performance evaluation, fostering of managers, and performance feedback toward managers impacted corporate performance. By identifying the direct relation between HRM practices and corporate performance, these studies have made a significant contribution toward verifying the aforementioned HRM model. However, when it comes to the mechanism of

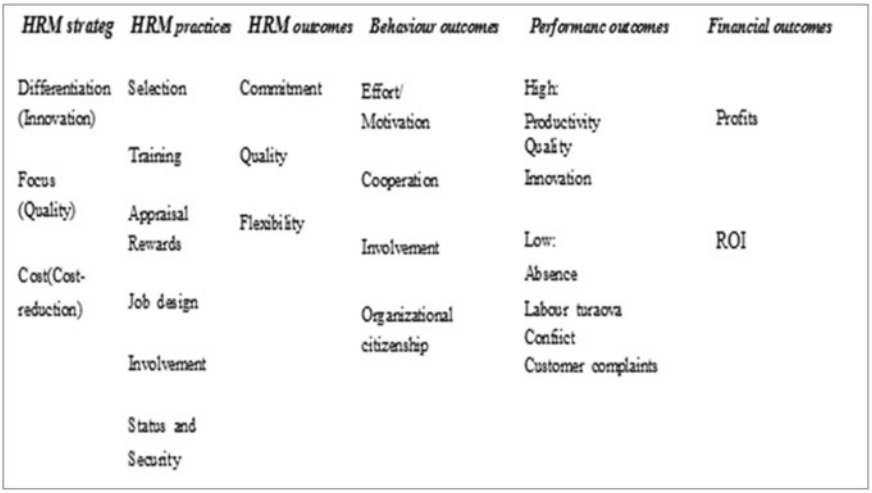

Fig. 2.1 Linking HRM and performance (Guest 1997)

how HRM practices contribute to corporate performance, we are still solely relying on the theoretical model provided by Beer et al. (1984) and Guest (1997). Although these studies predicted that employee behavior has an impact, they did not empirically identify the impact. Researchers thus started recognizing the importance of further clarifying the relationship between HRM practices and employee behavior by identifying the type of employee behaviors that can contribute toward corporate performance (Fig. 2.1).

2.4.3 *Employee Behavior that Impacts Corporate Performance*

Katz and Kahn (1978) categorized the behaviors that enhance performance into three categories: "joining and staying in system," "dependable behavior," and "innovative and spontaneous behavior."

"Joining and staying in system" applies to items such as joining the company, leaving the company, and work absences. High turnover rate and absence rate will excessively raise organizational uncertainty, and this will not only damage the stability of production activity but will also lower productivity. Consequently, participation and affiliation toward systems will be assessed as essential work behavior.

"Dependable behavior" refers to a behavior that can meet the organization's required standard of performance in a role. Categories and amounts of work per-

formance activities that are expected in the workplace (work rules, job description, requirements of superiors/organization, etc.) are established by the company. When workers meet these standards, the organization can achieve (or exceed) a minimum level of organizational performance. This kind of behavior is being recognized as "in-role behavior."

"Innovative and spontaneous behavior" refers to discretionary behavior that exceeds the expected behavior and required standards for a given role, and it includes a wide range of behaviors. These behaviors include, among others, "cooperative activities with fellow members," "actions protective of systems or subsystems," "self-training for additional organizational responsibility," and "creative suggestions for organizational improvement." Katz and Kahn (1978) call this third behavior "extra-role behavior" and suggest that this behavior is extremely important in securing organizational performance.

2.4.4 Two Types of Outside-of-Role Behavior

As one aspect of the third behavior indicated by Katz and Kahn (1978), Smith et al. (1983) conceptualized the employee discretionary behavior entitled "Organizational Citizenship Behavior" (OCB). This behavior is defined as a discretionary-type individual behavior that is beneficial to the organization, which is not guaranteed under the official compensation system. Although individual actions under this type of behavior will not have a significant impact on the overall organizational performance, when accumulated, they will streamline the operation of the organization and will have a medium- to long-term effect on organizational performance (Organ et al. 2005). Many researchers set OCB subscale. "Altruism" and "courtesy," advocated by Organ (1988), are two well-known behaviors in this category. Altruism refers to a behavior that helps others, and courtesy refers to a behavior that influences others to prevent problems in advance. We can assess this type of behavior as something like the third behavior suggested by Katz and Kahn (1978): "cooperative activities with fellow members" and "actions protective of system or subsystem."

Activities that promote improvement in organizations and work such as "self-training for additional organizational responsibility" and "creative suggestions for organizational improvement" are other pillars of the third behavior indicated by Katz and Kahn (1978). Improvement activity executed through employees own efforts is one of the most effective ways to achieve corporate goals and improve work efficiency. For example, making a constant effort to improve at the production line has contributed toward improvements in productivity at the production site as well as in product quality. Furthermore, in the service industry, where primary information from consumers is being compiled by onsite workers who are service providers, it is possible to achieve accurate and prompt workplace improvements

and to reform the process of providing services based on the initiative of workers. In recent years, many cases where these kinds of improvements and reforms are required by workers have been seen. Morrison and Phelps (1999) conceptualized this type of behavior as "taking charge" and conducted its operationalization. In the same way, similar behaviors such as "innovative behavior" by Scott and Bruce (1994) and "proactive behavior" by Parker et al. (2006) have also been conceptualized. In this study, we will call this type of behavior "improvement behavior."

OCB and improvement behavior have spontaneity in common, but also have important differences that contribute toward organizational performance through different processes. OCB contributes by urging smooth organizational activity through strengthening the social function of organization, while improvement behavior makes its contribution by changing the structure of the economic function of the organization. With these differences in mind, we believe it is best to examine these two behaviors separately.

2.4.5 Previous Studies on HRM and Employee Behavior

Previous studies have attempted to identify the mechanisms behind how HRM practices contribute toward corporate performance by clarifying the relation between HRM practices and employee behavior. For example, Sun et al. (2007) conducted a survey by targeting 2174 hotel employees of 81 hotels operating in 12 cities in the People's Republic of China. This survey analyzed the relation between HRM and OCB (OCB is recognized as a well-known employee behavior).

The results of the survey clarified that high-performance human resource practices composed of items such as job security, long-term perspective evaluation, extensive training, and participation in decision-making had an impact on OCB.

Furthermore, Gong et al. (2010) conducted a survey by targeting 454 senior executives who are enrolled in EMBA (Executive Master of Business Administration) programs in Shanghai. This survey was conducted by asking senior executives about their perception of HRM practices, while also asking them about the emotional commitment of middle managers (their subordinates) and condition of OCB. As a result, the study clarified that high-performance human resource practices had an impact on employee behavior through the medium of emotional commitment, while HRM practices directly affected elements of employee behavior.

Furthermore, Nishii et al. (2008) conducted a survey by targeting 4208 employees and 1010 departments of supermarket enterprises. The results of the survey clarified that quality and employee enhancement HR practices had an impact on employee behavior through the medium of employees' affective commitment and job satisfaction.

As shown above, researchers from various countries have attempted to identify the relation between HRM and employee behavior. These preceding studies only conducted by-country analysis, and therefore did not examine the differences between countries. However, to secure SCM efficiency, we must once again stress the importance of securing the quality of employee behavior of individual companies. Given this, we believe it is important to identify the impact that HRM has on the specific employee behavior that will lead to the desired quality of behavior (in other words, reliable behavior and innovative/spontaneous behavior). Accordingly, in this study, we will attempt to conduct a comparative survey regarding the relation between such HRM practices and employee behavior by comparing Thailand and China—countries that enjoy heavy investment by Japanese companies—and including Japan itself in the comparison.

References

Aoki M (1992) Nihon keizai no Seido Bunseki-joho, insenthibu, koshogemu [Information, incentives, and bargaining in the Japanese economy]. Chikuma Shobo, Tokyo

Asakawa K (2003) Gurobaru Keiei Nyumon. Nihon Keizai Shinbun Syuppankai, Tokyo

Asanuma B (1997) Nihon no Soshiki Kakushintekitekiou no Mekanizumu: Tyouki Torihiki kankei no Kouzou to Kinou [Organization of Japanese firms-mechanism for innovative adaptation]. Touyou Keizai Shinposya, Tokyo

Beer M, Spector B, Lawrence R, Mills W, Walton E (1984) Managing human assets. Free Press, New York

Buyens D, De Vos A (2001) Perceptions of the value of the HR function. Hum Resour Manag J 11 (3):70–89

Cusumano A, Takeishi A (1991) Supplier relations and management: a survey of Japanese, Japanese-Transplant, and U.S. auto plants. Strateg Manag J 12:563–588

Delaney T, Huselid A (1996) The impact of human resource management practices on perceptions of organizational performance. Acad Manag J 39(4):949–969

Dunning J (1993) Multinational enterprises and global economy. Addison-Wesley, Workingham, England

Dunning J (2009) Location and the multinational enterprise: a neglected factor? J Int Bus Stud 40 (1):5–19

Dyer H (1996) Specialized supplier networks as a source of competitive advantage: evidence from the auto industry. Strateg Manag J 17(4):271–291

Dyer H (1997) Effective intrafirm collaboration: how firms minimize transaction costs and maximize transaction value. Strateg Manag J 18(7):535–556

Dyer H, Nobeoka K (2000) Creating and managing a high-performance knowledge-sharing network: the Toyota case. Strateg Manag J 21(3):345–367

Fey F, Björkman I (2001) The effect of human resource management practices on MNC subsidiary performance in Russia. J Int Bus Stud 32(1):59–75

Fujimoto T (1998) Sapuraiya Sisutemu no Kouzou Kinou Hassei. In: Fujimoto T, Nishiguti T, Itoh H (eds) Riidhinngu Sapuraiya Sisutemu Chapter 2. Yuuhikaku, Tokyo, pp. 41–70

Gong Y, Chang S, Cheung Y (2010) High performance work system and collective OCB: a collective social exchange perspective. Hum Resour Manag J 20(2):119–137

Gooderham P, Parry E, Ringdal K (2008) The impact of bundles of strategic human resource management practices on the performance of European firms. Int J Hum Resour Manag 19 (11):2041–2056

Guest E (1997) Human resource management and performance: a review and research agenda. Int J Hum Resour Manag 8(3):263–276

Honda K (1999) Daikibo Kouri Manejya no Kyaria Keisei no Nichibei Hikaku [Career development of managers in large retailing in Japan and the U.S.]. Nihon Rohmu Gakkaishi 1 (2):24–34

Itami N (1988) Mieru teniyoru Kyousou: Buhin Kyoukyuu Taisei no Kourutusei, Kyousou to Kakushin: Jidousya Sangyou no Kigyou Seityou, Itami N, Kobayashi T, Itoh M, Kagono T, Sakakibara K (eds). Touyou Keizai Shinpousya, Tokyo, pp. 144–172

Katz D, Kahn L (1978) The social psychology of organizations, 2nd edn. Wiley, New York

Kimoto S (1994) Jinji Kohsatsu=Satei no hi: Nichieihikaku: Zai Einihonkigyou no Jirei wo Tyuushinni [Comparison of personnel evaluation and appraisal between Japan and the UK—based on cases of Japanese companies in UK]. Keiei Ronsyuu 41(3–4):55–91

Kuemmerle W (1999) The drivers of foreign direct investment into research and development: an empirical investigation. J Int Bus Stud 30(1):1–24

Lincoln R, Gerlach L, Ahmadjian L (1996) KEIRETSU Networks and Corporate Performance in Japan. Am Sociol Rev 61(1):67–88

Marsden D (1999) A theory of employment systems: micro-foundations of societal diversity. Oxford University Press, Oxford

Morrison W, Phelps C (1999) Taking charge at work: extra role efforts to initiate workplace change. Acad Manag J 42(4):403–419

Nishii H, Lepak P, Schneider B (2008) Employee attributions of the "why" of HR practices: Their effects on employee attitudes and behaviors, and customer satisfaction. Pers Psychol 61 (3):503–545

Organ W (1988) Organizational citizenship behavior: the good solider syndrome. Lexington Books, Lexington, MA

Organ W, Podsakoff PM, MacKenzie B (2005) Organizational citizenship behavior: its nature, antecedents, and consequences. Sage Publications, Thousand Oaks

Park T (2012) Tyuugokushijyou Bijinesu Senryaku. In: Chin S, Morimasa T, Shinzansya

Parker K, Williams M, Turner N (2006) Modeling the antecedents of proactive behavior at work. J Appl Psychol 91(3):636–652

Podsakoff M, MacKenzie B, Fetter R (1993) Substitutes for leadership and the management of professionals. Leadersh Quart 4(1):1–44

Ronstadt R (1978) International R&D: the establishment and evolution of research and development abroad by seven U.S. multinationals. J Int Bus Stud 9(1):7–24

Sako M (2004) Supplier Development at Honda, Nissan and Toyota: comparative case studies of organizational capability enhancement. Ind Corp Change 13(2):281–308

Scott G, Bruce A (1994) Determinants of innovative behavior: a path model of individual innovation in the workplace. Acad Manag J 37(3):580–607

Shintaku J, Ohki K (2012a) Nihon Kigyou no Kaigaiseisan wo sasaeru Sangyouzai Yusyutu to Shinsou no Gentika. Hitotubashi Bus Rev 2012:281–308

Shintaku J, Ohki K (2012b) Nihon Kigyou no Kaigaiseisan wo Sasaeru Sangyouzaiyusyutu to Shinsou no Gentika, MMRC Discussion Paper No. 419

Smith A, Organ W, Near P (1983) Organizational citizenship behavior: its nature and antecedents. J Appl Psychol 68(4):653–663

Sun Y, Aryee S, Law S (2007) High-performance human resource practices, citizenship behavior, and organizational performance: a relational perspective. Acad Manag J 50(3):558–577

Suzuki I (2004) Tyuugokukigyou to Zaityuugokunikkeikigyou to no Jinzaiikusei no Hikaku Kenkyuu [Comparative study of human resource development between Chinese enterprises and Japanese companies in China]. Wakou Keizai 36(2):17–33

Tanaka Y, Okamoto K (2013) Nissan Jidousya niokeru Kanagatatyoutatu no Gurobaruka, Kata Gijyutu, January, 22–25
Vlachos I (2008) The effect of human resource practices on organizational performance: evidence from Greece. Int J Hum Resour Manag 19(1):74–97

Chapter 3
Factors that Can Impact the Behavior of Manufacturing Employees in Japan, Thailand, and China

Abstract To address the issue of international HRM adaptability, we need to conduct a comparison of various ASEAN Plus Three countries, including Japan. In other words, to have employees actively engage in behaviors that are desirable for their companies, we must determine the most effective means of implementing HRM by identifying the differences between each region through conducting by-country analysis. Accordingly, in this study, we will focus on three countries by looking at Japan as the home country, and considering Thailand and China as Japanese companies' main foreign investment countries. By targeting local employees of Japanese companies in these countries, we will attempt to find a solution to determine the type of HRM practices that are needed to promote employee behaviors required to run efficient SCM operations, and to identify the differences between these countries.

Keywords HRM practices · Behavior of employees · Multiple group structural equation modeling · Organizational citizenship behavior

3.1 Research Background and Awareness of Problems

3.1.1 Supply Chain Management and Human Resource Management

In today's corporate world, companies are achieving competitiveness by maintaining business relationships with many enterprises rather than by engaging in transactions with a single entity. This chain of trade is called the "supply chain" (SC), and can be recognized as a type of network that consists of a wide range of processes including procurement, production, distribution, and customer delivery. In these processes, a chain of distribution and sales channels is being realized both upstream and downstream with the involvement of a range of entities (e.g.,

Work by Yasuhiko Haraguchi.

M. Itoh et al., *Automobile Industry Supply Chain in Thailand*,
Kobe University Social Science Research Series,
https://doi.org/10.1007/978-981-13-2360-7_3

materials enterprises, suppliers, assemblers, distributors, and retailers). From the standpoint of SC participants, there is a need to design and manage the string of flows ranging from procurement and production to consumption. The industry term for this type of management is called "supply chain management" (SCM). We believe that if individual players can properly execute SCM, they can raise the value of their business and secure profits, thus improving their financial outcomes and increasing their chances of survival.

Proper execution of SCM often requires handling issues between companies such as building a stable trade relationship between organizations. That said, we must also consider the fact that such stable and efficient interorganizational trade operations can only be achieved where individual companies have the foundation of stable and efficient internal management structures of their own. Accordingly, we believe that internal management of individual companies' organizational structure must also be recognized as an important factor. Particularly, if a company is considering running an efficient SCM operation from the standpoint of HRM, they must also consider improving the quality of their labor force, instead of just focusing on the quantity aspect. Specifically, a company needs to practice HRM that will encourage employees to engage in behaviors that are desirable for the company. However, when looking at the manufacturing industry in recent years, many manufacturers are carrying out their activities across multiple countries outside their home country. Given this, manufacturers are forced to build HRM practices that are suitable for employees working in their respective countries.

For Japanese companies, China and the ASEAN region have an extremely large presence as bases of production. Japanese companies that have entered these regions are trying out various HRM approaches to run smooth production operations at their respective local sites. As a result, they are forced to make a painstaking decision to choose between two approaches: (i) to implement the same HRM system as that used in Japan or (ii) to implement customized HRM systems to adapt to the characteristics and social systems of local workers. They are forced to face the issues of standardization and adaptability of HRM.

To provide a fixed solution to this kind of situation, we need to conduct an international comparison of various ASEAN Plus Three countries, including Japan. In other words, to have employees actively engage in types of behaviors desirable for their companies, we must conduct by-country analysis to figure out the most effective means of implementing HRM by identifying the differences between each region. Accordingly, in this study, we will focus on three countries by looking at Japan as the home country, and considering Thailand and China as Japanese companies' main foreign investment countries. By targeting local employees who are working for Japanese companies in these countries, we will attempt to find a solution to help determine the type of HRM practices needed to promote employee behaviors required to run efficient SCM operations, and help identify the difference between these countries.

3.2 Methodology

3.2.1 Survey Overview

We conducted a questionnaire survey by targeting employees who work in the automotive, machinery, and electronic components industries in Japan, China, and Thailand. The survey was conducted in March 2013 by distributing a total of 1800 questionnaires, with 600 questionnaires per each country. We collected a total of 1093 responses (60.7%), with the following breakdown:

- Japan: 328 responses (response rate 54.7%);
- Thailand: 352 responses (58.7%);
- China: 413 responses (68.8%).

We narrowed the number of respondents to those who answered all the question items, and the filtered results were:

- Japan: 270 responses (response rate: 45.0%);
- Thailand: 308 responses (51.3%);
- China: 377 responses (62.8%);
- Total: 955 responses (53.0%).

The sample attributes were as follows:

- Male versus female comparison:
  - Japan: female 58 persons, male 212 persons;
  - Thailand: female 128 persons, male 180 persons;
  - China: female 185 persons, male 192 persons.
- Average age:
  - Japan: 40.38 years old;
  - Thailand: 30.39 years old;
  - China: 31.35 years old.
- Average age:
  - Japan: 40.38 years old;
  - Thailand: 30.39 years old;
  - China: 31.35 years old.
- Average service period:
  - Japan: 147.5 months;
  - Thailand: 48.0 months;
  - China: 58.5 months.

We conducted the analysis in three phases. First, we conducted an exploratory factor analysis by targeting the entire sample and confirming the factor structure. In doing so, we calculated Cronbach's α concerning each scale and examined its

reliability, and used the scales that possessed such reliability. Next, to determine whether the population of each of the three countries possessed a common factor structure, we conducted a multiple group structural equation modeling to ensure that factors could be used for the analysis in this study. Lastly, we examined the difference between the three countries (Japan, Thailand, and China) by conducting path analysis through multiple group structural equation modeling. The examination of exploratory factor analysis and reliability during the first stage is further explained and discussed in Sect. 3.2.2 (Survey content). Multiple group structural equation modeling (factor analysis) during the second stage and multiple group structural equation modeling (path analysis) during the third stage are explained further in Sect. 3.3 (Analysis).

3.2.2 Survey Content

3.2.2.1 Behavior of Employees

In this study, we decided to measure employees' trust behavior and innovative/spontaneous behavior by excluding their participation/attachment toward the system.

For the scale concerning trust behavior, we used the scale of "behavior within role" that was used by Williams and Anderson (1991). Question items are composed of four items such as "I adequately complete duties." To differentiate spontaneous behavior from innovative/spontaneous behavior, we used the scale of "helping behavior" from Podsakoff et al. (1990). Question items are composed of five items such as "Is always ready to lend a helping hand to those around you." For innovative behavior, we used the scale of "improvement behavior" from Morrison and Phelps (1999). Question items are composed of four items such as "I often make constructive suggestions to improve how things operate within the organization."

We conducted exploratory factor analysis on items regarding employee behavior out of the above 13 items. To identify the number of factors, in addition to MAP criterion, we also used the Kaiser-Guttman rule that accepts eigenvalues of 1 or more, and we followed the MAP criterion in the case of any discrepancy. Regarding employee behavior, a three-factor structure was shown, with the value of MAP showing a variation of .0394, .0377, .0311, .0427, and so on. Furthermore, the Kaiser-Guttman rule also indicated a three-factor structure. Accordingly, we determined a three-factor structure to be appropriate.

Next, we conducted factor analysis by using the maximum likelihood method and oblique rotation (promax rotation) by fixing the number of factors as three. As a result, we conducted another analysis by excluding item 1 entailing factor load less than .40 (I often try to change how his or her job is executed in order to be more effective.), and we were able to achieve convergence by repeating it six times (Table 3.1). We decided to name factor 1 as "organizational citizenship behavior" (α = .892), since it consists of four organizational citizenship behavior items such

Table 3.1 Results of exploratory factor analysis of employee behavior

Question items	Factor 1	Factor 2	Factor 3	Commonality
Willingly helps others who have work-related problems	**0.827**	0.020	0.019	0.729
Helping others who have been absent	**0.800**	−0.001	−0.092	0.553
Is always ready to lend a helping hand to those around you?	**0.778**	−0.047	0.126	0.690
Helping others who have heavy workloads	**0.762**	0.064	−0.061	0.594
Helping orient new people even though it is not required	**0.623**	0.100	0.108	0.597
I fulfill responsibilities specified in job descriptions	0.021	**0.896**	−0.084	−0.739
I adequately complete duties	0.021	**0.856**	−0.025	0.730
I perform tasks that expected of me	0.034	**0.691**	0.119	0.636
I meet formal performance requirements of the job	0.023	**0.651**	0.091	0.533
I often try to correct a faulty procedure or practice	−0.470	−0.018	**0.924**	0.781
I often try to implement solutions to pressing organizational problems	0.029	−0.043	**0.802**	0.630
I often make constructive suggestions for improving how things operate within the organization	0.029	0.146	**0.643**	0.586
Factor Contribution ratio	5.349	5.144	4.534	
α coefficient	0.892	0.882	0.849	

as "Willingly helps others who have work related problems." We decided to name factor 2 as "work behavior" (α = .882), since it consists of four items related to daily work such as "I fulfill responsibilities specified in job descriptions." We decided to name factor 3 as "improvement behavior," since it consists of three items related to improvement behavior such as "I often try to correct a faulty procedure or practice."

