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

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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

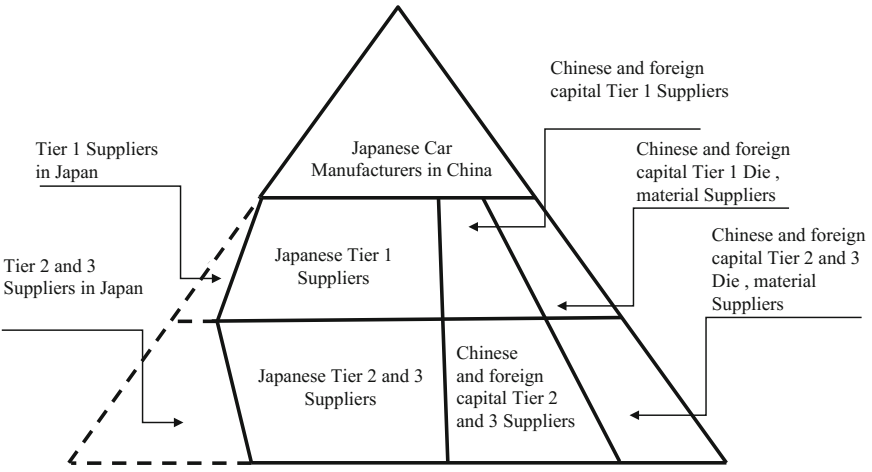

Fig. 6.1 Local procurement of parts and molds in China

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

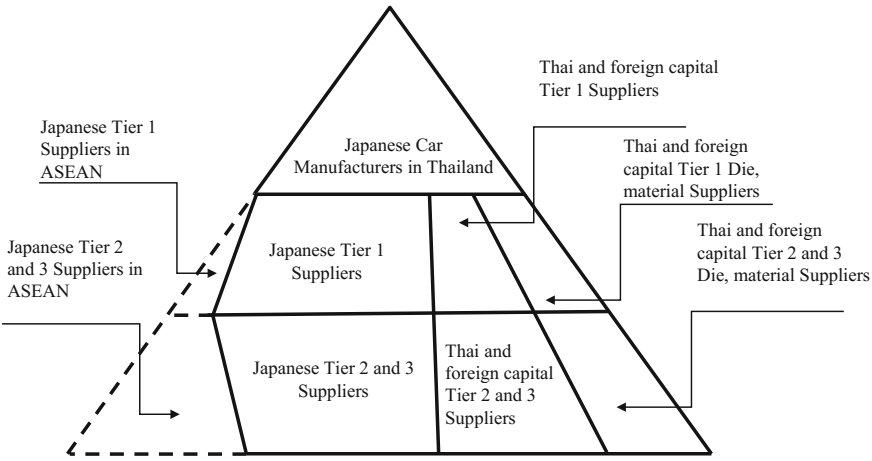

Fig. 6.2 Local procurement of parts and mold in Thailand

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

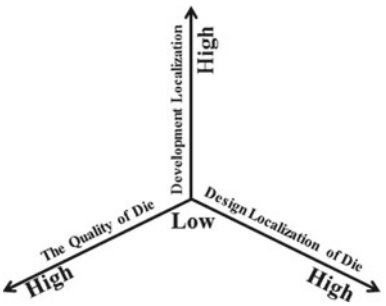

Fig. 6.3 Relation between locally self-reliant product development and localization of molds

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.

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