3.2.2.2 HRM Practices

Regarding HRM practices, we measured employees' perception of practices that covered educational training, performance-based systems, work–life balance (WLB), and job security.

For the question items on educational training, we used the scale from Zhang et al. (2008), Sun et al. (2007), Delery and Doty (1996), Ahmad and Schroeder (2003). The question items are composed of five items such as "Individuals in this job receive bonuses based on the profit of the organization." For the question items

on performance-based systems, we used the scale from Zhang et al. (2008), Sun et al. (2007), Deckop et al. (1999).

The question items are composed of six items such as "Individuals in this job receive bonuses based on the profit of the organization." For question items on WLB, we used the scale from Forsyth and Polzer-Debruyne (2007) and Baptiste (2007). The question items are composed of four items such as "My current work place provides help to improve or assist my work life balance." For the question items on job security, we used the scale from Gaertner and Nollen (1989), Lee et al. (2010), Sun et al. (2007) and Yamamoto (2009). The question items are composed of three items such as "Job security is almost guaranteed to employees in this organization."

We conducted an exploratory factor analysis on the HRM practices items composed from the above 18 items. When looking at the change in MAP value regarding HRM practices, it indicated a four-factor structure by showing the following changes: .0377, .0316, .0239, .0233, .0311, and so on. Furthermore, the Kaiser-Guttman rule also indicated a four-factor structure. Based on these findings, we found a four-factor structure to be appropriate.

Next, we conducted factor analysis by using the maximum likelihood method and oblique rotation (promax rotation) by fixing the number of factors as four. As a result, we were able to achieve convergence by repeating it five times (Table 3.2). Factor 1 consists of five educational training items such as "Employees will normally go through training programs every few years." and obe item on performance evaluation. We named it "educational training" in consideration of the content of the item (α = .940). We named factor 2 as "performance-based system" (α = .882), since it consists of five items on performance-based systems such as "Close tie or matching of pay to individual/group performance." We named factor 3 as "WLB", since it consists of four items on WLB such as "My current work place provides help to improve or assist my work life balance." We named factor 4 as "job security," since it consists of four items on job security such as "If the company was facing economic problems, employees would be the last to get downsized" After extracting these factors, we calculated the descriptive statistics of each factor and correlation coefficients between variables (Tables 3.3 and 3.4).

3.3 Analysis

3.3.1 Examination of Explanatory Model

The purpose of this study is to verify the validity of a model for each country. By making such comparisons, we attempt to conduct a by-country comparison to determine what kind of impact HRM practices have on employee behavior. In doing so, we decided to verify the relationship between the variables by using path

Table 3.2 Results of exploratory factor analysis of HRM practices

Question items	Factor 1	Factor 2	Factor 3	Factor 4	Commonality
Extensive training programs are provided for employees.	**0.924**	−0.085	0.034	−0.003	0.777
Employees will normally go through training programs every few years	**0.880**	−0.068	0.004	0.033	0.727
There are formal training programs for each new hires the skills they need to perform their jobs	**0.873**	0.046	0.022	−0.061	0.785
Formal training programs are offered to employees in order to increase their promotability in this organization	**0.776**	0.075	−0.024	0.065	0.737
Employees receive training and development in workplace skills on a regular basis	**0.753**	0.067	0.006	0.031	0.685
I can take a holiday and holiday enough	**0.615**	0.324	−0.021	−0.055	0.701
Individuals in this job receive bonuses based on the profit of the organization	0.000	**0.841**	−0.062	0.056	0.697
Close tie or matching of pay to individual/group performance	0.035	**0.835**	0.080	−0.101	0.738
Close tie or matching of pay to group performance	−0.083	**0.787**	0.051	0.066	0.639
My individual performance actually has many impacts on any incentive pay award®	0.061	**0.762**	−0.004	0.028	0.677
My performance actually has little impact on my salary®	0.145	**0.744**	0.005	−0.015	0.728
My current workplace provides help to improve or assist my work–life balance	−0.075	0.006	**0.860**	−0.018	0.650
My manager understands about my family responsibilities	0.043	0.046	**0.784**	−0.003	0.708
Flexible working options are available to me if needed	0.041	0.032	**0.752**	−0.005	0.635
I worry about my work outside working hours	0.068	−0.026	**0.699**	0.072	0.603
Job security is almost guaranteed to employees in this organization	−0.023	0.010	−0.045	**0.731**	0.483
If the company was facing economic problems, employees would be the last to get downsized	0.001	−0.036	0.069	**0.707**	0.537
Employees in this job can be expected to stay with this organization for as long as they wish	0.086	0.092	0.050	**0.606**	0.573
Factor Contribution ratio	8.173	7.879	6.726	5.536	
α coefficient	0.940	0.917	0.878	0.763	

Table 3.3 Descriptive statistics

	Total		Japan		Thai		China	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Education training	4.24	1.44	3.36	1.26	4.61	1.15	4.60	1.26
Performance-based system	4.35	1.35	3.52	1.19	4.52	1.10	4.80	1.10
WLB	4.44	1.24	4.09	1.31	4.42	1.11	4.73	1.06
Job security	4.61	1.11	4.56	1.16	4.54	1.07	4.71	1.02
Work behavior	5.22	0.98	5.05	0.96	5.40	0.94	5.20	0.90
OCB	5.24	0.99	4.70	1.02	4.85	0.94	5.94	0.89
Improvement behavior	4.69	1.11	4.40	1.19	4.66	1.04	4.91	0.91

analysis based on structural equation modeling (SEM). Since we did not find any extreme values regarding the mean, standard deviation, skewness, and kurtosis of the observed variables, we decided to use all variables in our analysis.

3.3.2 Examination of Factor Structure (Multiple Group Structural Equation Modeling)

The scale shown was the result of an exploratory factor analysis conducted on the responses of three populations (Japan, Thailand, and China). Given this, we need to check whether the factor structure will apply to each country in the same way. In doing so, we check whether the factor structure applies to all three countries based on the result of the exploratory factor analysis by conducting multiple group structural equation modeling that targets the three populations.

We analyzed each model by assuming model 1 as the fixed position model (without any equivalency restriction), model 2 as a model with equal factor load volume, and model 3 as a model where the path is equal between factor load volume and factor. For the adaptability criterion, we examined the value of Akaike's information criterion (AIC) and Browne–Cudeck criterion (BCC), in addition to goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), comparative fit index (CFI), and root mean square error of approximation (RMSEA). Both AIC and BCC were used as valid criteria in comparing multiple models, as they determine whether the adaptability of a model that indicates a smaller value is functioning at a high level.

The findings showed that, as indicated in Table 3.5, model 1 (fixed position model) achieved the best adaptability to the data for both employee behavior and HRM practices. Though it did not perform as well as model 1, we also found satisfactory adaptability for model 2 that placed equivalency restriction on factor load, thus leading to our determination that matters such as homogeneity of data are being ensured in Japan, Thailand, and China.

Table 3.4 Correlation coefficient between variables

	Age	Length of continuous service	Job changing frequency	Education training	Meritocracy	WLB	Employment security	Work behavior	OCB	Improvement action
Age										
Length of continuous service	0.674***									
Job changing frequency	0.228***	−0.216***								
Education training	−0.331***	−0.290***	−0.032							
Performance-based system	−0.313***	−0.292***	−0.020	0.743***						
WLB	−0.223***	−0.195***	0.034	0.614***	0.617***					
Employment security	−0.125***	−0.088*	−0.019	0.553***	0.536***	0.581***				
Job security	−0.105***	−0.155***	0.063	0.416***	0.423***	0.398***	0.440***			
OCB	−0.122***	−0.151***	0.073*	0.499***	0.478***	0.498***	0.518***	0.663***		
Improvement behavior	−0.177***	−0.202***	0.061	0.494***	0.542***	0.479***	0.452***	0.596***	0.591***	

* p<.05, ** p<.01, *** p<.001

Table 3.5 Results of factor structure (Multiple group structural equation modeling)

Scale		GFI	AGFI	CFI	RMSEA	AIC	BCC
Employee behavior	Model 1	0.938	0.906	0.966	0.039	528.648	534.723
	Model 2	0.933	0.909	0.965	0.038	539.935	546.437
	Model 3	0.887	0.872	0.922	0.051	781.359	783.717
HRM practices	Model 1	0.906	0.866	0.950	0.040	1231.552	1251.482
	Model 2	0.899	0.867	0.947	0.040	1240.536	1257.219
	Model 3	0.763	0.737	0.845	0.063	2317.243	2323.887

3.3.3 Examination of Explanatory Model

In continuing with the purpose of this study, we set up three models and conducted a test through multiple group structural equation modeling (path analysis) to find out whether there is a difference in explanatory model depending on nationality. In addition to GFI, AGFI, CFI, and RMSEA, we also used AIC and BCC for the adaptability criteria. We used the following three models for the analysis.

Model 1 is a model that assumes the entire path coefficient to be different depending on the country, without adding restrictions on the entire covariance and path coefficients. Model 2 is a model that assumes the path coefficient between observed variables to be different depending on the country, by deeming observed variables having equal quality by adding an equivalency restriction on covariance between observed variables. Model 3 is a model that assumes the path coefficient between latent variables to have the same quality for each country, by adding an equivalency restriction on path coefficient between observed variables for each country. Amos 18.0 was used for statistical analysis in this study. Our analysis results showed that only GFI, AGFI, and CFI of model 1 displayed a satisfactory value of more than .9, and RMSEA displayed a satisfactory value of less than .05. Furthermore, Model 1 also showed the smallest numerical value for AIC and BCC. Based on these results, we determined that a model with no added equivalency restrictions is the best type of model (Table 3.6).

Table 3.6 Goodness-of-fit index of each model

	GFI	AGFI	CFI	RMSEA	AIC	BCC
Model 1	0.996	0.938	0.997	0.040	170.990	175.115
Model 2	0.814	0.591	0.805	0.135	789.040	791.473
Model 3	0.797	0.706	0.784	0.115	838.363	839.739

3.4 Examination of Model by Country

3.4.1 Examination of the Model for Each Country

First, we will examine the model in Japan. In terms of educational training policy and WLB policy, we were unable to confirm that they had any impact on the three behaviors of employees. We recognized that the performance-based policy had a positive impact on improvement behavior, but we were unable to confirm that the policy had any impact on work behavior and organizational citizenship behavior. For job security practice, we confirmed that it had an impact on all behaviors that covered work behavior, organizational citizenship behavior, and improvement behavior.

Next, we will examine the model in Thailand. Our findings showed that educational training policy had an impact on work behavior. Our findings showed that performance-based policy had an impact on improvement behavior. Our findings further showed that WLB policy had an impact on organizational citizenship behavior. Job security policy had an impact on organizational citizenship behavior and improvement behavior.

Next, we will examine the model in China. Educational training policy was found to have an impact on organizational citizenship behavior and improvement behavior. Our findings showed that WLB policy did not have a significant impact on any behaviors of employees. Result-based policy and job security practices promoted all behaviors that covered work behavior, organizational citizenship behavior, and improvement behavior.

Lastly, with respect to the path that indicates a significant trend in the populations of two of the countries among Japan, Thailand, and China, we conducted a significance test of path coefficient to confirm whether a significant difference is found on the coefficient. We targeted the following items:

- Job security → work behavior
  - Japan = China
- performance-based system → improvement behavior
- Japan = China, Japan = Thailand, Thailand = China
- job security → OCB
- Japan = China, Japan = Thailand, Thailand = China
- job security → improvement behavior
- Japan = China, Japan = Thailand, Thailand = China

The test statistics on the differences between the parameters of each population is shown in Table 3.7. These values represent values that converted the difference between two path coefficients into a standard normal distribution, and it signifies that there is a significant difference (at a 5% significance level) between two path coefficients if the test statistic is above 1.96.

Table 3.7 Result of significant difference test in the path coefficient

	Japan = Thai	Japan = China	Thai = China
Performance-based system → Improvement behavior	0.869	−0.334	−1.256
Job security → Work behavior	–	1.053	–
Job → OCB	−0.809	1.522	2.283
Job security → Improvement behavior	0.253	1.339	1.051

The result of our significance test confirmed that a significant difference was shown at 5% standard for path of Thailand = job security between China → OCB. This shows that a relationship between job security → OCB is significant for both countries, and it also simultaneously shows that the difference in path coefficient between both countries is significant. More specifically, it shows that the non-standardizing coefficient in Thailand is at .160, and in China, it is at .336. In other words, we can suggest that the impact of job security has on OCB may potentially differ between the two countries. The other path coefficients did not show any significant values. Accordingly, we did not find any differences that can be detected from the sample used in this study, and therefore were unable to determine the existence of differences regarding the path coefficient that showed common significant values for each country (Figs. 3.1, 3.2, and 3.3).

3.4.2 Common Points Between the Models for Each Country

The findings showed that the impact that HRM practices have on employee behavior comes in two forms: impacts that are common among all three countries and impacts that are unique to specific countries. We will first examine the common

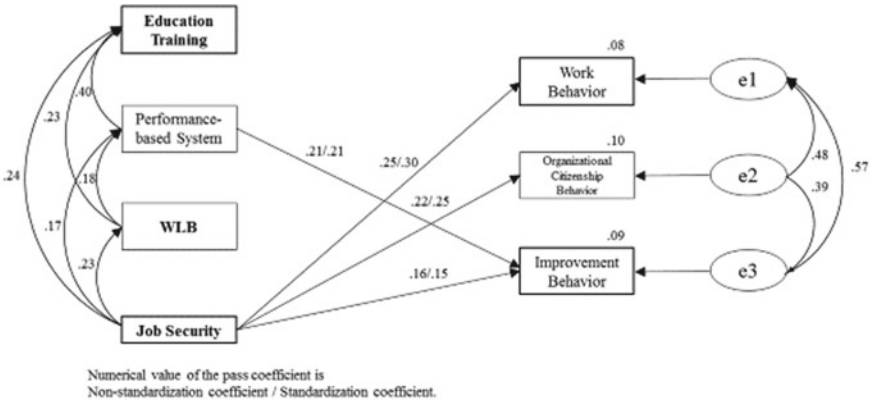

Fig. 3.1 Relationship between HRM practices and employee behavior (Japan)

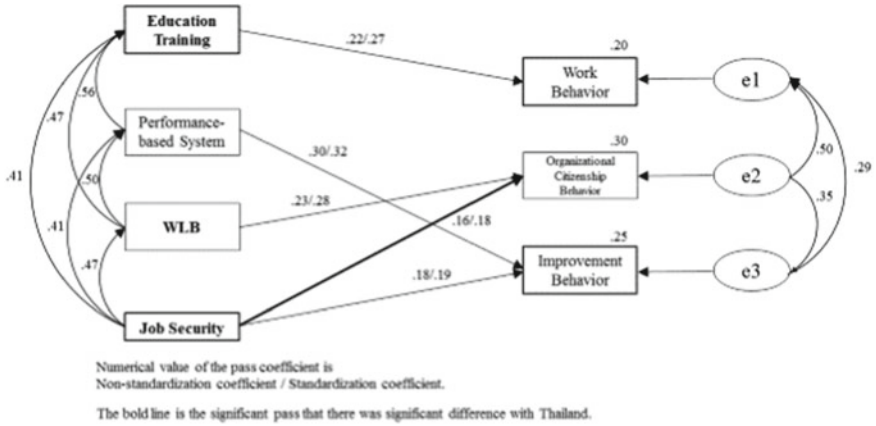

Fig. 3.2 Relationship between HRM practices and employee behavior (Thailand)

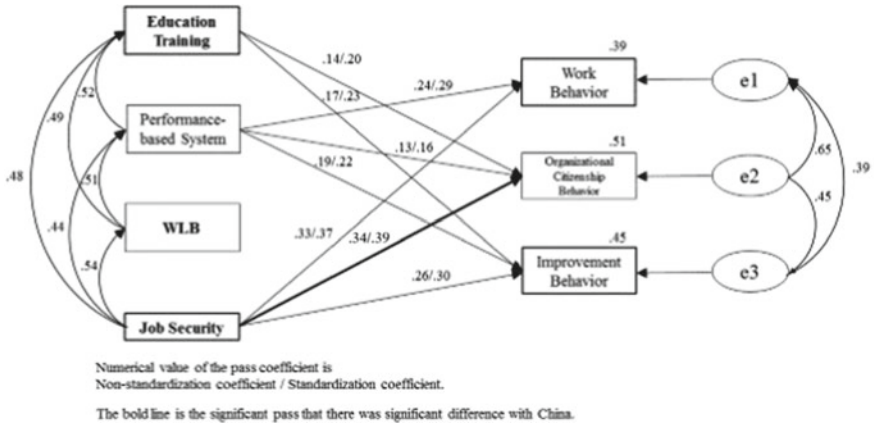

Fig. 3.3 Relationship between HRM practices and employee behavior (China)

impacts. First, we note that performance-based policy has an impact on improvement behavior of each country, when looking at it from the standpoint of the effect of the policy. Based on this finding, we can suggest that to promote improvement behavior in today's manufacturing industry, it is important to make sure such behavior is being evaluated in a proper way.

Second, we can point out that job security practices have an impact on organizational citizenship behavior and improvement behavior in each country. This shows that improvement in job security practices help employees feel secure in their employment status, thus vitalizing outside-of-role behavior that goes beyond their work behavior of fulfilling one's responsibility regarding regular duties.

When looking at the common point between these two based on behavior, it is important that the stance on job security is being expressed clearly at each country to promote the outside-of-role behavior referred to as organizational citizenship behavior. Furthermore, to promote improvement behavior—considered as the source of the strength of Japanese companies' production sites—as also being recognized as the same type of outside-of-role behavior, we believe that incorporating performance-based HRM on top of job security can potentially serve as an effective way to promote such behavior.

3.4.3 *Differences Between the Models for Each Country*

Next, we will discuss the differences between the models for each country. First, we can point out the impact of educational training policy. We did not find educational training policy to have any impact on employee behavior in Japan. However, we did confirm that educational training policy had an impact on work behavior in Thailand. Furthermore, in China, we did not find educational training policy to have an impact on work behavior, but we did confirm that the policy had an impact on organizational citizenship behavior and improvement behavior. Based on these findings, from the standpoint of promoting employee behavior, we can suggest that in Japan, it may potentially be more effective to strengthen other kinds of policies rather than strengthening the educational training policy. Furthermore, since the type of employee behavior being promoted by the educational training policy between Thailand and China was different, companies must recognize the effect of this policy and develop ways to strengthen it.

Second, we can point out the impact of performance-based systems. In Japan and Thailand, the awareness of performance-based policy only had an impact on improvement behavior, while in China, performance-based policy had an impact on all aspects of employee behavior. Based on these findings, when it comes to China, we can expect to gain a wide range of effects by strengthening the performance-based policy.

Third, we can consider the impact of WLB policy. WLB had an impact on employee behavior (organizational citizenship behavior) only in Thailand. We did not find WLB to have an impact in Japan or China. Based on this finding, we can conclude that it is important to strengthen WLB policy for Thailand.

Fourth, we can consider job security practices. Thailand was the only country that was not affected by this policy. Our findings also revealed that there was a difference in the strength of impact between Thailand and China regarding the impact job security had on organizational citizenship behavior. The findings showed that job security practices had a stronger impact on organizational citizenship behavior in China than in Thailand. As mentioned in Sect. 5.4.2, we can suggest that job security has a wide range of effects toward the promotion of employee behaviors in each country. We can also suggest that such effects can potentially carry greater weight in China compared to Thailand. At the same time,

we can also suggest the possibility of such effects not having as broad a range in Thailand compared to China and Japan.

When we combine these common points and differences, we can conclude that in order to promote the active engagement of desirable behavior among employees in the manufacturing industry in Japan, Thailand, and China, companies first need to strengthen the policies that function effectively throughout all three countries, and then select and strengthen the policies that are suited for each specific country.

3.5 Contribution and Issue

3.5.1 Contribution of This Study

The first contribution of this study is that it analyzes the common points and differences regarding the impact of HRM practices on employee behavior in the manufacturing industry in Japan, China, and Thailand. Very few previous studies have engaged in this kind of international comparison. Even where such comparisons were made, most studies did not engage in detailed analysis that compared models by confirming the commonality of factor structure and using path analysis with multiple group structural equation modeling. In consideration of the circumstances surrounding these preceding studies, we believe this study played the role of expanding the explanation area of HRM practices by conducting analysis that entailed higher levels of interpretability.

The second contribution is that by using this kind of analysis method, we clarified the common effect of HRM practices. Specifically, we revealed that limitations of WLB policy and the importance of job security practices are factors common to each country. This study was significant in the sense that it pointed out the common points between Japan—known as an economically advanced nation—and Thailand and China, which are known for having a relatively high level of economic development among developing nations.

By revealing these common points, this study made it possible for companies to draw up specific policy in figuring out how to advance the standardization of HRM that can go beyond national borders.

The third contribution is the concrete clarification of the difference in the effect of HRM practices. Specifically, it revealed that: the effect of educational training policy was not found in Japan, the effect of performance-based policy was shown widely throughout China, the effect of WLB policy was found in Thailand exclusively, the effect of job security practices showed the widest range in China and was limited in Thailand when compared to other countries, and the fact that such policy had less impact in Thailand than in China. By clarifying these differences, this study made it possible for companies to engage in evidence-based discussions to determine the specific type of policy that should be used to advance the local adaptability of HRM.

3.5.2 Study Task

In this study, we focused on the direct relationship between HRM practices and employee behavior to explain employee behavior. However, we can reasonably expect attitude variables such as work satisfaction and organizational commitment to act as mediation factors. In the future, we need to extend our analysis and take direct as well as indirect effects into consideration, including mediation factors.

Furthermore, we attempted to analyze only four individual policies among HRM policies in this study, omitting, for example, policies on work design and career development. In the future, we need to extend our study to address the entire HRM system by extending the individual policy category and conducting international comparisons.

Furthermore, we will also identify the sampling issues that were discussed in this study. Here, we conducted a survey by targeting employees working for Japanese companies in the manufacturing industry. In that sense, we could control the sample characteristics to a certain extent. However, we were not able to tightly control items such as industry type and regions within each country. In the future, we would like to see a study that can generalize the suggestions made in this study through sampling that can sufficiently control the sampling characteristic.

References

Ahmad S, Schroeder G (2003) The impact of human resource management practices on operational performance:recognizing country and industry differences. J of Operations Management, 21(1): 19–43

Baptiste, N (2008) Tightening the link between employee wellbeing at work and performance: A new dimension for HRM. Management Decision 46(2): 284-309.

Deckop R, Mangel R, Cirka C (1999) Research notes. Getting more than you pay for: or ganizational citizenship behavior and pay-for-performance plans. Acad Manag J 42(4):420–428

Delery E, Doty H (1996) Modes of theorizing in strategic human resource management: Tests of universalistic, contingency, and configurational performance predictions. Academy of Management J 39:802–835

Forsyth S, Polzer-Debruyne A (2007) The organisational pay-offs for perceived work-life balance support. Asia Pac J Hum Resour 45(1):113–123

Gaertner N, Nollen D (1989) Career experiences, perceptions of employment practices, and psychological commitment to the organization. Hum Relat 42(11):975–991

Lee H, Lee Z, Wu Y (2010) The relationship between human resource management prac tices, business strategy and firm performance: evidence from steel industry in Taiwan. Int J Hum Resour Manag 21(9):1351–1372

Morrison W, Phelps C (1999) Taking charge at work: extra role efforts to initiate workplace change. Acad Manag J 42(4):403–419

Nishii H, Lepak P, Schneider B (2008) Employee attributions of the “why” of HR practices: Their effects on employee attitudes and behaviors, and customer satisfaction. Pers Psychol 61 (3):503–545

Podsakoff M, MacKenzie B, Moorman H, Fetter R (1990) Transformational leader be haviors and their effects on followers' trust in leader, satisfaction, and organizational citizenship behaviors. Leadersh Quart 1(2):107–142

Sun Y, Aryee S, Law S (2007) High-performance human resource practices, citizenship behavior, and organizational performance: a relational perspective. Acad Manag J 50(3):558–577

Williams J, Anderson , S (1991) Job satisfaction and organizational commitment as predictors of organizational citizenship and in-role behaviors. Journal of Management, 17(3):601-617

Yamamoto K (2009) Jinzai Teichaku no Manejimento: Keiei Soshiki no Ritensyon kenkyuu [Retention management]. Tyuuoukeizaisya

Zhang, Z, Wan, D., Jia, M (2008) Do high-performance human resource practices help corporate entrepreneurship? The mediating role of organizational citizenship behavior. The Journal of High Technology Management Research 19(2): 128-138.

Chapter 4
Localization Process of Japanese Automobile Companies in ASEAN—The Role of Local Parts Development Division at Toyota

Abstract Based on previous studies on knowledge transfer, we examined how Toyota has been advancing localization of supply chain in ASEAN, especially in Thailand. In particular, we revealed that Toyota has been providing technical support to its suppliers by establishing a new specialized department in charge of technical support called the "Local Parts Development Division". Developing the suppliers is necessary in developing countries such as ASEAN countries where industrial competitiveness is not yet well developed. However, most of the previous studies did not shed light on how Japanese companies have been building their supply chain in developing countries. This study is significant in that, and it examined how the Japanese automobile company "Toyota" recognized the industrial competitiveness in developing countries and built its supply chain.

Keywords ASEAN · Thailand · Supply chain · Real local procurement KEIRETSU

4.1 Introduction

The purpose of this study is to examine the localization process of Japanese automobile companies in ASEAN. Although localization comes in a variety of ways, in this study, we will particularly focus on the local procurement of auto parts, since we believe that it is a vital element for Japanese automobile companies to be able to build a competitive advantage for supply chain in ASEAN successfully. As noted below, ASEAN is a region where Japanese automobile companies have a large market share, since they have been steadily expanding a competitive advantage over the years. However, unlike regions like North America, Europe, and China where Japanese automobile companies have expanded their business in the past, they had to expand their business and advance the localization of management

Work by Yoshitaka Shimono and Atsumi Kato.

M. Itoh et al., *Automobile Industry Supply Chain in Thailand*,
Kobe University Social Science Research Series,
https://doi.org/10.1007/978-981-13-2360-7_4

Table 4.1 The differences between ASEAN and other regions

Basic structure of industry	Range	
	Unitary state	Aggregate of multiple country
High	USA	EU
Low	China	ASEAN

in ASEAN since the industrial competitiveness of ASEAN dramatically differs from other regions.[1]

As shown in Table 4.1, the differences between ASEAN and other regions can be summarized in two parts as follows.

First is the fact that the U.S. and Europe already had industrial competitiveness for manufacturing companies because many local automobile companies and suppliers had already been operating over the years. In contrast, when it comes to ASEAN, many Japanese automobile companies had to expand their business without the basis of industrial competitiveness. In fact, it has been suggested that depending on the regions, Japanese automobile companies have different organizational functions in the areas, respectively (JETRO 2004). The second point is that unlike U.S. and China that are unitary states, ASEAN is an aggregate of countries that have diverse cultures, sense of value and different regulations. In addition, "Motorization" is also being advanced at a different pace depending on the country. Because of this, when Japanese companies made a business strategy in ASEAN countries, they had to integrate these different situations so that they can expand their business and localize the procurement of auto parts.

In this chapter, we will focus on Japanese automobile companies as the subject of this study, particularly, Toyota Motor Corporation (hereinafter "Toyota") which acquired the highest market share in ASEAN. Specifically, we will look into the transition of business development in ASEAN by examining the development of its supply chain and localization of parts procurement.

In Sect. 4.2, we will have an overview of Toyota's business transition in ASEAN. In Sect. 4.3, we will clarify the activities of Toyota's Local Parts Development Division (hereinafter "LDD") which is operating to advance the localization of parts procurement, and in Sect. 4.4, we will examine its role and significance. In the final section, we will present our conclusion and future issues.

In the next section, we will have an overview of Toyota's process of developing its supply chain in ASEAN that mainly focuses on Thailand and localization process of parts procurement. We will examine these processes and initiative toward real local procurement which is different from other regions (U.S., Europe, etc.). In particular, we will examine Toyota's purchasing strategy and the technical support to develop the suppliers in ASEAN by carefully looking into the role and significance of the LDD that Toyota set up in ASEAN.

[1]The industrial competitiveness refers to technical abilities and knowledge for automobile development and manufacturing in this study.

Table 4.2 List of interviews

Interview day	Interview
January, 2013	Local procurement office
June, 2015	Local procurement office
August, 2015	Procurement division, procurement technology office
September, 2015	Procurement division
March, 2016	Local procurement office
September, 2016	Local procurement office

To achieve the purpose of our study, we conducted interviews with members of Toyota's technical center in Thailand (TMAP-EM). Specifically, we conducted a total of six interviews (Table 4.2) from January 2013 to September 2016. The duration of each interview was between 1.5 and 2 h.

4.2 Toyota's Business Transition in ASEAN

4.2.1 Transition of Business Activities in ASEAN

Figure 4.1 shows the progress of Toyota's vehicle production volume in the ASEAN region in recent years. It shows that Toyota's production volume in five ASEAN countries in 2008 was roughly 800,000 vehicles, of which roughly 70% were manufactured in Thailand. Although Toyota smoothly expanded its production scale from the end of 1990s after the Asian Financial Crisis, its production volume dropped due to the global crisis triggered by the 2008 financial crisis (Lehman shock) and the 2011 flood disaster in Thailand. However, the production volume of 5 ASEAN countries reached roughly 1.16 million vehicles in 2012, due in part to the rapid growth in the production volume in Thailand that almost reached 900,000 vehicles. This kind of rapid increase in production volume was largely due to the policy of the Thai government.

The domestic market in Thailand was stimulated by the policy, "First Car Tax Reduction" (IRC 2015; Fourin 2015). The "First Car Tax Reduction" is a tax reduction measure that was implemented between September 2011 and December 2012, where commodity tax was refunded to the consumers who bought their cars (four-wheel cars) for the first time. However, the domestic market in Thailand dropped after the end of the First Car Tax Reduction measure, owing to factors such as a downturn after this tax reduction and the 2014 Thai coup d'état.

The percentage of Indonesia in the total production volume in the ASEAN region that remained at roughly 20% reached roughly 30% in 2014, exceeding Thailand's sales volume in the same year. Since Indonesia has a large population of 200 million, the sales volume is expected to grow in this market with the progress of its motorization. In September 2013, a low-priced green car promotion program

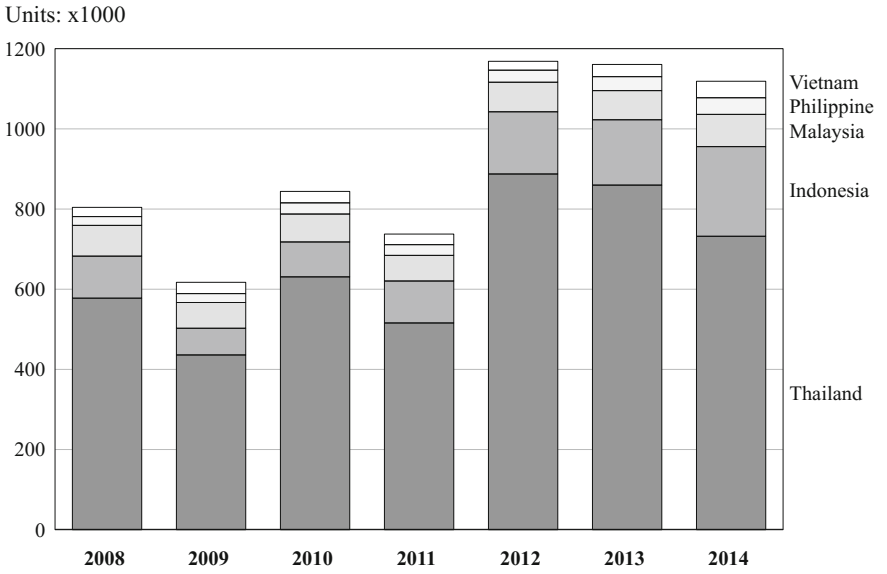

Fig. 4.1 The Change of Sales Volume of Toyota in the ASEAN region. *Source* Prepared by the author on the basis of Fourin (2015)

"LCGC (Low Cost Green Car) policy" was implemented in Indonesia (IRC 2015; Fourin 2015). A total exemption from luxury tax was implemented for cars that conform to the LCGC criteria. Although ASEAN market is transitioning from overconcentration in Thailand to a multi-countries production system comprised of Thailand and Indonesia, we expect the further expansion of the entire market to take a little more time.

Even though the market growth has settled down as described above, Toyota still maintains its competitiveness in ASEAN. Figure 4.2 shows the market share of each automobile company in six main ASEAN countries.[2] Toyota was ranked first in 2014 with market share of 29.9%. Toyota is showing a high level of competitiveness with over 30% market share in Thailand, Indonesia, Philippines, and Vietnam. In Indonesia where Toyota is not ranked first, its wholly-owned subsidiary, Daihatsu Motor Corporation (hereinafter "Daihatsu") claimed first place with the share of 29.5%. The market share of Daihatsu and Toyota group in the entire ASEAN was 11.9 and 41.8%, respectively. Honda had over 10% market share in Thailand, Indonesia, and Malaysia, and was ranked third in the entire ASEAN region. Isuzu, well known in Thailand as a pick-up trucks manufacturer,

[2]Main 6 countries in ASEAN refer to Thailand, Indonesia, Malaysia, Philippines, Vietnam and Singapore.

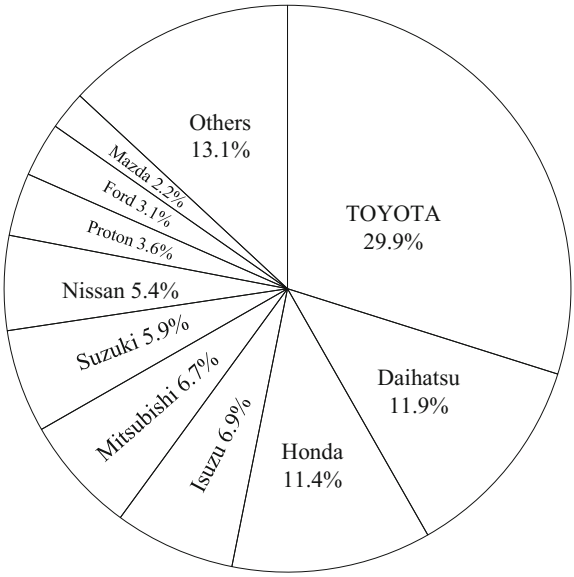

Fig. 4.2 The market shares of each automobile company in six main ASEAN countries in 2014. *Source* Prepared by the author on the basis of Fourin (2015)

ranked fourth. Mitsubishi Motors with roughly 20% of the Philippines market came in fifth for the entire ASEAN market, respectively. Thus, Japanese automobile companies have a major presence in the ASEAN market.

4.2.2 Transition of Business in ASEAN Countries

Toyota had started its expansion in ASEAN before it carried out its full-fledged expansion in the U.S. and EU, tracing all the way back to its start of business in Thailand in 1962. Toyota's business development in ASEAN has over 50 years of history, and we can examine its transition by dividing the history into three parts.[3] First is the period known as "Genesis"—the period up to 1990s after Toyota launched its business in ASEAN. Toyota entered the Thai market in 1962 and established Toyota Motor Thailand (TMT).

In 1964, Toyota started assembling trucks at Samrong plant of TMT, and it expanded local production by opening factories in Malaysia in 1968 and in Indonesia in 1970. Starting from 1970s, Toyota advanced the development and production of special cars for ASEAN called Basic Utility Vehicle (BUV) together with its suppliers (Tanaka and Hoshino 2015).[4]

[3]Toyota Motor Annual Report 2012.

[4]The original project name was BUV, but was changed to TUV (Toyota Utility Vehicle) in 1986 (Tanaka and Hoshino 2015).

In 1976, it began producing "Tamaraw" in the Philippines, and in the following year, began producing "Kijang" in Indonesia. Toyota introduced these special vehicles that can be used for multiple purposes with an affordable price to reflect the local needs and contribution to local economic development. Toyota made an effort to provide vehicles with an affordable price and developed the vehicles with a design that matched local technology (for example, not having press machines that can create special curve design). To this end, Toyota procured 100% of body steel plates locally and aimed to assure the quality that can withstand the harsh environment of roads, etc. This kind of initiative and concept toward development and production of special cars to the market outside Japan was taken over by the subsequent IMV project which is detailed below. During the genesis period, Toyota developed special vehicles with its suppliers while improving the infrastructure of car industry in the ASEAN region.

Second is the transition period roughly between 1990 and 2000. During this period, a mutually complementary production system within the ASEAN region was constructed (Kawabe 2011). Prior to 1990, Toyota constructed a production system in each ASEAN country that mainly focused on compliance with domestic regulation of production and on the avoidance of tariffs. However, tariffs on vehicles were eliminated incrementally through AFTA-CEPT scheme in the entire ASEAN region and a global supply base of pick-up trucks was established in Thailand. Toyota began restructuring and optimizing the fragmented production system within ASEAN region. However, since it was difficult for automobile manufacturers to produce parts such as engines which require large investments in each ASEAN country, they needed to construct a kind of production system that can produce certain parts intensively (in one place) in a single country and supply them to other countries within ASEAN as needed. Specifically, Toyota has been producing some auto parts intensively (in one place) in each country (for example, diesel engines in Thailand, gasoline engines in Indonesia, steerings in Malaysia, and transmissions in the Philippines) (Kawabe 2011). As a result, Toyota established a mutually complementary production system among ASEAN countries.

In 1997, Toyota introduced a special car for Asia called "Soluna", but it suffered a stagnant sales volume due to the Asian Financial Crisis right after its release. Furthermore, when they planned model change for pick-up truck "Hilux" and TUV whose models had remained the same since 1997, they decided to adopt a common platform for the new models of Hilux and TUV at competitive costs by taking advantage of economy of scale and raising the local procurement rate (Ogawa 2015). This decision eventually led to the subsequent IMV project. Although Hilux was also produced by Hino Motors in Japan during that time, Toyota decided to produce Hilux as IMV project in Thailand since demand for Hilux was declining in Japan. Starting from the third period known as "development period" in 2000s, Toyota began to build a global production system which includes IMV project.

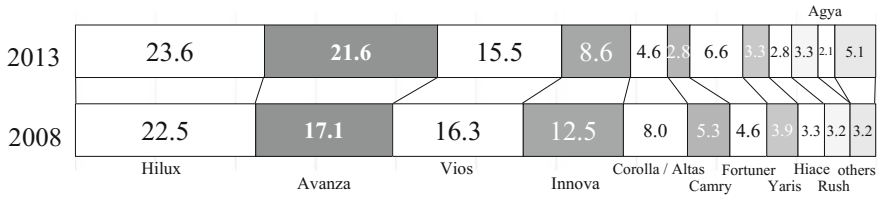

Fig. 4.3 Toyota's share of sales volume based on the model type in six main ASEAN countries. *Source* Prepared by the author on the basis of Fourin (2015)

4.2.3 IMV Project

When we examine Toyota's business development in ASEAN, its 2000s era can be viewed as a development period that mainly focused on IMV project. IMV stands for "Innovative International Multi-Purpose Vehicle", a project carried out to produce 3 types of vehicles (pick-up trucks, SUV, and minivan) by using a common platform (Kawabe 2011).

The first generation of IMV was produced in Thailand in August 2004, then subsequently in Indonesia, South Africa, Argentina, and India. In addition, knockdown production was carried out in Malaysia, Philippines, Venezuela, Vietnam, Taiwan, and Pakistan. In terms of sales, they are being sold in roughly 170 countries around the world and the total sales volume reached 5 million in 2012.[5]

Figure 4.3 shows Toyota's share of sales volume based on the model type in six main ASEAN countries. It shows that IMV-based pick-up trucks (Hilux) claim the highest share with 22.5%, and U-IMV-based Avanza took up 17.1% share.[6] Asia special car "Vios" takes up 16.3% share, and IMV-based minivan "Innova" mainly sold in Indonesia came in fourth with 12.5% share.[7] The figure further goes down for the global models "Corolla" and "Camry". Also, note that the share of Hilux slightly increased in 2013 to 23.8% share compared to 2008. The share of Avanza increased rapidly and landed in second place with 21.6%. On the other hand, the share of Vios (third place) and Innova (fourth place) decreased to 15.5 and 8.6%, respectively. In general, IMV (special vehicles for developing nations) has a major presence in the ASEAN market.

[5]Toyota Motor Annual Report 2012.

[6]U-IMV (Under IMV) was a project to develop smaller vehicles than IMV and was carried out jointly by Toyota and Daihatsu (Source: Toyota's website: 75 years History of Toyota).

[7]Vios is sold exclusively in Asia and succeeds to Soluna (Kawabe 2011).

4.2.4 Parts Procurement in ASEAN

Toyota Technical Center Asia Pacific Thailand (TTCAP) was established in 2003 (Kawabe 2011). Although new vehicles based on IMV project were designed in Japan, TTCAP was in charge of gathering information needed for the concept creation of new model cars and changing the design to adjust to local needs. By 2006, Toyota established the organization, Toyota Motors Asia Pacific Thailand (TMAP Thailand) that supervised the production bases in the Asia region. In 2007, Toyota unified TTCAP and TMAP and established Toyota Motors Asia Pacific Engineering and Manufacturing (TMAP-EM).[8] This organization was built to coordinate the functions of engineering and manufacturing and to integrate the functions of purchasing, manufacturing, and distribution in the entire ASEAN region. The establishment of TMAP-EM made it possible to carry out the design of upper body and engines partially in Thailand. It also realized a more systematic and organized procurement by integrating all the procurement functions in TMAP-EM.

Toyota divided auto parts procured in ASEAN into the following three groups. First are the auto parts procured around the world. For example, they supply certain auto parts that are produced in Japan to various ASEAN countries. These types of auto parts require advanced technology and technological innovation. Second are the type of auto parts that are procured intensively (in one place) in the entire ASEAN region. For example, such auto parts are procured in countries like Thailand, Indonesia, and India, and are supplied to various ASEAN countries through the mutually complementary production system. Third is the type of parts procured under the control of the purchasing department in each ASEAN country. Auto parts with a relatively low technical level belong to this category. They took factors such as quality, cost, and delivery into account when they determine whether such auto parts should be procured intensively (in one place) in the entire ASEAN region or in each ASEAN country.

In the IMV project that was implemented from 2004, the local procurement rate of pick-up truck Hilux increased dramatically compared to the model prior to IMV. The local procurement rate of Hilux reached 96% through minor model changes in 2008 and 2012. The remaining 4% of parts are imported from Japan. Such auto parts require a high level of technology and it is impossible to procure these auto parts from Japanese suppliers in ASEAN because Japanese suppliers which supply these parts in Japan did not expand their operations in ASEAN. Toyota makes them in Japan to take advantage of economy of scale.

Toyota introduced a new model of Hilux in May 2015, and began its production in Thailand. The local procurement rate of auto parts in Thailand increased from the first model 96% to second model 98%. Although only 2 percentage points increase

[8]Toyota and its wholly-owned subsidiary Daihatsu officially established their internal company responsible for compact vehicles for emerging markets on January 1, 2017. TMAP-EM was renamed Toyota Daihatsu Engineering and Manufacturing Co. Ltd. (TDEM) and became an entity under the new internal company.

is shown in terms of numerical value, the local procurement has advanced beyond what is just shown numerically. In other words, even though the local procurement rate from tier-1 suppliers increased only by 2 percentage points, Toyota was able to drastically accomplish real localization of procurement by localizing materials and molds which are procured by tier-2 and tier-3 suppliers. In addition, there was a transition from procuring parts in the ASEAN region to procuring them in each country. During the period of the first IMV model, Toyota built the complementary supply chain in the ASEAN region. Each production base procured some specific parts in the country based on its advantage and they supplied the parts to other production bases.

However, when the second IMV model was introduced in the market, because the production volume in ASEAN countries except Thailand increased, each production base of each country could ensure enough amount of production for economy of scale. The growth of production volume of vehicles also increased the volume of auto parts supplied to each country and increased logistics cost of auto parts. To solve the problem, for the second IMV model, Toyota decided to advance localization of production in each country (for example, local procurement of engine parts in India) which in turn led to a decrease in parts procurement in the entire ASEAN region. Under the strategy to purchase the local parts, the LDD was built inside TMAP-EM in 2012 and is playing a significant role. In the following section, we will have an overview of the initiative behind the division.

4.3 The Role of Local Parts Development Division

4.3.1 History of Its Establishment and Organizational Structure

In January 2012, Toyota set up "BR vehicle and parts localization department" inside Toyota headquarters in Japan.[9] It promoted local production and local procurement outside Japan. Toyota aimed to realize production and procurement suitable for local regions by integrating related functions that are scattered throughout different sections (R&D, production, purchasing, etc.) inside its headquarters in Japan, and by providing technical support to its subsidiaries outside Japan. Toyota also aimed to improve the resistance against the fluctuations in exchange rate by strengthening the cost competitiveness. At the same time, Toyota also set up the LDD in the technical center operating under TMAP-EM. It was necessary for the LDD to boost the procurement of local materials and local auto parts so that they can realize R&D specific to ASEAN region. With the support of BR vehicle and parts localization department in Japan, the LDD opened branch

[9]From Nihon Keizai Shimbun December 20, 2011. BR means Business Reform and is a task force-like organization to respond to management issues quickly.

offices in Indonesia and India to advance localization throughout the entire ASEAN region.[10] Under the strategy of the LDD, they are advancing three types of localization—materials, units such as engines, and auto parts. Specifically, the LDD has the following three missions: (1) supporting auto parts development for local procurement by discovering new potential suppliers with future prospects, (2) implementing technology development and organizational improvement to advance "real local procurement" rather than "superficial local procurement", and (3) promoting local procurement that can cater to the needs of the ASEAN regions which are different from those in developed nations and regions like the U.S. and the E.U. For example, in-house production of engine component parts changed to outside production and procuring materials changed from Japan to the ASEAN region. They also set this up to advance the localization of component parts procurement for the second generation IMV whose mass production started in Thailand in May 2015.

The LDD consists of both Japanese staff and local staff. Japanese staff comes from production engineering department, quality control department, and R&D department in Japan. They support their suppliers by using their specialized knowledge and know-how. The LDD also has staff who are responsible for both this division and other TMAP-EM departments. They support production engineering, quality control, and purchasing department, respectively, and promote the communication between these departments.

4.3.2 Certification Process of New Suppliers

The LDD under TMAP-EM provides support to various stages of procurement process. For example, although the selection of suppliers starts at the initial stage of product design, their mission also includes exploring new suppliers on a local basis. We stated previously that parts procurement in ASEAN is largely divided into parts procured by the purchasing department in Japan and those procured on a local basis (by the purchasing department in Thailand) depending on the characteristics of parts. In the case of the local parts, a new supplier is certified when a decision is made to purchase parts from the supplier. The new supplier must go through the following three steps: (1) New Supplier Pre-Evaluation, (2) Authorization, and (3) Registration as the official supplier for Toyota.

The basic steps are the same whether the parts are procured in Japan or Thailand. The purchasing department investigates the candidate supplier and quality assurance department screens the capability of the supplier. However, in the case of procurement from outside Japan, LDD provides support to the design and quality assurance departments at local subsidiaries. Engineers in design and quality assurance departments are dispatched from Japan to the local subsidiary, if parts are

[10]BR vehicle and parts localization department was abolished in March 2013.

procured outside Japan by the purchasing department in Japan. If purchasing department in TMAP-EM procures parts locally, the local design and quality assurance departments take charge of the Quality Control. If each local department does not have enough capability, engineers in charge of design and quality control at the LDD will support them.

Most of the vehicles that are made and sold in ASEAN are designed in Japan. For example, the LDD provides information of local suppliers to the engine parts designers in Japan in order to facilitate the local procurement of the parts. Particularly for the development of second-generation IMV, Toyota evaluated and adopted new local suppliers in Indonesia and India as Toyota-certified suppliers, instead of using the existing suppliers only in Thailand.

4.3.3 Supporting the Evaluation of the Prototype and the Production Preparation

Just like in Japan, purchasing group of Toyota is divided into purchasing department and purchasing engineering department in ASEAN. Purchasing department is in charge of searching and selecting suppliers. A list of candidate suppliers and information on the production department are gathered by the purchasing department. However, they receive the support from the LDD when it comes to the support of technological aspects (to find out whether its suppliers have enough technological capability for development and production).

On the other hand, the purchasing engineering department is in charge of activities for production preparation and of providing support to suppliers after mass production starts. Activities for production preparation include the management of the project for launching new vehicles, and purchasing engineering department has a responsibility to ensure that the project is advancing according to the plan and to coordinate the related departments. Activity for production preparation is carried out roughly 2 years before the start of mass production. Basically, the suppliers build plans such as “how to manufacture dies for mass production and make the production process based on the completed drawing of the vehicle”, “how to assure the quality”, and “how to implement the proposed plan while coordinating with Toyota”. However, these plans are managed by the purchasing engineering department with the support of the LDD.

In addition, purchasing engineering department and LDD also support the suppliers when the suppliers are refining the drawing of parts (to be exact, these kinds of activities are separated from the activity for production preparation), and these activities are implemented 6–8 months prior to the start of the activity for production preparation. Therefore, suppliers make the drawings together with Toyota and they need feedback such as how to manufacture the parts more easily and how to reduce the cost to refine the drawings. Toyota reflects such feedback on the drawing before the final version of drawing is established.

In terms of second-generation IMV, Toyota was able to avoid changing the drawings of vehicles after the evaluation of the prototype which was conducted to verify its quality for mass production one year before the start of mass production. As a result, they were able to implement problem solving in advance and were able to realize zero defects and zero late delivery at the stage of developing the prototype for mass production. It was their first ever achievement for TMAP-EM. Thus, they implement measures to avoid troubles in advance rather than rely on ex-post measures.

4.4 Discussion

4.4.1 Roles of LDD

As mentioned previously, since industrial competitiveness of ASEAN is different from other regions, Toyota set up the LDD so that they can advance localization that can be adjusted to the unique conditions of this region. With this understanding, we look into the specific roles of the LDD.

Thailand is the only country in the world where Toyota established the LDD. The following four points can be suggested as the reasons. First are the unique conditions of the ASEAN region. Unlike the U.S. which is a single country, ASEAN is a region comprised of different countries and each country has different regulations. Therefore, it was necessary for Toyota to make a strategy that can be adjusted to these countries and regions. In doing so, they built the LDD so that they can integrate as many functions as possible into a single entity. In the U.S. and Europe, the industrial competitiveness for automobile production has already improved because the automobile industry has long history.

In contrast, the ASEAN region does not have industrial competitiveness and therefore it became necessary for Toyota to build it upon its own initiative. Although several Japanese suppliers are expanding in this region, many of them are still focused on Thailand, and their presence in Indonesia is increasing gradually. In order to improve the industrial competitiveness and to develop local suppliers, they needed to set up a specialized department called the “LDD”. Although Toyota had already started localization prior to setting up the LDD, Japanese engineers still had to fly out from Japan and carry out the task in the ASEAN region in the past. In order to address this problem, they decided to set up the LDD so that they can solve such problems locally.

Second, it is necessary for cross-sectional organization to integrate different functions. In the past, the R&D department, the purchasing department, and the production engineering department carried out the search, selection, and development of local suppliers all on their own. This practice led to an inefficient way of carrying out explorations of its suppliers, because each department would often end up examining the same suppliers. There was also a case where each department

would engage in this kind of inefficient overlapping explorations on their own, when they were searching for forging parts suppliers of engine, transmission, chassis, etc. Accordingly, Toyota decided to set up this new cross-sectional department that can go across barriers between departments and grasp the entire process.

Third is the specialization of local staff. Each local department that handles procurement, design and quality control is in charge of various tasks. These departments do not have the ability to carry out the extra task of certifying new suppliers, because these departments need to prioritize improving their ability by focusing on their primary tasks, instead of spreading themselves too thin. By establishing the LDD in charge of these new tasks, Toyota can make each department focus on their special tasks.

Fourth is to develop the whole supply chain. It is imperative that they grasp the whole supply chain in order to realize real localization. Investigation on the whole supply chain (tier-3, tier-4, etc.) was implemented in Japan triggered by Tohoku Region Pacific Coast Earthquake. They also investigated supply chain in Thailand upon the occurrence of floods in 2011. So far, they have a grasp of up to tier-4 level. In Thailand, they realized local procurement with a ratio close to 100% at tier-1 level. However, in terms of the actual component parts produced by such tier-1 suppliers (in other words, tracing back to tier-2 suppliers), we found that localization is not moving forward in many cases. For example, even if they were able to procure the local engine parts, there are many cases where the component parts, materials, molds, etc. are still procured from Japan. It goes without saying that tier-1 suppliers have the authority to select tier-2 suppliers. Although there are cases where Toyota is involved in the technical support of tier-2 suppliers, the right to select suppliers still ultimately rests on tier-1 suppliers. To carry out real local procurement, they increasingly use local materials and molds through tier-2 and below. When the LDD goes around searching for new suppliers, they sometimes introduce candidate suppliers to tier-1 through their information.

4.4.2 Building Supply Chains in ASEAN

In this case study, it became clear that Toyota's LDD is deeply involved in developing its suppliers in Thailand. The missions of LDD include analyzing the manufacturing process of each auto parts, clarifying the supply chain, and discovering and developing new suppliers while advancing the local procurement. Especially, they had to engage in the process of developing local suppliers to meet the acceptable level of cost advantage, while maintaining the same quality as in Japan.

In order to enable these local suppliers which do not have enough technology compared to Japan to achieve the level of technology required by Toyota, Toyota has had to develop these suppliers by providing active support to them. In order to

improve the competitiveness of these suppliers, Toyota has had to provide full-fledged support to the factories of these suppliers.

Furthermore, even if the business is expanded globally, tier-1 suppliers will still maintain R&D organization in Japan to be deeply involved in R&D of Japanese automobile companies as long as Japanese automobile companies develop the vehicles in Japan. Because of this, the suppliers which are deeply involved in R&D activities with Japanese automobile companies will get a great advantage. Meanwhile, since many of these suppliers in Thailand still do not have sufficient technology, there are not many tier-1 suppliers which have enough capability to support their tier-2 suppliers. Under these circumstances, it will be difficult to solve quality problems at local factories without the active technical support by Toyota.

Thus, Toyota has been building their supply chain in Thailand through the strategy of purchasing parts while developing suppliers. To do so, they launched a specialized department called the "LDD" and have been providing active technical support for suppliers ever since. In order to sustain the same quality as Japan, Toyota will have no choice but to transfer production system and their know-how to other countries, and such knowledge transfers will not be successful without the active support of Toyota.

4.5 Conclusion

Toyota has been applying their procurement policy of "purchasing from suppliers while developing them" in ASEAN, especially in Thailand. Previous studies also suggested that Toyota has been carrying out long-term relationship based on the philosophy of coexistence (Fujimoto 1998; Dyer and Nobeoka 2000). For their overseas business, Toyota is searching and selecting their suppliers based on long-term relationship with them. This is based on Toyota's philosophy of developing suppliers just as they operate in Japan. In terms of developing suppliers, President Akio Toyota stated "Our basic principle is to purchase auto parts from the suppliers which we develop. Since we establish that philosophy, we will grow together with the suppliers and cooperate with them in the manufacturing process" when he was a chief officer of purchasing group.[11] Furthermore, Liker (2004) suggested that Toyota has the philosophy that if Toyota finds their partners, they grow together with a long-term relationship and a mutual prosperity. Specifically, he stated that "Toyota will only give a small amount of orders at first to the new supplier. The new supplier must then prove to Toyota that they will make whole-hearted efforts to meet the high goal set by Toyota. If the new supplier can prove this on their initial orders, they will take a large amount of orders subsequently. Toyota will then teach them the "Toyota Way" and accept them as part of

[11]The Nihon Keizai Shimbun March 12, 2006 issue.

"Toyota Family". Once the supplier joins the family, they will not be expelled unless they make a big mistake."

Behind the technical support to partners and philosophy of mutual prosperity, there is the fact that Toyota pays attention to the whole supply chain and not just itself. For example, when they change the supplier, one of the reasons why Toyota is so cautious to switch the supplier is that if they switch to another tier-1 supplier, the change will dramatically affect tier-2 suppliers under the tier-1 supplier and damage them. Since in many cases tier-2 suppliers depend on a specific tier-1 supplier, switch of tier-1 supplier will dramatically affect tier-2 suppliers. Because of this, easy switch of tier-1 supplier can sometimes cause tier-2 suppliers to go bankrupt. It is very common for major tier-1 suppliers to transact with a large number of tier-2 suppliers. If Toyota switches to another tier-1 supplier, such changes will dramatically affect the tier-2 suppliers. Supposing that a tier-2 supplier goes bankrupt, such a bankruptcy may damage the stable supply chain to Toyota. Because of this reason, once Toyota starts trading with a certain supplier, they do not switch to another supplier easily and they provide active support to the supplier to maintain a long-term relationship.

These facts suggest some implications to academic research. Although previous studies pointed out the technical assistance by Toyota, they did not discuss the significance of technical support to develop suppliers sufficiently. Most of the previous studies analyzed relationships between automobile companies and suppliers based on the transaction cost theory or trust. On the other hand, Dyer and Nobeoka (2000) focused on Toyota's cooperative network based on knowledge management theory. Their study clarified how Toyota transfers both explicit and tacit knowledge and share it within their "KEIRETSU" network.

Furthermore, Sako (2004) revealed the supplier development based on knowledge (organizational capability) transfer. Since it was already revealed that Toyota was providing technical support in these previous studies based on knowledge transfer and transfer of organizational capability, these studies focused on how to transfer the knowledge effectively.

Based on these previous studies on knowledge transfer, in this study, we revealed how Toyota has been advancing localization of supply chain in the ASEAN region, especially in Thailand. In particular, we clarified that Toyota has been providing technical support to their suppliers by establishing a new specialized department called the "LDD". Developing suppliers is necessary in developing countries such as ASEAN countries where industrial competitiveness is still not well developed. However, most of the previous studies have not shed light on the topic of how Japanese automobile companies have been building their supply chain in developing countries. This study is significant because we examined how Japanese automobile company Toyota recognized the situations in developing countries and built their supply chain including corporate group "KEIRETSU" outside Japan. However, when we consider the process to build a supply chain, more elaborate examination is necessary to reveal "why Toyota supports suppliers and others to focus on technical support".

This subject has not been discussed enough because the corporate group "KEIRETSU" is not conceptualized, especially in the Japanese automobile industry. Based on the findings we examined, we should conceptualize corporate group "KEIRETSU" and how "KEIRETSU" was built and worked well in Japanese automobile companies for our future study.

References

Dyer JH, Nobeoka K (2000) Creating and managing a high-performance knowledge-sharing network: the Toyota case. Strateg Manag J 21(3):345–367

Fourin (2015) ASEAN Jidosha sangyo 2015 (ASEAN Automobile Industry 2015) (in Japanese)

Fujimoto T (1998) Supplier system no kozo, kino, hassei (Structure, function, and occurrence of supplier system). In: Fujimoto T, Nishiguchi T, Itoh H (eds) Readings supplier system, Chap 2. Yuhikaku, Tokyo, pp 41–70 (in Japanese)

IRC (2015) Thailand and Indonesia jidosha sangyo no jittai 2015 (The reality of automobile industries of Thailand and Indonesia in 2015) (in Japanese)

Itami H (1988) Mierute niyoru kyoso: buhinkyokyu taisei no kouritsusei (Competition by the invisible hand: the efficiency of the parts supply system). In: Itami H, Kobayashi T, Itoh M, Kagono T, Sakakibara K (eds) Kyoso to kakushin (Competition and innovation), Chap. 6. Toyo Keizai Shinposha, Tokyo, pp 144–172 (in Japanese)

JETRO (2004) JETRO boeki toshi hakusho (JETRO white paper on international trade and foreign direct investment) (in Japanese)

Kawabe N (2011) Thai Toyota no keieishi: Kaigai kogaisha no jiritsu to tojokoku sangyo no jiritsu (Business history of Toyota Motor Thailand: the independence of foreign subsidiaries and the independence of the industries of developing countries). Yuhikaku, Tokyo (in Japanese)

Liker JK (2004) The Toyota Way. McGraw-Hill

Ogawa K (2015) Open and close senryaku: nihonkigyo saiko no joken (Open and close strategy: requirements for revival of Japanese companies). Shoeisha, Tokyo (in Japanese)

Sako M (2004) Supplier development at Honda, Nissan and Toyota: comparative case studies of organizational capability enhancement. Ind Corp Change 13(2):281–308

Tanaka T, Hoshino M (2015) Indonesia Toyota no keieishi: Karoseri tanki seihinkaihatsu cycle ni taiousita seihin hanbai sesaku (Business history of Toyota in Indonesia: the product and sales strategy of the short-term development cycle of Karoseri). Tokyo Kei Daigaku Kaishi (J Tokyo Keizai Univ Bus) 288:57–76 (in Japanese)

Chapter 5
Supplier Development of Japanese Automotive Parts Suppliers—Purchasing Strategy of Denso in ASEAN

Abstract The purpose of this study is to examine the supplier development (SD) of Japanese automobile suppliers in ASEAN. The globalization of automobile supply chain is progressing rapidly in recent years. With this globalization of the supply chain, it becomes necessary for Japanese automobile manufacturers to implement SD overseas. This applies not only to the relationship between automobile manufacturers and tier-1 suppliers but also to the relationship between tier-1 suppliers and tier-2 suppliers. However, it is difficult to execute SD effectively for tier-2 suppliers who are small and medium-sized companies. We indicated that the Japanese supplier Denso is strengthening its SD by combining SD by headquarters and SD by local initiative. While tier-1 suppliers tend to enforce SD unilaterally on tier-2 suppliers from start to finish, it is preferable for tier-1 suppliers to encourage the voluntary efforts of tier-2 suppliers and to execute SD sustainably.

Keywords Global supply chain · Supplier development (SD) · SD by headquarters · SD by local initiative

5.1 Introduction

The purpose of this study is to examine the Supplier Development (SD) of Japanese automobile parts manufacturers (suppliers) in the ASEAN region. Globalization is expanding for automobile industry supply chains. In order for automobile companies to supply products in a timely and efficient manner while maintaining the balance between supply and demand on a global scale, they need to establish a competitive supply chain. However, this is by no means an easy task. To achieve this, the following three methods (Wagner 2006) can be suggested as a way to develop competitiveness by solving various problems inherent in the supply chain. The first is to switching of the suppliers. We can replace less competitive suppliers with more competitive ones. The second is vertical integration where a company

Work by Yoshitaka Shimono and Atsumi Kato.

M. Itoh et al., *Automobile Industry Supply Chain in Thailand*,
Kobe University Social Science Research Series,
https://doi.org/10.1007/978-981-13-2360-7_5

can make the auto parts in-house that were previously outsourced to suppliers. The third is for the company to strengthen its own supply chain through SD by improving the suppliers' performance and strengthening the suppliers' capability. In particular, Japanese companies have been improving their competitiveness of supply chain through the active implementation of SD (Sako 2004). In recent years, not only Japanese companies but also companies across the globe have started to recognize the importance of SD and are actively engaged in this measure (Wagner 2006; Khan and Nicholson 2014).

As the globalization of supply chains expands further, it is becoming increasingly necessary for companies that purchase products and auto parts to implement SD overseas. However, the overseas expansion of SD has not been discussed enough. Furthermore, since most of the previous SD studies focused on issues between automobile companies and tier-1 suppliers, few studies focused on SD between tier-1 suppliers and tier-2 suppliers. Since most of the tier-1 suppliers that directly supply auto parts to automobile companies are well-established, they are equipped with management resources to proceed with overseas expansion. However, such is not the case for the tier-2 suppliers that supply auto parts to tier-1 suppliers. They cannot expand the global operations in many countries because they do not have enough management resources. Accordingly, the tier-1 suppliers need to plan and execute the SD of tier-2 suppliers in a more careful and elaborate manner.

In this chapter, we will examine a type of SD deemed effective in the ASEAN region by focusing on Denso Corporation (hereinafter "Denso"), which is a major Japanese tier-1 supplier. Denso has been expanding globally from an early stage, especially in the ASEAN region, and Denso is one of the leading companies that have been implementing SD in a most advanced way. To be specific, as shown in Table 5.1, we conducted interviews with representatives such as the executives of the purchasing group of the headquarters in Japan, the procurement representatives of the regional headquarter in the ASEAN region, and the procurement representatives of the manufacturing subsidiary in Thailand. Each interview took roughly between 1.5 and 2 h (see Table 5.1).

Table 5.1 List of interviews

Interview day	Place	Interview
January 2013	Thailand	The manufacturing subsidiary
March 2015	Thailand	The manufacturing subsidiary
April 2015	Japan	Purchasing Group
September 2015	Thailand	The manufacturing subsidiary The regional headquarters for Asia and Oceania
June 2016	Japan	Purchasing Group
September 2016	Thailand	The manufacturing subsidiary The regional headquarters for Asia and Oceania

5.2 Review of Previous Studies

5.2.1 Categorization of SD Studies

Studies into SD became popular in the 90s, as many researchers started conducting studies from a variety of perspectives (Wagner 2006). Since different studies were done from different perspectives, the definition of SD differs greatly depending on the researchers. For example, some define SD as "corporate activities to improve the capability of suppliers" (Sako 2004), while others define it as the "process to improve the performance of suppliers" (Park et al. 2010).

Ahmed and Hendry (2012) categorize SD study into the following five types: (1) SD activities, success factors, barriers, and pitfalls, (2) Direct SD and indirect SD, (3) SD as reactive or strategic process, (4) SD in lean six sigma, and (5) SD from the supplier perspective. The majority of the studies focused on type categorization of SD, as well as the success factors and hindrance factors of SD. The second most common studies on SD are the ones that focused on the process of SD. Studies that focused on SD type categories and success factors/hindrance factors are static, while studies that focused on the process of SD are more dynamic. Hartley and Jones (1997) defined SD as "working together with suppliers to improve their performance and capability." The SD entailed two purposes: (1) Solving a problem by adding an immediate change to the operation of suppliers. (2) Improving a type of capability that will enable suppliers to carry out improvements on their own. Hartley and Jones (1997) referred to the former as result-oriented SD, and the latter as process-oriented SD. They suggested that process-oriented SD has a greater effect in the long run.

5.2.2 SD Process

Khan and Nicholson (2014) divided SD process into the following three steps and addressed the key operational problems during each step—(1) Qualify stage, (2) Evaluation stage, and (3) Interactive stage. Meanwhile, Sillanpää et al. (2015) divided the SD process into four categories—(1) Supplier assessments, (2) Competitive pressure, (3) Supplier incentives, and (4) Direct involvement. While SD process is understood in a variety of ways depending on the study, many studies tend to focus on a process that entails the evaluation of the qualified suppliers who passed the search/selection stage and the subsequent improvement in problems of such suppliers.

Some studies focused on how various SD processes tend to coexist with one another. Sako (2004) clarified the SD characteristics of Japanese automobile companies (Honda, Nissan, and Toyota) by recognizing such SD as an attempt to transfer (reproduce) the capability within their own organization to their suppliers beyond the corporate boundaries. Specifically, Sako (2004) categorized SD based

on two aspects, the first being the three organizational capability types referred to as "maintenance capability," "improvement capability" and "evolutionary capability," and the second being the application range of SD such as the entire corporation that includes specific production lines, an entire plant, and the management outside of the plant. These three automobile companies have been implementing SD to solve medium-term and long-term problems throughout the entire plant and corporation, instead of just dealing with immediate problems on production lines. It became clear that a fine balance is maintained between voluntary learning by suppliers and semi-compulsory support by automobile companies, while a variety of knowledge is transferred to suppliers by combining multiple SD activities.

5.2.3 *Global Expansion of SD*

Sako (2004) discussed how difficult it is for these three Japanese companies to carry out SD activities at overseas sites. The reason behind is that there are differences in each country's historical background and knowledge, such as tacit knowledge, that is difficult to transfer. For example, Sako (2004) pointed out the following problems in transferring knowledge to suppliers in Europe/U.S. from Japan: (1) European automobile companies and Japanese automobile companies have different styles of corporate governance and (2) the suppliers in Europe and the U.S. do not trust automobile companies.

Dyer and Nobeoka (2000) discussed how Toyota reproduced the supplier network in the U.S. that had been constructed in Japan. This study clarified Toyota's implementation in stages as follows: (1) weak ties between Toyota and suppliers (Supplier association, general meetings), (2) strong ties between Toyota and suppliers (consulting/problem solving teams), and (3) strong ties among suppliers (voluntary learning teams/*Jishuken*). In other words, as Toyota's supplier network started progressing, so did its spread of SD in the U.S.

As for emerging countries, Khan and Nicholson (2014) examined the SD relationship between Japanese automobile companies and Pakistani suppliers. Even for emerging countries, the interplay between automobile companies and suppliers must also be strengthened in stages. They suggested that the suppliers' lack of absorptive capacity during the initial stage of the SD process leads to an especially dire restriction for emerging countries.[1]

[1]Absorptive capacity is a concept developed by Cohen and Levinthal (1990) which means a firm's ability to recognize the value of new information, assimilate it, and apply it to commercial ends.

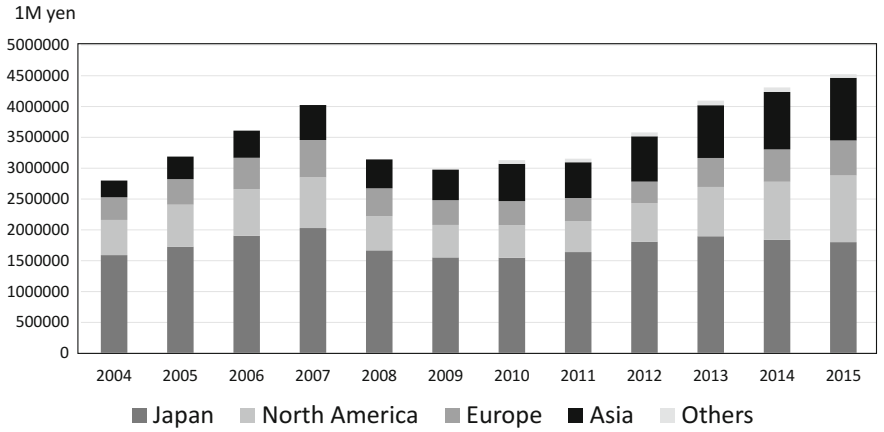

Fig. 5.1 The change of Sales by Region of Denso. *Source* Prepared by the author on the basis of Denso's annual reports

5.3 Business Expansion in the ASEAN Region

5.3.1 Progress of Denso's Overseas Expansion

Denso is a supplier affiliated with the Toyota group. Denso is a global supplier with consolidated sales in fiscal 2015 showing 4.52 trillion yen ranked first in Japan, and ranked second in global markets to the German supplier, Robert Bosch GmbH. Figure 5.1 shows the transition of sales by region at Denso. Its sales by region ratio shows 39.3% for Japan, 22.4% for Asia and Oceania, 23.9% for the U.S., 12.6% for Europe, and 1.5% for others. In recent years, its sales ratio went down for Japan and increased for Asia and Oceania and the U.S.[2]

Denso's overseas expansion began in the Asia/Australia region. In 1972, Denso established Denso Thailand (hereinafter "DNTH"). During that period, foreign-affiliated companies were not allowed to enter the Thai market without establishing a joint venture with local capital. Therefore, Denso formed an alliance with a partner of Mitsubishi Company (Thailand) Ltd. (Tsuda 2007). Currently, Denso's investment ratio toward DNTH is at 51.3%. Toyota had established a plant in Thailand in 1962 and had been advancing the local production of automobiles. Initially, Toyota procured auto parts from Japan and would only carry out knockdown production that entailed assembling work at their Thai factory. However, in order to comply with the industrial policy of Thai government that promoted domestic production of automobiles, Japanese automobile companies started expanding their local production and asked suppliers to do the same. Denso also started local poduction in Thailand in line with their request (Tsuda 2007).

[2]Although Denso's sales figure in South America was included under "North America" up to 2009, it is categorized under "others" from 2010.

5.3.2 Progress of Local Production in ASEAN

From the 70s to the middle of the 90s, ASEAN countries were controlled by the domestic regulations of automobiles production. Because of such regulations, automobile companies had to raise their local procurement rate and Denso also established plants in various countries in ASEAN. Spearheaded by the establishment of DNTH in Thailand in 1972, Denso established production companies in Indonesia in 1975, Malaysia in 1980, and Australia in 1989. Each production company produced various items such as thermal components and electrical appliances.

AFTA (ASEAN Free Trade Agreement) was signed in 1993. With the progress of free trade, the ways in which production and procurement were carried out started changing as well.[3] Out of the product lineup produced by Denso, thermal components such as HVAC came in large volumes with enormous distribution costs. Consequently, they had to produce these products near the plants of the automobile companies. Under the circumstances, Denso also had to establish plants in various countries in ASEAN. However, small sized advanced products such as starters and alternators did not need to be produced near the plants of automobile companies. Rather, they narrowed the range of products produced in each ASEAN country and adopted the policy for supplying products produced intensively in each country to the entire ASEAN region, and strived to establish a so-called "ASEAN Complementation". Specifically, they determined which products would be produced intensively at which plant by 1994, such as deciding to produce starters and alternators in Thailand, car air conditioner compressors and spark plugs in Indonesia, and electric appliances in Malaysia. In 1995, they established a production plant of meters in the Philippines, from which they had withdrawn temporarily. In 2001, they established a mutually complementary production system by producing starters and alternators intensively in Thailand in order to eliminate the overlap between Thailand, Malaysia, and Indonesia, and transferred the production of spark plugs and horns from Thailand to an existing plant for such auto parts in Indonesia. Furthermore, in 2001, they began to produce engine function parts in Vietnam (Tsuda 2007).

5.3.3 Construction of Economic Cooperative Framework in ASEAN

In order to realize the ASEAN Complementation, it was essential to drastically reduce import duties and to facilitate the import/export within the ASEAN region. From the late 80s, a scheme called BBC (Brand-to-Brand Complementation) was

[3]Based on No. 181 of "Japanese Automobile Survey Monthly Report (FOURIN)".

constructed which reduced or exempted import duty on auto parts that were procured from three countries within the ASEAN region upon assembling the same car in these three countries (Tsuda 2007). However, since the BBC scheme was only authorized for automobile companies, Denso had to take different measures by taking advantage of AICO (ASEAN Industrial Cooperation Scheme). In 1996, AICO was established by ASEAN countries. From the beginning of 1997, Denso also started its negotiations to benefit from AICO in four countries (Thailand, Indonesia, Philippines, and Malaysia). Although the progress of the negotiations had been stalled, they were able to advance the negotiations due to the Asian economic crisis which occurred during the negotiation period. In November 1998, Denso received AICO certification in two countries (Thailand and Philippines), the first ever Japanese corporation to do so. Afterward, Denso expanded its certification from two countries to four countries and also expanded its product lines covered under such certification. As a result, they were able to reduce the import duties within the ASEAN region to between 0 and 5% (Tsuda 2007).

The trend for free trade accelerated in the 2000s. In 2000, domestic regulation for production was abolished following a decision by the WTO (World Trade Organization). In 2002, four main ASEAN countries implemented AFTA and dramatically reduced import duties with the exception of certain products. Amid the trend for free trade, automobile companies and suppliers started to change their strategies from just operating within ASEAN region to exporting outside it. Toyota's IMV project mentioned later is a typical example of such moves. In 2010, tariffs among the leading six ASEAN countries became virtually zero (Tsuda 2007).

In recent years, Denso has been trying to change its production structure in ASEAN especially for electrical appliances. In the past, they implemented a so-called "ASEAN Complementation" where they would intensively produce certain products in each country and would supply these products to other countries as necessary, such as producing starters and alternators in Thailand, small-size motors in Indonesia, electronic parts in Malaysia, and meters in the Philippines. However, the production base is decentralized due to the expansion of the production scale of automobile companies. Starting from 2015, they began to produce the starters and alternators in Indonesia and Malaysia. Accordingly, it is becoming more necessary to strengthen SD and restructure the supply chains by transitioning from centralized production to decentralized production in each ASEAN country.

5.4 Localization of Parts Procurement in Thailand

5.4.1 Procurement Function in Thailand

There are three plants under DNTH in Thailand. Thermal components such as HVAC and air conditioner units are produced at the Samrong plant, established in 1972. In 1995, they established the Bangpakong plant and products such as

alternators, starters, ESS (electric equipment), and ECC (magneto, two-wheel generators) are produced at this plant. The products of its subsidiary ASMO (wiper-related products and washer-related products) are also produced at this plant. In 2004, they established the Wellgrow plant to expand the production of thermal components. The purchasing division under DNTH is located in two places (one in the Samrong plant and the other in the Bangpakong plant), and this division is in charge of the selection of suppliers, price negotiations, production preparation, etc.

In 2015, the local procurement rate of auto parts in Thailand by DNTH reached roughly 80% including in-house production. That said, it took them many years to realize this high level of local procurement. In 1997, Toyota and Honda started selling Asia exclusive cars (Asia Cars) in Thailand, which became mega-hit products. However, the domestic production rate during that period was only around 20–30% even for Denso who had expanded to Thailand way back in 1972. Since one-tenth of those figures was accounted for by assembly done locally, the actual domestic production rate was even lower (Tsuda 2007).

Toyota's IMV (Innovative International Multipurpose Vehicle) project that began production in 2004 was the triggering factor that drastically increased the local procurement rate of the Denso Group (including DNTH) in Thailand. IMV refers to a project that produces pick-up trucks (three vehicle types), minivans, and SUVs through a common platform by engaging in international division of labor (only outside Japan) for cars exclusive to the overseas market.[4] Although Toyota carries out R&D in Japan, the Denso Group in Thailand also made a transition to procure auto parts locally instead of importing them from Japan, since Toyota manufactures such vehicles in Thailand, Indonesia, South Africa, and Argentina.

In 2007, a company Denso International Asia Co., Ltd that oversees the entire ASEAN region (including Thailand) was established. DIAT has a division for procurement throughout ASEAN. Instead of just managing the operations for procurement throughout ASEAN, this division is also in charge of purchasing materials which are used commonly throughout ASEAN countries.

5.4.2 *Expansion of Manufacturing Partners to Thailand*

There are roughly 250 suppliers for the whole of DNTH as of 2015. There are roughly 180 companies that supply auto parts (excluding indirect supply) to DNTH. Roughly, 80% of the auto parts are purchased from Japanese suppliers in Thailand in *value terms*. The remaining 20% or so are procured mostly from local suppliers

[4]Based on the official website of Toyota Motor.

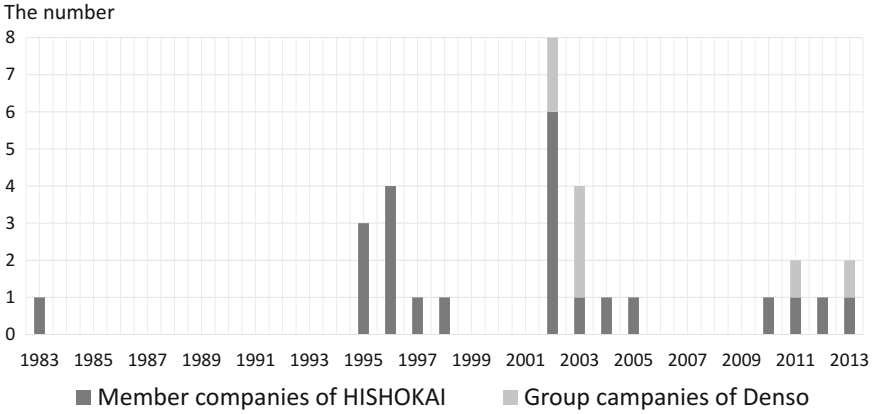

Fig. 5.2 The number of companies which have advanced to Thailand. *Source* Prepared by the author on the basis of IRC (2013)

in Thailand, but a certain portion is procured from Indian and Taiwanese suppliers in Thailand.

DNTH has increased the ratio of Japanese suppliers in stages. In the case of processed parts, Denso in Japan organized its supplier association called "Hishokai".[5] Through Hishokai, Denso carries out studies and training for manufacturing and safety with members of Hishokai for the purpose of voluntary learning between members. Companies that belong to Hishokai and Denso group companies have been expanding into Thailand in stages[6] (Fig. 5.2). While just a single company made its foray into Thailand as early as in 1983, many suppliers set up operations in Thailand to coincide with Toyota's project.

By the middle of the 90s when the production of Asia cars began, 9 Hishokai companies started operations in Thailand. Around 2004 when the production of IMV started, a total of 14 companies started their business in Thailand (nine Hishokai companies and five group companies). In the 2010s, a total of six companies have expanded into Thailand (four Hishokai companies and two group companies). Their expansion can be attributed to the second-generation IMV project which started its production in 2015. As shown above, 23 Hishokai companies

[5]In 1959, Denso established a supplier association called "Denso Cooperative Organization" to achieve co-existence and co-prosperity between Denso and suppliers, and they changed the name to "Hishokai" in 2000 (Based on DENSO CSR Report 2009).

[6]Fig. 5.2 covers 71 companies (members of first subcommittee) of Hishokai companies listed on "Field study of Denso Group, 2013 edition" (IRC). Out of 71 companies, it indicates when 30 of them expanded to Thailand. Please note that these 30 companies may have expanded to Thailand for reasons other than supplying auto parts to Denso.

and 7 group companies have expanded into Thailand. Unlike in Japan, supplier association like Hishokai is not advancing in Thailand.

5.4.3 *"Thai Pure" Activity and in-Depth Localization*

The start of Toyota's first-generation IMV production in 2004 gave Denso the momentum to accelerate its local procurement. However, this kind of local procurement remained at an insufficient level. Denso group (including DNTH) in Thailand implemented the following two activities to promote the localization of procurement. The first was called "Thai Pure" activity. Indeed, the local procurement of auto parts increased through the production of first-generation IMV. However, many of these suppliers were Japanese suppliers with ongoing dealings. Although Japanese suppliers came with high-reliability with regard to product quality, for example, there were many issues in terms of cost competitiveness. Because Thailand's automobile market was sluggish due to the worldwide recession stemming from the Lehman shock in 2008 and the 2011 floods in Thailand, automobile companies, and suppliers had to improve their cost competitiveness to expand their sales. To coincide with the model change of Toyota's compact car EFC (Entry Family Car) exclusive to emerging countries, DNTH started switching over the main suppliers of auto parts for EFC from Japanese suppliers to local suppliers in Thailand from around 2011.[7]

The second activity was the in-depth localization. Previously, the suppliers for DNTH (the Japanese suppliers in particular) used Japanese technologies, molds, materials, and machine tools in many cases. Their localization of procurement just meant that they localized the machine work. The costs were still high under this kind of superficial local procurement. The Denso group (including DNTH) refers to local procurement that includes local materials, local machine tools, local molds, etc., as in-depth localization. The Denso group requires not just itself but also its suppliers to engage in in-depth localization (Shintaku and Ohki 2012). For example, the local procurement of aluminum can be cited as Denso's own in-depth localization. Prior to this move, aluminum was imported from Japan to Thailand. Starting from 2014, a Japanese supplier established a plant in Thailand and started partial production of aluminum parts locally. Furthermore, they started localizing the more upstream processes of melting and *rolling* in Thailand in 2015.

If they see that a supplier's cost competitiveness is low, they would encourage the supplier to engage in the in-depth localization by proposing ideas such as identifying the points that are inferior to competitors and figuring out improvement measures. Since Denso determines product specifications in many cases, Denso would provide support in evaluating the suppliers (tier-3 suppliers) of the supplier (tier-2 supplier), and Denso would assist them in finding alternative tier-3 suppliers and switching to more competitive tier-3 suppliers.

[7]Based on Toyota Motors' news release (3/25/2013).

5.5 Supplier Development (SD) of Denso

5.5.1 Restructuring the Purchasing Group in Japan

In 1999, Denso restructured its organization by dividing it into different business units, with the aim of speeding up the decision making of each business unit. Specifically, it was divided into the following four autonomous units[8]: (1) Powertrain systems business group, (2) Electronic systems business group, (3) Electronics devices business group, and (4) Thermal systems business group.

They set up a procurement division within each business group and strived to realize a close cooperation with other divisions such as R&D and production. They also set up a procurement group at the corporate center in charge of the company's entire operations. This section was in charge of the purchasing planning for the entire Denso organization, procurement from overseas supplier, management of quality/technology, and procurement of materials/machine tools.

In 2009, the purchasing divisions were separated from each business group and were integrated into the purchasing group. The purchasing planning department of the purchasing division within the corporate center became an independent purchasing planning division, and the material purchasing department became an independent material purchasing division. The electronics devices purchasing division under the electronics devices business group was renamed as the purchasing division 1 without undergoing any changes. Purchasing division of special parts that belonged to each business group that handles assembling parts, bearings, carbon, magnets, etc., were integrated into the purchasing division 3. In 2010, processed parts such as cutting parts, plastic mold parts and press parts were switched from purchasing by business group to purchasing by a functional organization. Since they became integrated into the purchasing division 2, the operations for purchasing completely shifted from purchasing by business unit to a functional organization for procurement.

In addition to the unification of contact points with suppliers and the common usage of competitive suppliers by each business group, we can also point out the strengthening of the support for suppliers as being the factors behind their transition from purchasing by business unit to purchasing by a functional organization. Business groups in the past also provided various kinds of support for closely-related suppliers. However, they only provided limited support such as building production lines for new products. In order to give support for improving the organizational capability of suppliers and help suppliers obtain new methods and technologies instead of just making manufacturing process more efficient, the

[8]In 2006, they set up the information safety business group as its fifth business group. This business group handles items such as car navigation, radar cruise control, and meters. There are currently four business units since the electrical devices business unit was incorporated into the powertrain systems business group and the information safety business group in 2011 (Based on the official website of DENSO).

support by each business group was not enough. Accordingly, they built the organization where the purchasing group provides support to suppliers with the cooperation of the Production Innovation Center. Furthermore, activities such as consultation and support for the suppliers upon their overseas expansion became possible after the functional organization for purchasing was established.

5.5.2 Roles of the Purchasing Engineering Department

By shifting from purchasing by each business unit to purchasing by a functional organization, it became possible to decide the purchasing strategy depending on the characteristics of the auto parts procured. For example, suppliers for electronic parts, specialized parts, and materials are mainly comprised of major global suppliers, and Denso decided to make the purchasing group in Japan manage these global suppliers and purchase these parts and materials intensively (only in Japan). On the other hand, the suppliers of processed parts that are handled by the purchasing division 2 are largely comprised of small and medium-sized local suppliers. In Japan, companies that belong to the previously mentioned Hishokai serve as the main suppliers. Although purchasing group in Japan makes its decision of purchasing strategy on a global scale regarding processed parts, some auto parts are actually procured by individual plants around the world, while other auto parts are procured at a regional level in Europe and ASEAN. Upon the establishment of the purchasing group in 2009, a *supplier support office* was established by integrating the supplier support functions that were set in the different business units. In 2012, the *supplier support office* was renamed the purchasing engineering department. The purchasing engineering department, which was set up as an organization directly under the purchasing group, is an organization that strives to reduce costs, improve quality, and manufacturing processes by providing support to the suppliers on TIE (Total Industrial Engineering) and production technology. There are roughly 70 staff members working at the purchasing engineering department. Many of them are veterans who gained experience at production department rather than at purchasing department.

The purchasing engineering department has the following two roles. First is the activity support through Hishokai. Training on manufacturing, quality, and safety is organized through Hishokai, which serves as the supplier association (*Kyoryokukai* in Japanese) for coexistence and co-prosperity (*Kyoson Kyoei* in Japanese) with Denso. Specifically, they are engaged in voluntary study groups (*Jishukenkyu-kai or jishuken*) activities, such as study groups for manufacturing and quality study. The study for manufacturing is held once every six months. In the Hishokai (a supplier association), those that want to participate would form groups comprised of about seven companies each, and they would implement improvement activities on themes related to manufacturing at six different sites. On the other hand, the study group for quality deals with activities aimed at reducing defects in the manufacturing processes by focusing on quality problems, and at reducing manufacturing

Table 5.2 Denso's Constitution Assessment Program for Suppliers (CAPS)

Evaluation items	Assessment criteria
Quality (Q)	• Attitude toward implementation • Quality system • Documents and records management • Supplier management • Process management • Nonconformance Management • Continuous improvement • Defective delivery
Cost (C)	• Attitude toward implementation • Cost management • Cost improvement • Technological development • Cooperation for cost reduction • Achievement of pushing VA/VE
Delivery (D)	• Attitude toward implementation • Production management • Continuous improvement • Delivery performance
Safety Environment (S)	• Attitude toward implementation • Environment management • Safety and fire management • Acquiring ISO 14001 or eco-stage
Management (M)	• Attitude toward implementation • Business management • Management improvement • Financial situation • Advance into oversea markets

Source Prepared by the author on the basis of Denso CSR Report 2004

processes that generate bottleneck of quality problems. Thus, the purchasing engineering department has created an environment for suppliers to train themselves as the voluntary study groups (*Jishuken*). Second is the activity that supports the self-evaluation of suppliers. Specifically, Denso introduced an evaluation method called CAPS efforts.[9] Denso provides an evaluation standard as described in Table 5.2 so where suppliers can strengthen their organizational capability through their own that Denso's main suppliers can strengthen their organizational capability.

Specifically, each supplier will conduct its own evaluation on such items as quality, cost, delivery, safety/environment, and management (QCDSM), and Denso collects the results and provides feedback to the supplier. It is an initiative to make suppliers improve their own problems based on this result. Although CAPS was utilized by a large number of Hishokai companies, it became difficult for companies to identify where problems lie within them, since most of the companies eventually started receiving a high rating through CAPS. Currently, they are using CAPS + α that expanded the evaluation criteria to include the management of CAPS (M).

5.5.3 Transfer of SD from Japan to Thailand

During the time when DNTH was involved in the production preparation of the first-generation IMV in the early 2000s, Japanese advisors would fly out to Thailand and would provide support for local suppliers for a few months. After

[9]CAPS is an abbreviation of Constitution Assessment Program for Suppliers (Based on DENSO CSR Report 2007).

completing the support for suppliers such as handling of production preparation of new products and quality issues of products, they would head back to Japan. Furthermore, it was common for local supplier employees who received support to leave the company due to voluntary. As a result, improvement on supplier sites remained temporary throughout the entire process.[10]

In preparation for Toyota's model change of IMV in 2015, Denso strengthened its support for suppliers in Thailand from 2013. In July 2013, one of the staff members that belonged to the purchasing engineering department of the purchasing group in Japan was dispatched to DNTH for the following two purposes. The first was to implement improvement activity with regard to suppliers of DNTH who had problems on quality (Q) and delivery (D). The second was to train local staff members of DNTH so that these locals can provide appropriate support for local suppliers without the presence of the Japanese personnel. Denso aims to create successful examples of local suppliers support and local staff education in Thailand where many Japanese suppliers have a presence, so that they can apply this to the entire ASEAN region and other regions (horizontal expansion).

In 2013, they separated DNTH suppliers into thermal parts suppliers and electric parts suppliers, selected roughly five companies that had problems with quality (Q) and delivery (D) in each group, and they gave support to improve the factories of roughly 10 suppliers under the leadership of the Japanese staff members who had been transferred to DNTH as resident employees for a few years. Specifically, they strengthened the inspection at the suppliers' shipment stage to prevent the outflow of defective products from the suppliers' plants. From 2014 on, they have been performing the same support for improvement every year by selecting suppliers who have problems on quality (Q) and delivery (D). The suppliers who are subject to the improvement measures range from those who have been selected every year previously to newly selected ones. However, as improvement continues, the serious problems held by suppliers have been reduced. For example, at the start, they concentrated on implementing improvements to avoid any outflow of defective products, but the focus gradually shifted toward avoiding manufacturing defective products during the manufacturing process.

Furthermore, some of the suppliers who received support from DNTH have requested that DNTH introduce CAPS and CAPS + α to them after the quality (Q) and delivery (D) problems have been solved. After DNTH completes its support activity toward a supplier, the supplier needs to continue to engage in the

[10]SD activity in Thailand was initially conducted by Siam Denso Manufacturing (SDM), prior to DNTH. SDM, which was established in 2002, manufactures fuel injection system (common rail systems). Since auto parts in this product require a high level of technology, Denso procured these auto parts only from the suppliers who possessed that high level of technology, even in Japan. They constructed a Supplier Park near a plant of SDM and supported the plants of Japanese suppliers. SDM who has powertrain business was engaged in SD of local suppliers by introducing CAPS etc. before the purchasing group was established in Japan, though the focus of SD by SDM was on Japanese suppliers in Thailand.

improvement activity voluntarily. As a tool to help such efforts, CAPS and CAPS + α are utilized in the same way as in Japan. This kind of self-evaluation tool not only encourages suppliers to engage in improvement activities on their own but also contributes greatly to the training of DNTHs local staff. This is because they can identify the points and the extent of the improvements that need to be made by suppliers using specific evaluation tools.

5.6 Discussion

5.6.1 Summary of the Findings

This chapter provides an overview of Denso's SD in the ASEAN region by focusing on Thailand. Denso has been manufacturing the products intensively (in one country) or extensively (in many countries), depending on the characteristics of the products. With electrical appliances, Denso had been carrying out production strategy whereby they would limit the range of products that were produced in each ASEAN country, and would supply such products to the entire ASEAN region (also known as ASEAN Complementation). However, in recent years, they have gradually been making a transition toward producing a wider range of electrical appliances in each ASEAN country, like with thermal components. In the wake of the change in the local production policy, they have also been changing the way auto parts are procured. Although auto parts were mainly imported from Japan at the start of the expansion into ASEAN, they gradually increased local procurement. Particularly, many Japanese suppliers took the production of the first-generation IMV as an opportunity to expand into Thailand. Subsequently, these suppliers have been advancing genuine localization (with local materials, local dies and molds, and local machine tools) and not just superficial localization (with Japanese materials, Japanese dies and molds, and Japanese machine tools) through the Thai Pure activity and in-depth localization.

By advancing the localization of procurement, they also started focusing on SD. Although the previous SD was limited to the activities within each business unit, SD was implemented throughout the whole of Denso by building the purchasing group in Japan. In terms of SD overseas, Japanese staff would provide support for a limited period on such occasions as the construction of a production line for new products and a sudden discovery of defective products after the start of mass production. However, once advisors returned to Japan, it was difficult for the suppliers and local staff to carry out sustainable improvement activities on their own. Denso took the opportunity of Toyota's IMV model change to advance SD in Thailand by implementing measures such as having Japanese advisers reside in Thailand and programs that allow sustainable improvement activities.

5.6.2 *Denso's Purchasing Strategy: SD by HQ (Headquarters) and SD by Local Initiative*

Through Denso's SD activity in Thailand, we can reveal their strategy, "purchasing strategy (while developing suppliers)". Before Denso decided to strengthen SD overseas, they first improved the SD in Japan. They implemented SD because in order to improve the performance of a Japanese supplier's Thai subsidiaries, the supplier's headquarters in Japan first needs to have the capability to solve problems and to make improvements. The suppliers are encouraged to carry out the process-oriented SD suggested by Hartley and Jones (1997) to improve their voluntary effort and to implement sustainable SD. Specifically, Denso was engaged in Hishokai's activities (*Jishuken*) from 2009 and strived to improve the suppliers' manufacturing process and capability to improve the quality of products. They constructed a process that can apply the improvement capability that they learned at the headquarters in Japan to overseas subsidiaries. In this chapter, we will call this SD through a supplier's parent company "SD by HQ (headquarters)." Although the activity itself is supported by Denso, this voluntary study groups (*Jishuken*) are unique in that in principle, it allows member companies of Hishokai to improve each other's capability through mutual effort. They aimed to improve the voluntariness of suppliers by first improving the capability of headquarters in Japan and by expanding it overseas. They did so because the suppliers' capability can only improve so much just by relying on support from Denso. Particularly, a supplier's overseas subsidiaries are largely dependent on the top management's visions. A supplier needs to construct a policy where the focus is on overseas SD as well, by developing human resources with a strong sense of improvement, and dispatching such talent as top management of overseas subsidiaries.

On the other hand, it is also important to strengthen the support from Denso's overseas subsidiaries for the suppliers' overseas subsidiaries. In the past, Denso's production division and production engineering division overseas have provided support for suppliers. However, the extent and period of such support have been limited. Furthermore, the advisers from Japan failed to provide adequate level of support for overseas suppliers. In 2013, the advisors of the purchasing engineering department in Japan were dispatched overseas for the first time. By having experts with years of experience at production sites reside in Thailand, they were able to enhance the support in improving the Japanese suppliers' overseas subsidiaries and local suppliers in Thailand. In this chapter, we will refer to SD where Thailand's Denso is directly supporting suppliers as "SD by local initiative." While Khan and Nicholson (2014) and Sillanpää et al. (2015) referred to the processes such as selection of suppliers, evaluation of suppliers and support for suppliers, we can point out the importance of providing follow-up for the suppliers of DNTH after supporting them. In the past, DNTH (with the help of Denso headquarters in Japan) has been providing support for constructing and improving the production lines upon the launch of new products, and for improving production sites by carrying out emergency measures by rushing to suppliers' work sites to address sudden

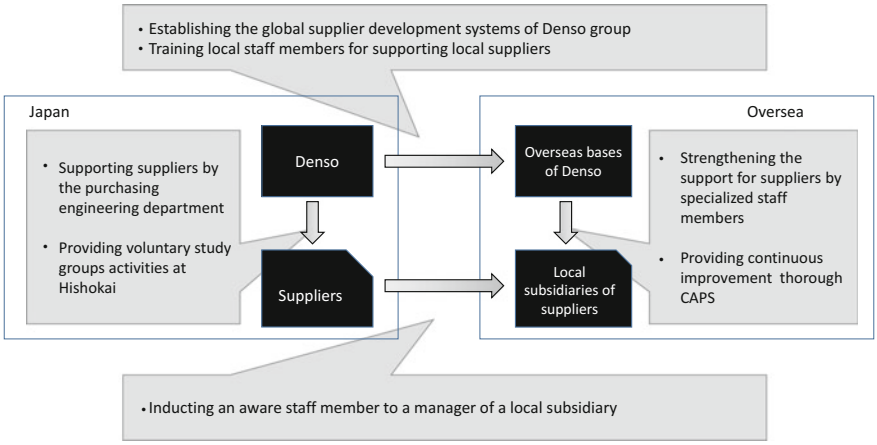

Fig. 5.3 Global collaboration between Denso and its suppliers

problems. However, once the improvement activity was completed and DNTH staff left the supplier work sites, it was common for such work sites of suppliers to go back to the former situation before the improvement was made. Because of this, DNTH strengthened its follow-up led by the expatriate Japanese advisers. Specifically, DNTH introduced self-evaluation methods called "CAPS and CAPS + α" to suppliers who requested such measures among the suppliers who completed the support for improvement provided by DNTH. These methods allow suppliers to make more accurate self-evaluations, as well as to contribute to the training of DNTHs local staff. Consequently, the follow-up after SD and evaluation feedback plays an important role for the SD by local initiative.

With DNTH at the core, Denso in Thailand is jointly using SD by HQ and SD by local initiative (Fig. 5.3). The effectiveness of such SD through multiple channels was also suggested by Sako (2004). Improvement through SD will never become permanent if forced upon suppliers. Rather, a supplier is expected to adopt the policy so that a supplier who receives SD will make a voluntary effort. Tier-2 suppliers who are small and medium-sized companies tend to receive the suggestions for improvement from beginning to end, but this kind of engagement will make it difficult to sustain improvements through SD. We believe that it is crucial for overseas tier-2 suppliers to combine SD by HQ and SD by local initiative with thorough follow-up and feedback after supporting suppliers.

5.7 Conclusion

In this chapter, we examined the SD of Japanese automobile suppliers in ASEAN. The globalization of automotive supply chains is progressing rapidly. With this globalization of the supply chains, the need for SD is also increasing overseas. This applies not only to the relationship between automobile companies and tier-1 suppliers but also to the relationship between tier-1 suppliers and tier-2 suppliers. However, it is difficult to execute SD effectively for tier-2 suppliers who are small and medium-sized companies. We learned that the Japanese supplier Denso is strengthening its SD by combining SD by HQ and SD by local initiative. While tier-1 suppliers tend to enforce SD unilaterally on tier-2 suppliers from start to finish, it is preferable for tier-1 suppliers to encourage the voluntary efforts of tier-2 suppliers and to execute SD sustainably. However, in reality, some suppliers may show an immediate effect, while others may not show any effect at all, even if they all receive SD from the same company. In the future, we need to conduct SD studies from the standpoint of suppliers who receive support to reveal the differences of effects between suppliers.

References

Ahmed M, Hendry L (2012) Supplier development literature review and key future research areas. Int J Technol Innov 2(4):293–303

Cohen D, Levinthal DA (1990) Absorptive capacity: a new perspective on learning and innovation. Adm Sci Q 35(1):128–152

Dyer JH, Nobeoka K (2000) Creating and managing a high-performance knowledge-sharing network: the Toyota case. Strat Manag J 21(3):345–367

FURIN (2014) Nihon jidosha chosa geppo (Japanese automobile survey montly report) (in Japanese)

Hartley J, Jones G (1997) Process oriented supplier development: building the capability for change. Int J Purchasing Mater Manag 33:24–29

IRC (2013) Denso group no jittai chosa 2013 (Field study of Denso group 2013 edition) (in Japanese)

Khan Z, Nicholson JD (2014) An investigation of cross-border supplier development process: problems and implications in an emerging economy. Int Bus Rev 23:1212–1222

Park J, Shin K, Chang T-W, Park J (2010) An integrative framework for supplier relationship management. Ind Manag Data Syst 110(4):495–515

Sako M (2004) Supplier development at Honda, Nissan and Toyota: comparative case studies of organizational capability enhancement. Ind Corp Change 13(2):281–308

Sillanpää I, Shahzad K, Sillanpää E (2015) Supplier development and buyer-supplier relationship strategies—a literature review. Int J Procurement Manag 8(1/2):227–250

Wagner SM (2006) Supplier development practices: an exploratory study. Eur J Mark 40:554–571

Shintaku J, Ohki K (2012) Nihonkigyo no kaigaiseisan wo sasaeru sangyozai yushutsu to shinso no genchika (Import of industrial goods and real local procurement in oversea production of Japanese companies). Hitotsubashi Bus Rev 2012:22–38 (in Japanese)

Tsuda K (2007) Sekaie: Denso no kaigai tenkai (To the world: the business expansion of Denso). Chubu Keizai Shimbunsha (in Japanese)

Chapter 6
Achieving Foreign Subsidiaries' Self-reliant Product Development in Host Countries Through Mold Localization—Case Study of Nissan in China and Thailand

Abstract This study analyzed how Nissan and its parts suppliers are linking their local product development and production in Thailand and China to achieve the localization of cars and molds. Since China is the world's largest car manufacturer and Thailand is the center of ASEAN car industry, we focused on China and Thailand as the target of our case study. By conducting the case study on the localization of car development in these countries that are experiencing the rapid expansion of car production, this research makes comparative analysis on the localization of product development related to molds and dies in host countries at an in-depth level.

Keywords Self-reliant product development · Quality of molds
Localization of product development · Technological level of mold design
Auto industry in China and Thailand

6.1 Introduction

In recent years, consumers' demands have become more and more diversified in global car market due to the rapid growth of developing countries' markets. In order to survive in this ever-diversifying global market, car manufacturers have been setting up R&D centers in host countries and advancing the localization strategy that can promptly enable themselves to enter host country markets by developing products suitable for local market's needs.

However, since most of these R&D centers only possess a function of modifying the designs of parts drawn in their home countries to cater to the local demands, global firms' subsidiaries in host countries most of which are developing countries have difficulties executing tasks such as shortening the product development lead

Work by Park Taehoon.

M. Itoh et al., *Automobile Industry Supply Chain in Thailand*,
Kobe University Social Science Research Series,
https://doi.org/10.1007/978-981-13-2360-7_6

time and developing new localized products that can meet host country's needs. To counter this problem, extant studies have argued that companies needed to take a bold step of transferring significant amount of technology and handing over decision-making authority to their product development centers in host countries (Nobel and Birkinshaw 1998; Hejazi and Safarian 1999; Feinberg and Gupta 2004).

However, the previous studies failed to examine the localization of product development through the collaboration between product development and mold technology in an in-depth way. Although car manufacturers drastically have transferred their technology to their overseas subsidiaries, in many cases, the locally self-reliant product development did not advance as they had planned in the host countries. To carry out locally self-reliant product development, car manufacturers need to produce prototypes and run the tests quickly in host countries. Since mold and die technology tends to play a key role in producing prototypes, the localization of supporting industry products such as molds and dies may potentially have a great impact on the localization of product development. Nowadays, most of the car manufacturers gradually realized that carrying out a drastic transfer of technology to the local R&D centers would not automatically achieve locally self-reliant product development if the mold and die technology that supports the prototype development did not reach a high level.

Nevertheless, preceding studies paid little attention to the collaboration between self-reliant product development and localization of molds and dies. In this study, we will examine the type of collaboration needed between localization of molds and dies and locally self-reliant product development to help advance localization of product development at a deeper level. To answer this question, this research will analyze the case that shows how Nissan and its suppliers link their product development and mold production in Thailand and China to achieve localization of them. We decided to cover China and Thailand as the subject of this study, since China is the world's largest car manufacturers and Thailand is the center of ASEAN car industry. By conducting the comparative study on localization of car development and production of these two countries that enjoy high growth rate of car production, we can make the comparative analysis on the localization of product development and production of molds at a deeper level.

6.2 Case Study

In this study, we will focus on car industry. The reasons are as follows. Since the production of cars requires numerous molds, car industry is the ideal subject in researching how closely localization of product development and molds are linked to each other. The relationship between the localization of product development and their molds differs significantly depending on an industry. For example, in many cases, the product development of pharmaceutical industry is more directly related to the usage of patents, and it has little to do with mold industry (Rothaermel and Boeker 2007). Therefore, we will look into Nissan and Calsonic Kansei as the

subject of this case study. This paper focuses on Nissan for the following reasons. First, Nissan has high local parts procurement rate due to its longstanding history of expansion in China and Thailand. Nissan's sales in Chinese market take up relatively large portion of its entire sales ratio. Second reason is that when it comes to the molds that accompany the introduction of new cars, Nissan is more aggressive in procuring molds at global basis (local procurement, etc.) compared to other Japanese car manufacturers. Another contributing factor is that Nissan is also proactive in localizing its product development, as evidenced by the fact that they have large-scale R&D centers in both China and Thailand.

Calsonic Kansei is a supplier that delivers instrument panels and radiators to Nissan who has a strong presence in China and Thailand. Since Calsonic Kansei established its development centers in China and Thailand, it is an ideal subject to compare the localization of parts development in these two countries. By internationally comparing a car manufacturer and its supplier to comprehend how they are advancing localization of car development through localization of molds in China and Thailand, we can build the insightful framework to explain the linkage between localization of product development and molds.

To compare the technological level of mold designs and mold quality in both countries, we will direct our attention to well-known mold manufacturers in China and Thailand as the case study subject. Since the tooling for mass production is broadly categorized into the mold for forming plastic parts and the die for pressing metals, we will divide the type of tooling manufacturers into two categories, one as "die manufacturer" and the other as "mold manufacturer" in order to conduct the case study of tooling manufacturers.

6.2.1 Case Study on China

6.2.1.1 Product Development of Nissan in Guangzhou

In the following section, we will examine how Nissan and Calsonic Kansei are advancing their localization of product development in China. In 2006, Nissan established Dongfeng Nissan R&D center in Guangzhou, Guangdong Province. In 2011, Nissan established Nissan Design Center China in Beijing as one of the global design bases following Japan, U.S., and UK. Dongfeng Nissan launched Venucia as its new original brand in China. The platform of this model was diverted from the model that was developed at Nissan's headquarters in Japan. Contrarily, designs of interiors were mainly conducted in China as the local original brand. The development center in China took charge of designing interior designs and seats, modifying specifications of air conditioners, suspensions, and steering wheels. Guangzhou development center is advancing the vehicle development by closely cooperating with Nissan R&D center located in Atsugi city, Japan (Iwata and Ken 2009).

To advance the localization of engineering works, Nissan dispatched 20 Chinese engineers in 2008 for roughly 5 months to the R&D center in Japan. They had

in-depth discussions during the R&D meetings, and Chinese engineers from Dongfeng Motor which was the counterpart of joint venture in China also attended these meetings (Iwata and Toki 2009). In 2002, Calsonic Kansei established their subsidiary in Guangzhou and start producing parts such as instrument panels, radiators, and exhaust manifolds. They are proactively advancing the localization of product development by establishing R&D centers "Calsonic Kansei (Shanghai)" and "Calsonic Kansei (Guangzhou)" with the scale of roughly 100 staff. These development centers are carrying out operations such as localization of product development in China, technology transfer, technology consultation, and technology research. Upon starting their mass production, Dongfeng Nissan's quality assurance supervisor inspected Guangzhou Calsonic Kansei's mass production line to secure the stabilization of product quality.

In 2005, Calsonic Kansei established "Calsonic Kansei (Guangzhou) Molding Co, Ltd." as their affiliate that can produce and repair molds. This firm established an R&D center in China. Furthermore, by 2012, the combined number of designers and engineers for mold affiliate and product development center increased to approximately 400 persons.

6.2.2 Procurement of Molds in China

Localization of self-reliant product development is advancing in China as mentioned in the previous section that examined the case of Nissan. Advancement of localization of mold technology can be attributed to why self-reliant product development is advancing in China. In the following section, we will investigate how Nissan is procuring the molds. Nissan is proactively advancing the global procurement of molds (Tanaka and Okamoto 2013). Nissan's localization strategy of molds is based on Hub & Spoke—a concept that pursues localization of molds by placing more orders to mold manufacturers that will be able to grow into the hub of each regional area and making them foster the spread of mold technology into other mold manufacturers which will serve as the spoke of the wheel. Nissan has been selecting mold manufacturers that possess high technological capability and focusing on fostering them as the local hub base. Nissan's hub bases are found in Japan, China, Thailand, and Europe.

By forming network that radially connects various small- and medium-sized local firms, the mold manufacturers designated as the hub are playing the role of spreading technology to small- and medium-sized mold manufacturers in host countries. The reason why global mold procurement is critical in forming competitiveness is due to the increase in the needs to develop car models that can cater to local demands in host countries and consume them locally. To successfully create design of cars that can cater to local needs, car manufacturers are now required to launch localized models on a global scale by procuring molds from host countries. Because of such demands, Nissan focused on training human resources at overseas production bases serving as the hubs (Tanaka and Okamoto 2013).

The mold manufacturers in Japan are being called “Global Core”, and they are expected to serve the role of presenting the most advanced development technology to overseas mold manufacturers. When it comes to the design of mold parts that can be used commonly in Japan, they try to use common designs in Japan as much as possible. They are also advancing other types of mold parts designs in the host countries (Kitoh 2013).

6.2.3 Plastic Mold and Die Manufacturers in China

The reason behind how Nissan could procure plastic mold locally can be attributed to the Chinese local mold manufacturers that possess technological capability well acknowledged by foreign car manufacturers in China. In this section, we will investigate the case study of plastic mold manufacturers, Xingtai Plastic Mould Co., Ltd. (XPM), and SanLei Mould & Plastic Co., Ltd. (SMP) that possess high technological capability.

XPM was established in 1999, and it currently holds 380 employees. Their main products are molds for bumpers, instrument panels, and door panels. Their main trading partners are Nissan, Mercedes Benz, BMW, First Automotive Works, SAIC Motor, Ford, Suzuki, Toyota, and GM. XPM produces molds for Nissan’s door panel. Although the firm first started producing molds for consumer electronics, it has focused more on large-sized molds for cars since 2004. Ever since then, XPM has been growing rapidly. At the beginning of producing molds for cars, the firm had to receive engineering guidance from Japanese firm in improving its technological capability. Since XPM possessed the technological ability of developing high-quality molds through its strenuous efforts, its sales and the number of customers have been increasing year-by-year. It also built a R&D center with 13 staff at Pudong, Shanghai in 2015 to engage in technological development nearby car manufacturers.

We will examine SMP as our second target of the case study on Chinese mold manufacturers. The firm was established in 1989 and it has 350 employees. Its main products are molds for bumpers, instrument panels, lamps, and door panels. SMP’s main trade partners are Zhengzhou Nissan and Mazda. The firm delivers bumpers to Zhengzhou Nissan and Mazda.

In the following section, we will investigate the case study on the localization of dies in China. Although most of the dies are imported from Japan, Nissan has been gradually increasing the number of the dies for pressing parts in China. Locally procured dies can be divided into two types (in-house produced dies and outsourced dies). The affiliate founded by Nissan produces most of the dies for Guangzhou Nissan. Outsourced car body dies are being procured from firms such as Mitsuike Corp and UNIPRES. Since China has the presence of major car panel die manufacturers such as Toyota FAW (Tianjin) Die Co., Ltd., Faw Tooling Die Manufacturing Co., Ltd., China’s technological level of dies has been rising year-by-year.

6.2.4 Case Study on Thailand

6.2.4.1 Nissan Thailand's Product Development

In this section, we will investigate just how much locally self-reliant product development is being advanced by Nissan and Calsonic Kansei in Thailand. In 2016 with the investment of 1 billion bahts, Nissan built 6600 m^2 R&D center with a test facility nearby Thailand plant. Roughly, 200 staff at Thai R&D center are advancing the development of cars that are produced at 7 plants in 5 countries inside ASEAN. Operations such as providing supports toward domestic production of parts mainly being developed in Japan and making minor changes in car models are being conducted in this R&D center. Ideas behind development of prototypes are being discussed at Global Production Engineering Center (GPEC) in Japan through teleconferences and simultaneous designs of 3D CAD.

After completing the production of prototypes in Japan, green light is given to start the mass production in Thailand while simultaneously reconfirming the past problems. Upon the start of mass production, the support team comprised of production and quality engineers from GPEC Japan visited Thailand plant to give technological supports.

Calsonic Kansei was established in 2008, and it holds 2329 employees. Their trade partners are Nissan, Isuzu, and GM. The company mainly produces instrument panels, car air conditioners, combination meters, compressors, exhaust modules, and radiators. Their development center mainly focuses on improving the products developed in Japan to satisfy the demands in Thailand. Nissan and several parts suppliers formed the team to develop instrument panels. Aside from Calsonic Kansei, several suppliers that make parts of instrument panel (combination meter, glove box, etc.) gathered at interior and exterior design department of Nissan and attended the design meetings.

When problem was found on an instrument panel, three support engineers from Japan came to Thailand and solved the problems by staying in the Thai plant for roughly 1 month. These engineers also attended the meetings on the launch of mass production line in Thailand.

6.2.4.2 Mold and Die Manufacturers in Thailand

In this section, we will examine the technological level and industrial clusters of mold and die manufacturers in Thailand. First, we will conduct the case study of the country's well-known mold manufacturers T. Krungthai Industries Public Co., Ltd and Automotive Mold Technology Co., Ltd. T. Krungthai Industries Public Co., Ltd is a Thai mold manufacturer established in 1973 that has 1200 employees. This

company produces medium- and large-sized plastic parts for cars and molds. The company started the mold production in 1996 under the guidance of Japanese engineer dispatched by Japan International Cooperation Agency (JICA). The dispatched Japanese engineer remained in the firm after the expiration of 1-year dispatch contract, and was involved in providing guidance on mold production and mold plant construction by becoming the supervisor of the firm. The firm trades with Nissan, Toyota, Isuzu, Mitsubishi, Honda, GM, and Ford. There are 50 employees working in this plant, and 10 of them are engaged in 3D CAD designs of molds.

Automotive Mold Technology Co., Ltd. is a firm established in 2001 that specializes in medium- and large-sized molds for car parts. This firm is a joint venture between Japanese companies "Creative Technology Inc." and "Nagase & Co., Ltd.". The firm has transactions with Nissan, Isuzu, Toyota, and Honda. Their production items are molds for instrument panels, bumpers, door panels, front grills, console boxes, engine covers, and fan shrouds. They have roughly 150 employees and 20 of them are engineers. There are few manufacturers who can produce large-sized plastic molds for bumpers in Thailand. Aside from Automotive Mold Technology Co., Ltd., only one Japanese firm and one Korean firm can produce molds for bumpers in Thailand.

In this section, we will examine the localization of dies in Thailand. UNIPRES is a firm that supplies Nissan's car body panels in Japan. Although the firm established both distributors and production base in China, it only established car body parts distributors in Thailand. Because of this, Nissan Thailand is procuring press molds for car body from Kyokuyo Industrial Co., Ltd, Thai Summit Auto Parts Industry Co., Ltd., and YMP Press & Dies (Thailand) Co., Ltd. UNIPRES is supplying its technology to Thai Summit Auto Parts Industry Co., Ltd. In the following section, we will introduce Thai Summit Auto Parts Industry Co.'s case.

Thai Summit is a Thai firm established in March 1977 with 21,860 employees. Its main products are car body panels, wire harness, bumpers, instrument panels, door hinges, and upper and underbody panels. In terms of trade partners, the firm is generating large sales from Mitsubishi and trades with Nissan, Toyota, Mazda, GM, and Ford. While collaborating with Japanese Firm Press Kogyo Co., Ltd., it also bought Japanese die manufacturer Ogihara Corporation. Thai Summit R&D center has a test facility where design review meetings can be conducted for prototypes. Eight Japanese staff assigned from Ogihara Corporation visited Thai Summit for technological supports upon the launch of die development. Two Thai engineers received trainings in Japan to study designs of dies. One Thai staff is permanently stationed at Ogihara Corporation to serve as the liaison office. Japanese engineer from Ogihara Corporation was assigned to Thai Summit to give guidance on the design aspect of dies.

6.3 Analysis of Case Study

6.3.1 *Self-reliant Product Development by Subsidiaries and Localization of Molds in China*

In this section, we will analyze result of Nissan China's case study up to this point. Nissan China's self-reliant product development ability is improving, and its level of mold technology is also gradually advancing. For this reason, unlike Thailand, the product development in China is becoming more and more self-reliant. Figure 6.1 shows the structure of parts procurement of Chinese car industry. Chinese car market is divided into two sub-markets (one for foreign manufacturers and the other for Chinese local manufacturers). Because of this, mold manufacturers in China are becoming more and more bipolarized. In specifics, they are categorized as one being aspirational mold manufacturers who are capable of supplying molds to foreign car manufacturers by rapidly improving its technological level, and the other being typical mold manufacturers who are expanding its transactions with Chinese local car manufacturers (Kanemura 2012).

Japanese car manufacturers started utilizing more and more medium and large-sized press dies for car body frames produced by Chinese local die manufacturers. In terms of plastic molds, Japanese car manufacturers are now able to procure large-sized plastic molds such as bumpers and instrument panels that require the highest level of technology (Saitoh 2014).

Based on the result of our case study analysis on Dongfeng Nissan, self-reliant product development of models is more advanced in China than Thailand. Dongfeng Nissan could achieve high level of locally self-reliant product development because it could procure high-quality plastic molds in China. Following the

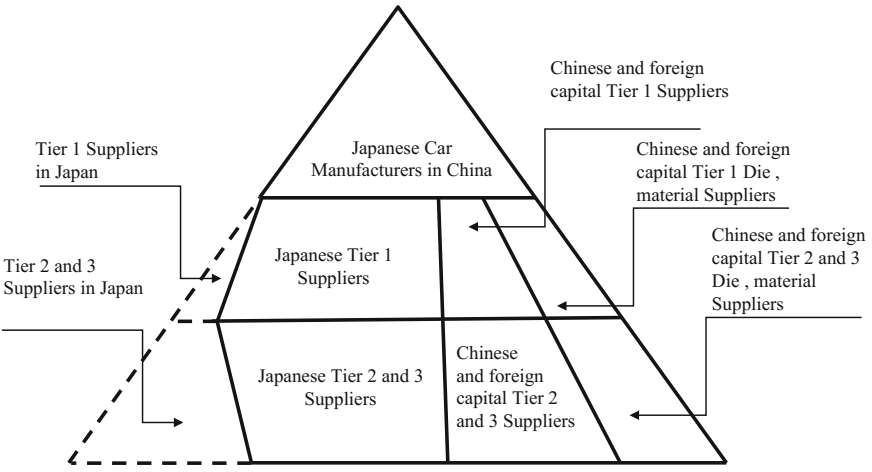

Fig. 6.1 Local procurement of parts and molds in China

case study analysis on Chinese mold manufacturers, it became obvious that design capability and quality of molds are improving in China, because Chinese mold manufacturers tend to possess their own R&D centers.

6.3.2 *Self-reliant Product Development and Localization of Molds in Thailand*

In this section, we will examine the result of case study regarding self-reliant product development and localization of molds in Thailand. Figure 6.2 shows that Japanese car manufacturers in Thailand have high ratio of parts procurement from Japanese tier-1 suppliers. In fact, Nissan has transactions with roughly 200 tier-1 suppliers, and 85% of these suppliers are Japanese firms. In addition, Nissan's transactions in Thailand with other Japanese suppliers located in ASEAN region are also increasing. When it comes to high-tech parts that are difficult to be produced locally, Nissan has been importing these parts from Japan. In recent years, parts procurement from Thai tier-2 and tier-3 suppliers are also increasing. At the same time, Japanese tier-2 and tier-3 suppliers are also expanding in Thailand.

In Thailand, the dies for small press parts and molds for small plastic parts are being procured from Thai firms. However, since the technological level of molds in Thailand is still considered an immature level, when it comes to large-sized dies and molds, car manufacturers still rely on in-house production at local plants or imports from Japan. As it is shown in Fig. 6.2, procurement portion of Thailand's molds and materials is smaller than that of China's. Figure 6.2 demonstrates that local procurement rate of molds is low in Thailand, and the increase of importing molds from the countries other than Japan such as China and Korea. Severe human

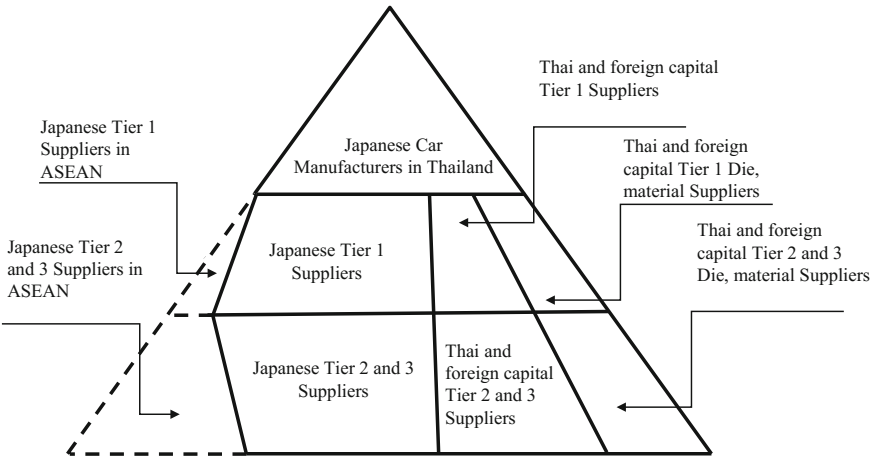

Fig. 6.2 Local procurement of parts and mold in Thailand

resource shortage in mold industry can be attributed to why the Thai mold industry is experiencing such a slow technical progress.

Through this case study of Nissan, it became apparent that Nissan's self-reliant product development level in Thailand is still stranded at the level of modification of Japanese models' designs. We also learned that self-reliant product development is hard to be achieved in Thailand due to the difficulties of procuring large-sized molds caused by the immature local mold technology. Based on these reasons, it is obvious to say that low rate of local procurement of molds and dies in Thailand is one of the most important factors that caused the delay in self-reliant product development of Japanese car manufacturers.

6.3.3 *Self-reliant Product Development and Local Procurement of Mold/Die*

By examining the case study analysis, this section will present our proposition regarding the in-depth localization based on localization of molds. Figure 6.3 shows our discussion up to this point. Figure 6.3 matrix is composed of three dimensions (i.e., self-reliant car product development, technology of mold design, and quality of molds in the host country). In this matrix, technology of mold design and quality of molds refer to explanatory variables, and self-reliant of car product development can be regarded as the predictor variable. First axis of Fig. 6.1 indicates the level of self-reliant product development. Locally self-reliant product development will be the highest degree of the localization of car product development. During the initial phase, the drawings of products designed in Japan are being modified to cater to local needs. After completing this initial phase, when the scale of local market becomes larger and the needs for localized car models increase, car manufacturers start designing products based on local specifications through self-reliant product development. Investments toward local development centers and test facilities will increase during this phase. In other words, as the degree of localization of development starts increasing, the type of product development evolves from a local modification of designs into a locally self-reliant

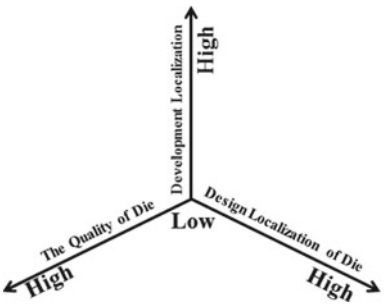

Fig. 6.3 Relation between locally self-reliant product development and localization of molds

product development. Second axis of matrix indicates the degree of molds design technology that serves as the factor that influences self-reliant development of cars. Localization will first start by localizing simple molds. Firms will at first carry out local designs of simple molds for plastic parts that are invisible to consumers. Since these molds mostly come in small sizes, they do not have that much influence on car development, particularly at host countries.

However, local designs of large-sized plastic molds are required to shorten the lead- time of creating prototype of cars and further reduce the development costs during development of car in the host country. Accordingly, car manufacturers began a full-fledged local designing of instrument panels and attempt to localize large-sized molds for instrument panels. Huge amount of investment in R&D and production facilities is needed to achieve the design of large-sized molds. Furthermore, since large-sized parts are composed of many small-sized parts, the number of required small molds in host countries should be locally designed. After that, locally designed small molds should be upgraded to large-sized mold designs.

Third axis indicates the quality of molds as the factor having an impact on self-reliant product development. Strong positive correlation between the quality of mold and self-reliant product development exists. Even if the local designs of molds are being advanced, it will still be difficult procuring molds if such molds are produced in a poor quality. High level of localization of product development cannot be achieved without the high-quality molds. There is a need to keep on improving the local designs of molds and quality of molds in order to correspond to demands for the quick creation of prototypes and changes in designs. In addition, locally self-reliant product development will be possible if local mold procurement rate starts going up with the accompaniment of technological progress of local molds. Accordingly, it is also necessary to improve the quality of molds to raise the level of localization of product development (Baba 2007). In other words, in order to advance locally self-reliant product development, car manufacturers need to improve the local procurement rate of molds and quality of molds.

6.4 Summary

In this chapter, we conducted the case study of Nissan in Thailand and China by focusing on the collaboration between the localization of product development and molds as the method of advancing the localization of product development in the host countries. The result revealed a significant difference between China and Thailand when it comes to the localization of self-reliant product development. It also demonstrated that Nissan's locally self-reliant product development progressed with the advancement of localization of product development and molds in China.

On the other hand, we also learned that since localization of product development and molds are not advancing in Thailand, Nissan's locally self-reliant product development of cars in Thailand was not advancing as much as in China. Based on the results of case analysis, it became obvious that two factors "local design of

molds" and "quality of molds" were having an impact on the localization of self-reliant product development in host countries. Most importantly, we learned that self-reliant product development is being progressed when the local designs of mold ratio and quality of locally produced molds sit at a high level. As our proposition, we clarified that when the development of molds and localization of production are progressing, it triggers the advancement of locally based self-reliant product development and in turn enables in-depth localization of production.

In the following section, we will examine the academic contribution of this chapter. First, in order to expand the overseas businesses in a more elaborate way, firms will be able to use this study's analytical framework by reflecting "localization of molds" during the localization phase of product development. Preceding studies have suggested that types of overseas expansion can be divided into four categories depending on whether a firm establishes the development function and research function at a home country or a host country (von Zedtwitz and Gassmann 2002). First is the type that a firm only conducts R&D at a home country and not at a host country. Next phase is the case of conducting research at a home country and product development at a host country. On the other hand, there are cases where product development is being conducted at a home country and research at a host country. Furthermore, when the technological level of local subsidiaries starts improving, in many cases firms would conduct R&D in host countries and would only have functions to adjust such R&D at their home countries. Lastly, there is a pattern where R&D is being conducted in both home country and host country. This pattern can be categorized into three types–local subsidiary playing an accompanying role, home country and host country having an equal role-sharing, and host country taking the primary role and home country taking the accompanying role.

However, most of the car manufacturers tend to transfer their product development functions to host countries, whereas they rarely transfer research functions to host countries. During the initial phase, the product development function of host country's R&D center mainly focuses on activities such as modifying and applying the existing technology. Furthermore, when the local market starts expanding further, the host country's R&D centers start raising the level of localization of product development by converting their product development type from modifications of home country's products to locally self-reliant product development. However, this kind of research did not adequately reflect the analysis regarding the localization of molds that serve as an important borderline between the phase in transitioning from localization of product development to localization of self-reliant product development. When we re-categorize the localization process based on our result of analysis, it will come out as follows.

First, molds are being imported from home countries so that overseas affiliates can locally produce the products. The intensification of competitions in local markets will lead manufacturers to shorten the start-up time of production line, thereby causing them to advance in-house production of molds in their host country plants. Once the in-house production of molds begins, they will gradually start outsourcing molds more and more to reduce costs. During this phase, a type of product development to improve the home country products will begin. Next, when

the needs of local market start diversifying, out of the necessity to develop localized models, the demands toward locally developed molds will increase. The development technology and quality of molds start improving through the entry of home country mold suppliers and local manufacturers' technology will accumulate, thereby arriving at the phase where self-reliant product development becomes predominant in the host country. When the self-reliant product development starts progressing even further in the host country, a local product development center will evolve into an R&D center that can conduct basic research.

Second, with respect to the discussion on in-depth localization, this study expanded the level of analysis by stretching to the scope that covers the localization of self-reliant product development through local procurement of molds. Previous studies suggested that in-depth localization is defined by the synergy effects between the reduction of production costs and improvement activities achieved by the localization of parts and machines (Shintaku and Ohki 2012). However, this study revealed that the localization of molds accelerates the localization of self-reliant product development by expanding the scope of in-depth localization concept to the point of achieving self-development through localization of molds.

Third, since the number of studies that tackled localization of molds tends to analyze what types of molds are being procured locally, they did not conduct systematic analysis that linked the localization of product development and molds. This study clarified that localization of product development will progress if the technological capability to develop and produce high-quality molds in host countries improves. Even if the local product development center develops its own models, if design capability and quality of molds do not improve, car manufacturers may have difficulties shortening their development lead time and reducing their development costs in host countries.

The future issues concerning this study to be dealt with are as follows. First, since fostering of local human resources plays a vital role in raising the level of localization of molds and mold technology, we need to also analyze the type of fostering process that needs to be taken place in the host countries. In this study, we focused on analyzing the localization of product development and molds from the standpoint of in-depth localization. Through this study, we learned that fostering human resources required for production of molds and car development differs dramatically between China and Thailand. The differences of both countries can be attributed to the fact that in China, and there are numerous universities and vocational schools that professionally train students, thereby making it relatively easy for firms to secure human resources. Such the factor may have contributed to the rapid progress of self-reliant product development and localization of molds in China. As an extension of the analytical framework discussed in this study, the research on the utilization of local human resources should be made.

Second, as local development of molds starts progressing, we must conduct a study to assess the division of task and cooperative relationship between home countries and host country's mold manufacturers. If firms decide to transfer the production and product development of molds that was conventionally produced at home country over to overseas plant, such move will reduce the production volume

of mold manufacturers in home country and may cause a hollowing out effect in the industry in a home country. Furthermore, if it becomes possible for host country manufacturers to design molds in their own capability and acquire the competitiveness in the market, it may create a competitive relationship with a home country manufacturer in the future. However, from the long-term perspective, increase in the number of global production will also trigger an increase in home country production. This phenomenon will also help increase the number of molds needed in home countries, thereby contributing to the growth of home country's mold industry (Shintaku and Ohki 2012).

In order to create an environment where home country mold industry can grow continuously in this manner, home country mold manufacturers must continue to play a core role in globalization of production by constantly developing cutting-edge mold technology.

Third, we must examine how innovation of host country mold technology is having an impact on mechanism of generating home country's innovation. Preceding research has suggested that there are numerous cases of so-called "reverse innovation" that refers to the arising of innovations in host countries that are developing countries, which has an impact on home country's innovations (Hoenen and Kostova 2015).

However, localization of mold designs may potentially have an impact on the innovation of both firm's home country and host country. There is also a need to construct a framework regarding the mold innovation that serve as a bridge between the production and product development innovation.

Fourth, although we made discussions by focusing on the localization of mold development as the factor that has a critical impact on localization of self-reliant product development in a host country, we also need to examine how other factors are influencing on the localization of self-reliant product development. Aside from the factor related to "localization of molds," we can list items such as government's industrial policy, history of country's industrial development, social value, and country's intellectual property laws as factors that may have an impact on localization of product development. For example, in the case of China where government has strongly urged foreign firms to invest in R&D, this type of aggressive policy may serve as one of the important factors behind the progress of self-reliant product development in host countries. There is a need to clarify how various factors are having an impact on the localization of self-reliant product development by identifying the interaction between the localization of molds and these factors.

References

Baba T (2007) Kouhatukoku no kanagata Sangyou Hatten Dankai Sokuteikijyunn Settei to Indo Jibasangyou Hattendainkai Sokutei no Kokoromi, Sono1. Keizai Shirin 74(4):1–29

Feinberg S, Gupta A (2004) Knowledge spillovers and the assignment of R&D responsibilities to foreign subsidiaries. Strategic Manag J 25(8–9), 823–845 (August–September)

Hejazi W, Safarian AE (1999) Trade, foreign direct investment, and R&D spillovers. J Int Bus Stud 30:491–511

Hoenen A, Kostova T (2015) Utilizing the broader agency perspective for studying headquarters–subsidiary relations in multinational companies. J Int Bus Stud 46(1):104–113

Iwata T, Ken J (2009) Nihonkigyou no Tyuugoku niokeru Kenkyuukaihatu no Gurobaruka: Nissan Jidousya no jirei. Keizaigaku Kenkyu 59(3):99–116

Kanemura T (2012) kaisouka suru Shijyou heno Tyuugoku Kanagata Sangyou no Kyoukyuu Kouzou. Sanda Gakkai Zassi 105(3):401–421

Kitoh, H. (2013), Gurobaru Tenkai niokeru Denso no Katagijyutu no Kadai to Tenbou, Kata Gijyutu, January, pp 30–33

Nobel R, Birkinshaw J (1998) Innovation in multinational corporations: Control and communication patterns in international R&D operations. Strateg Manag J 19:479–496

Rothaermel F, Boeker W (2007) Old technology meets new technology: complementarities, similarities, and alliance formation. Strateg Manag J 29:47–77

Saitoh E (2014) Tyuugoku niokeru JIsousya muke Ohmono Purasutikkuyou Kanagata no Rohkaru Meeka no Bunseki: Kohiki Shanhaiken niokeru Jibakanagatameeka no Gijyutu Reberu no Koujyou to Torihikisaki no Henka. Ohsaka Keizai Daigaku Ronsyuu 65(2):7–17

Shintaku J, Ohki K (2012) Nihon Kigyou no Kaigaiseisan wo Sasaeru Sangyouzaiyusyutu to Shinsou no Gentika, MMRC Discussion Paper No. 419

Tanaka Y, Okamoto K (2013) Nissan Jidousya niokeru Kanagatatyoutatu no Gurobaruka, Kata Gijyutu, 22–25 January

von Zedtwitz M, Gassmann O (2002) Market versus Technology Drive in R&D Internationalization: Four different patterns of managing research and development. Res Policy 31(4):569–588

Chapter 7
Discussion and Implications for the Future

Abstract This study examines the patterns for building automotive supply chains in high-growth member countries of the Association of Southeast Asian Nations (ASEAN) in recent years and ways to effectively manage them. In particular, the study focuses on transactional supply chain relationships in the automotive industry. It also (1) identifies supply chain partnerships from the perspective of sales and service and not just production; (2) explains the supply chain localization process; (3) explicates trade practices within supply chains; and (4) examines, from three perspectives, the differences among country factors that impact the behavior of manufacturing industry employees. Currently, the expansion of automotive markets in ASEAN countries is causing major changes in how supply chains are created in the automotive industry, including for Japanese firms. At the end of the study, we offer thoughts on management on the basis of supply chain survey results from the automotive industry in Thailand, a major auto-making country.

Keywords ASEAN · Automobile industry · Supply chain management KEIRETSU · Local procurement

7.1 Introduction

In this study, we have analyzed ASEAN automotive supply chains from various perspectives, with a focus on Thailand. The analyses were carried out from perspectives such as competitive advantage, including the automotive systems on which suppliers work and their technologies, human resource management (HRM) in supply chains, intrafirm and interorganizational relationships in supply chains, and localization of automotive development and production. In this chapter, we present a brief overview of the features of automotive production supply chains in ASEAN, particularly Thailand, from multiple perspectives and proceed to discuss the direction in which these will be transformed in the future.

Work by Munehiko Itoh, Atsumi Kato, Yoshitaka Shimono, Yasuhiko Haraguchi, and Park Taehoon.

M. Itoh et al., *Automobile Industry Supply Chain in Thailand*,
Kobe University Social Science Research Series,
https://doi.org/10.1007/978-981-13-2360-7_7

7.2 Features of Thailand's Automotive Industry Supply Chains

This section summarizes the features of Thailand's automotive industry supply chains. First, there exists an acknowledged correlation between the operational years and technologies of a Thailand firm. Specifically, firms with precision cutting and precision casting technologies have relatively shorter histories. In contrast, we found that firms with screw and spring technologies have been in operation for quite a long time. Thus, Thailand's supply chains greatly differ from those in other regions, particularly Japan. In this section, we summarize the features of Thailand supply chains and discuss how suppliers should evolve.

7.2.1 Supply Chain Characteristics

Multi-supplier firms are those that work for non-KEIRETSU companies. An analysis was carried out to find out what types of companies use multiple suppliers; the results of the analysis are listed below.

(1) In Thailand, a certain number of years in operation are required to do business with numerous automakers. In other words, as KEIRETSU suppliers venture from Japan into Thailand, they can form new relationships after developing production experience in Thailand.
(2) Body parts and accessories are diverse and range from large to small. In particular, large engine, bulky, seat, and instrument panel parts carry high logistics costs, and there can be a cost advantage to locating assembly plants nearby. Thus, KEIRETSU suppliers located nearby have more opportunities for sales.
(3) Companies with screw and spring technologies tend to have multiple suppliers because automobiles use many screws and springs, and thus, these parts are easy to standardize between and within models.
(4) Technologically, the question of whether a company with press processing technology or plastic and ceramic molding should have multiple suppliers or modularize depends on the number of component parts.

Pressed upper body parts must be changed for each model due to styling issues, making modularization difficult. Underbody brake systems, exhaust systems, and plastic parts used in instrument panels, mirrors, and lamps are relatively easy to modularize; however, the large number of parts makes the argument for modularization even more difficult.

As mentioned above, in Thailand's automotive industry, unlike that of Japan, the shift to multiple suppliers has been important for expanding the production volumes, stabilization, and improving technical capabilities of suppliers. At the same time, improving productivity has been an incentive to move forward with standardization among multiple automakers, and it is beyond doubt that there are

various requirements within the relationships between KEIRETSU automakers. In particular, cast parts are often used in engines, where secrecy is more important than advanced technologies. In addition, cast parts are often used in transmissions, steering systems, and suspensions. Transmissions and suspensions that use these cast parts are areas of differentiation for automakers, and therefore it is easier to do business within a KEIRETSU. At the same time, steering systems are typically produced outside of a KEIRETSU. In summary, automobile designs in recent years have used platforms heavily impacted by communication, and there is little advantage in doing business outside of a KEIRETSU because core parts and platforms are differentiators. Platforms are sometimes used across two generations of vehicles, increasing the amount of business done with the KEIRETSU manufacturers involved in development.

7.2.2 Characteristics of Thai Suppliers

Automotive industry supply chains are extremely broad in scope with many suppliers. With the KEIRETSU system, Japanese automakers have created a lean production system wherein they can produce high-quality vehicles in a short period. Thailand has been increasing the size of its automotive production center within the ASEAN region for more than 50 years. Practically, all Japanese automakers have expanded into Thailand and their automotive supply chains are analyzed herein. In the Japanese domestic automotive industry, it is common for suppliers and automakers to maintain long-term business relationships in vertical networks called KEIRETSU. In such business relationships, a multiplicity of suppliers builds up their facilities and technology in response to the demands of KEIRETSU automakers. Moreover, automakers have viewed suppliers as participants in the supply chain with complementary technologies and production equipment to produce automobiles to automakers' unique specifications.

A survey of automotive parts suppliers in Thailand revealed that vertical networks are in transition. Automakers decide on suppliers from among a broad array of options for necessary technologies or in order to reduce costs, and suppliers now deliver products to automakers outside of their KEIRETSU. One conclusion of this study is that these actions denote a move to a multi-supplier system. However, not all suppliers are becoming multi-suppliers. This study primarily shows that there are many industrial parks in Thailand, with clusters of automotive suppliers in each region networks formed with automakers. In addition, the material processing technologies of suppliers show a greater use of multiple suppliers when a technology becomes more universal, considering the factor of the standardization of parts. In Thailand, there are numerous suppliers with various material processing technologies although even among small firms one can find many examples of companies increasing the enrollment of employees due to the growing use of

multiple suppliers. It was discovered that for many suppliers, production in Thailand leads to more advanced technologies for parts production in Japan and to expansion in hiring.

7.3 Factors that Can Impact the Behavior of Manufacturing Employees in Japan, Thailand, and China

7.3.1 Summary

In this study, we first discussed the relationship between supply chain management (SCM) and HRM, noting the need for stable and efficient management of business among organizations to properly manage a supply chain. We also emphasized the need to ensure stability and efficiency of management in individual firms to accomplish this. Next, we reviewed the literature, particularly studies on HRM, HRM practices, corporate performance, employee behavior that contributes to corporate performance, and HRM and employee behavior in firms that expanded overseas. The results of this review are as follows.

First, in examining existing research on HRM in companies that have expanded overseas, we found that when companies from certain countries expand overseas, the HRM in these companies develops differently in the overseas countries than in their home countries. Second, the literature on HRM practices and corporate performance notes the relevance of HRM practices to corporate performance although it also mentions the inability to fully explain the mechanisms that account for this relevance. Third, the literature on employee behavior that contributes to corporate performance emphasizes the importance of employee behavior that contributes to corporate performance, namely, "work behavior" as "in-role behavior" and "organizational citizenship behavior" and "improvement behavior" as "outside-of-role behavior." Fourth, previous studies regarding HRM and employee behavior mention attempts by researchers from various countries in order to explain the relationship between HRM and employee behavior although existing studies are limited to one analysis from each country and also point out that differences between companies have not been clarified. Moreover, studies mention that in light of the current reality that SCM contains many international business transactions, there is a need for an international comparative analysis of the relationship between HRM practices and employee behavior when ensuring the stability and efficiency of SCM. Some of these studies also argued for the need to analyze the relationship between HRM practices and employee behavior among workers in Japan, Thailand, and China where Japanese companies are actively doing business with SCM.

Next, we conducted a survey and analysis. The survey comprised a questionnaire given to employees of automotive, equipment, and electrical equipment parts industries in Japan, Thailand, and China. On the basis of the data gathered from this

survey, a comparative analysis was carried out using multiple group structural equation modeling, and two items were found in common among the models from each country. First, a performance-based system has an impact on improvement behavior in each country. Second, job security measures have impacts on organizational citizenship behavior and improvement behavior in each country.

In addition, we found the following four points of difference in the models for each country. First are the differences in the impact of educational training. In Japan, there was no impact found on employee behavior through educational training. In Thailand, such an impact was confirmed. In China, an impact on work behavior, which is part of employee behavior, by educational training measures was not confirmed although an impact on organizational citizenship behavior and improvement behavior was confirmed.

Second is the impact on performance-based practices. In Japan and Thailand, performance-based practices only had an impact on improvement behavior. Conversely, in China, there was an impact on all employee behaviors. Third is the impact of work–life balance. Only in Thailand, work–life balance (WLB) had an impact on employee behavior (organizational citizenship behavior). In other countries, no such impact was confirmed. Fourth is the impact of employment security measures. Employment assurance measures did not have an impact on employee behavior only in Thailand. In China, the impact of employment security policies on corporate citizenship behavior was stronger compared with that in Thailand.

7.3.2 Discussion

The findings in this study have made possible several practical suggestions for HRM in Japanese companies. First, synthesizing the points in common in the results identified in each country's analysis, we can see that making explicit employment security is important in all countries for promoting behavior external to a role, namely, organizational citizenship. In addition, a firm may consider the effectiveness of using performance-oriented HRM in addition to employment security to promote improvement behavior, also external to a role.

We can also synthesize the differences noticed in the results identified by the analysis for each country and propose the following six points as practical suggestions. First, attempting to reinforce other measures is a more effective approach than educational training in Japan. Second, in Thailand and China, educational training measures must be reinforced with an awareness of the differences in impact of the training measures, on the basis of the differences in the quality of employee behavior promoted by the measures. Third, in China, broad effects can be expected from bolstering performance-oriented policies.

Fourth, in Thailand, reinforcing work–life balance measures is very important. Fifth, employment security policies are broadly effective for promoting employee behavior in each country but they have relatively higher efficacy in China in particular. Sixth, in Thailand, the effect of employment security policies is not as broad as it is in China or Japan.

In combining these commonalities and differences, we can say that there is a need within the Japanese, Thai, and Chinese manufacturing industries to strengthen measures that function effectively regardless of the differences between countries, and then select and reinforce the measures appropriate for each country in order to promote employee behavior that is desired by the firm.

7.3.3 Implications

A characteristic of manufacturing supply chains, notably those in the automotive industry in ASEAN countries, is the increasing use of multiple suppliers among many firms, meaning an increase in transactions between firms and other firms outside of a KEIRETSU. This use of multiple suppliers is not only increasing transaction volume with suppliers and engendering the multinationalization of vendors but also increasing the number of supplier sites and the multinationalization of those sites, in the sense that firms are expanding into multiple countries. For example, a certain automotive supplier, Company A, has around six sites domestically, but has 18 sites in eight countries in Southeast Asia, including ASEAN. In this way, even midsized suppliers in Japan have greatly expanded in size in Thailand and other parts of the ASEAN region and are faced with the need to operate stably and efficiently across multinational sites.

With regard to this state of affairs, this study identifies differences in proper HRM among various countries. In other words, this study identifies that companies must practice HRM differently in each country where they operate in order to have stable and efficient management. This study also proposes HRM that accounts for differences in Japan, Thailand, and China.

At the microlevel, or from the perspective of individual firms, this study will greatly contribute to improvements in corporate management for firms such as company A that have expanded overseas and have sites in multiple countries. In addition, at the macrolevel, or from the perspective of managing an entire supply chain, this study greatly contributes to the maintenance of stable and efficient SCM in supply chains that have integrated and connected suppliers. This study contributes in that sense to the management of firms and the improvement of the overall supply chains of those firms.

7.4 Buyer–Supplier Relationship of Automotive Supply Chain in ASEAN

In Chaps. 4 and 5, we considered the process of building buyer–supplier relationships in automotive supply chains in ASEAN countries, particularly supplier development (SD). In Chap. 4, we focused on the role of Toyota's Local Parts Development Division (LDD) and provided an overview of the buyer–supplier relationships of automakers and tier-1 suppliers. In Chap. 5, we considered the buyer–supplier relationships of tier-1 suppliers and tier-2 suppliers through purchasing strategies of Denso which is the tier-1 supplier in the Toyota group. Certainly, the supply chains developed by Toyota and Denso do not exist independently but are interlinked to form the overall ASEAN automotive supply chain. Below, we shall summarize the characteristics of ASEAN-specific buyer–supplier relationships and SD.

7.4.1 Characteristics of Buyer–Supplier Relationships in ASEAN

We can safely say that the process of creating automotive supply chains and implementing SD activities in ASEAN has not been fully considered from a theoretical perspective to date. In this study, we give an overview of the localization of parts procurement and supplier support at Toyota and Denso and are able to give a glimpse of an automotive supply chain in ASEAN that was formed in stages.

Toyota expanded into Thailand in 1962, and in its genesis period of the 1970s, the company built up industrial competitiveness in various ASEAN countries while developing and manufacturing vehicles which were rooted in the local countries, with its partner suppliers. In the transition period of the 1990s, the company reshuffled and optimized its supply chain to move away from production and parts procurement system structured around individual countries toward a mutually complementary production system within the ASEAN region. In the development period of the 2000s, when the Innovative International Multi-purpose Vehicle (IMV) project began, the companies positioned ASEAN countries within their global supply chains. As the restructuring of ASEAN automotive supply chains progressed, Toyota instituted the LDD in 2012 in order to strengthen R&D in the ASEAN region and the local procurement of parts.

In conjunction with the process of building the supply chain of Toyota, Denso, a tier-1 supplier in the Toyota group, simultaneously moved from a production system in each ASEAN country, through the construction of "ASEAN complementarian," to the globalization and localization of its supply chains.

Previous studies have noted the long-term, sustainable partnerships of Toyota on the basis of the spirit of coprosperity. In ASEAN as well, Toyota has kept these long-term, sustainable partnerships with its suppliers in mind as it has searched for

and selected suppliers. This is most likely due to deeply rooted thinking that suppliers should be nurtured, as in Japan. Toyota's coprosperity philosophy has permeated the overall supply chain built by Toyota and has had an enormous impact on the supply chain of Denso with whom Toyota directly transacts.

The buyer–supplier relationships that Toyota holds up as ideal are the same whether in Japan or overseas although the methods used to arrive at them differ. This is because ASEAN is in an environment that is different from that of Japan, the United States, and Europe. One way of creating buyer–supplier relationships is SD where supplier performance is improved and supplier capabilities are strengthened. This study reveals that Toyota and Denso have deeper SD in ASEAN countries than they do domestically in Japan.

7.4.2 Characteristics of Supplier Development in ASEAN

Previous studies have noted that the aggressive use of SD by Japanese firms has increased supply chain competitiveness. In recent years, firms in various countries, not just in Japan, have become aware of the importance of, and actively work on, SD. The globalization of supply chains has heightened the need for an overseas expansion of SD. However, overseas SD and SD of tier-2 and lower suppliers by tier-1 suppliers have not really been debated.

As noted above, in developing countries like those in the ASEAN region, we found that Toyota and Denso have focused their efforts on SD in order to increase the competitiveness of their overall supply chains. In particular, when selecting tier-2 or lower suppliers and incorporating them into a firm's supply chain, the building of a supply chain where continuous and stable parts procurement is possible requires SD by both automakers and tier-1 suppliers. This is because tier-2 or lower suppliers have limits to the global expansion of businesses with their relative lack of management resources.

Toyota strengthened SD in ASEAN through the LDD, which was established in 2012. Specifically, Toyota is striving for SD that (1) comprehensively covers multiple sites throughout the ASEAN region, such as Thailand and Indonesia; (2) goes across barriers between departments, such as the R&D department, the purchasing department, and the production engineering department at the local site; (3) increases the professionalism of Toyota's local staff by supporting its suppliers; and (4) includes not only direct partners but also the partners of partners.

Denso restructured its procurement organization of Japan in 2009 and strengthened its SD in ASEAN around 2013. Details of Denso's efforts in that regard include (1) restructuring of the procurement organization of Japan shifted from purchasing by business unit to a functional organization for procurement, and strengthening of its support system for suppliers; (2) implementation of SD across multiple channels, with SD by HQ(headquarter) and SD by local initiative; (3) dispatching one of the professional staffs that belonged to the purchasing engineering department of the purchasing group in Japan to Thailand in order to support suppliers and train local staff

members of Denso; and (4) the implementation of a self-evaluation system called CAPS as a way to follow up with the practice of SD.

We can see that in ASEAN, Toyota and Denso have carried out SD across various boundaries—between the home country of Japan and overseas countries; within ASEAN countries; within their companies and with their partners; and with direct partners and indirect partners (partners of partners). Outside Japan, we may point out the need to work on SD that is spatially expansive.

Moreover, on the basis of the example of Denso, the importance of SD for tier-2 suppliers by tier-1 suppliers was identified. In other words, it is necessary to increase the autonomy of tier-2 suppliers using SD that is spatially expansive in conjunction with SD by HQ and SD by local initiative. In addition, by assiduously following up with suppliers after the SD activities, it becomes possible to increase the sustainability of improvement efforts by tier-2 suppliers. These tier-2 suppliers have relatively few management resources. It is important for these tier-2 suppliers to consider not only SD that is spatially expansive but also SD over a longer period.

7.5 Achieving Foreign Subsidiaries Self-reliant Product Development in Host Countries Through Mold Localization—Case Study of Nissan in China and Thailand

Previous research has taken cognizance of press dies and resin molds as critical production technologies for the localization of products but they have not received the focus they deserve as a factor that greatly impacts the deeper levels of the localization of development. This section uses the example of press mold and die localization to consider the interrelationship between autonomous development and the localization of molds and press dies as one factor that extends to deeper localization of development. Autonomous development in Thailand does not necessarily lead to cost reductions by firms but is increasingly important from the standpoint of identifying local requirements more quickly and incorporating them into product development.

The fact remains, however, that the current development of core technologies is usually done in the home country, by tailoring to local market needs performed to a certain extent through local design revisions. For example, in the development of Toyota's IMV for the ASEAN market, core technology development was done in Japan with portions requiring local enhancements developed in Thailand. Nissan has followed a similar path, and local autonomous development among Japanese automakers has been slow to take off.

However, with greater global competition, it may be possible that Japanese firms will take steps toward autonomous local development in Thailand in the future. As we have seen in this chapter, autonomous development demands that critical molds and dies be developed and produced locally although in Thailand it has been mostly impossible to procure high-precision molds and dies. This phenomenon is not

unique to Thailand because it can also be observed in Nissan México, where, in 2016, Nissan celebrated 50 years of operation. Nissan México established a development center in Toluca although its role is limited to revising plans of models for the local market. Nissan México has filled a critical role as an export base to North America after the signing of the North American Free Trade Agreement. In addition, in recent years, Mexican factories have become increasingly important due to their proximity to South America and Central America, given the growth of the Mexican and Brazilian economies. However, despite the expansion in local production, no progress has been made in the development of production molds and dies in Mexico, and thus, autonomous development has also not moved forward. In Mexico, local procurement of parts has made progress although there has been no localization of the mold and die industries, and thus, molds and dies are either made in Nissan's Mexican factories or made in Japan and then exported to Mexico. Analyzing the case of Thailand used in this study, the localization of molds and dies faces the following hurdles.

First, molds and dies impact the precision of parts and productivity and therefore their development requires the accumulation of technology and know-how over long years of intense effort. Few Thai firms have been in business over such a long period, making it difficult to acquire these technologies. There are few small- and medium-sized firms in Thailand that specialize in molds and dies, and those that do work with molds and dies do not focus on them as their main line of business. Thus, the acquisition of technology over long years is a difficult structural problem.

Second, only a very small number of molds and dies are ever ordered at one time; therefore, there is no effect from mass production. As a result, mold and die makers are often tiny small- and medium-sized firms and tend to have weak management foundations. To achieve economies of scale in die production, the domestic market for automobiles must be of a certain size at the least. In the case of China, the domestic market is quite large so that even with large economic fluctuations, there is a constant demand for molds and dies at a certain level. In contrast, Thailand has a small domestic market that requires increases in the quantity of molds and dies ordered in order for small- and medium-sized firms to build sustainable businesses.

Third, the molds and die industries are asset intensive and are impacted by economic cycles; therefore, order quantities are continually going through drastic changes. The production of high-precision molds and dies requires investing in expensive equipment, making it difficult to forecast equipment investment and labor against a backdrop of major fluctuations in order quantities.

Fourth, it is extraordinarily difficult for small- and medium-sized firms such as mold and die manufacturers to find personnel who will devote themselves to technology over a long period of time. A major difference between Thailand and China is that China has vocational schools and universities to develop personnel for die manufacturers, whereas Thailand has no such vocational schools.

The following strategies are required for Thailand to move beyond the stage of making modifications to designs into that of autonomous product development.

First, Japanese mold and die manufacturers must be aggressively encouraged to expand into Thailand. This will require manufacturers of parts and automakers to own the molds and dies for the parts that they develop and to have policies that are advantageous to die manufacturers when it comes to amortizing the development costs of molds and dies. For example, this would require the rapid reimbursement in a lump sum, to the maximum extent possible, of the amortized development costs of molds and dies owned by automakers and parts manufacturers.

In addition, partnerships with local vocational schools and universities are required in order to be able to recruit personnel for mold and die manufacturers in Thailand and to accumulate technology and know-how over the long term. In doing so, vocational schools in Thailand must bring in Japanese engineers, or those retired after many years of experience in Japanese firms, to provide technical instruction.

Moreover, industrial parks specific to mold and die manufacturing must be built in Thailand and other ASEAN countries so that mold and die industries cluster can be created along with exports. ASEAN is expected to have greater growth in the automotive industry in countries such as Indonesia and the Philippines, and thus, mold and die industries must be developed based in Thailand, where there are social infrastructure and clusters of parts manufacturers as an export base for molds and dies to the overall ASEAN market.