
13.1 Introduction

As the rate of market growth in advanced nations is tapering off, emerging nations are showing great growth potential, with markets expanding alongside increasing income levels of the people of these countries. As such, emerging nations are increasingly becoming attractive as locations for R&D centers to capture their growing markets. Emerging nations themselves are incentivized to attract corporate R&D from advanced nations. These centers make possible the development of highly skilled workers, and are expected to improve the technical abilities of related firms.

There are various reasons firms conduct R&D overseas: (1) taking advantage of research resources not available in their home country, (2) carrying out development to localize products and services, and (3) conforming, from a technical aspect, to necessary local laws such as safety regulations. The aspect they share in common is their need for access to local research resources (such as personnel and technologies), consequently making the selection of local partners vital.

In this chapter, we explore Thailand's National Science and Technology Development Agency (NSTDA), and the possibilities this agency provides to Japanese corporations as an R&D partner. The history of Japanese companies in Thailand is long. Economic ties between the two countries are strong, with more than 1,500 subsidiaries of Japanese companies in Thailand, putting the country third behind China and the US.

With AFTA (ASEAN Free Trade Agreement), industries are continuing to consolidate on a regional basis within the ASEAN countries. Thailand has an auto industry agglomeration, with most local productions being conducted by the Japanese subsidiaries. The Japanese companies are represented in a wide array of industries in Thailand, from manufacturing sectors such as electronics and food products to retail and restaurants sectors. Yet R&D activities are still limited to only a few of these firms. In this case study, we explore whether firms should

aggressively pursue R&D activities in Thailand and whether the NSTDA is a suitable partner in such a pursuit.

13.2 Thailand as a Business Destination

As a result of stronger yen stemming from the 1985 Plaza Accord, the Japanese companies built in succession manufacturing bases throughout Southeast Asian nations. Among these nations, Thailand enjoyed robust foreign investments, with companies in electronics and transportation sectors moving into the country. While the amount of investments temporarily shrunk in 1997 because of the Asian currency crisis, investment has been growing since 2000. Some of the major Japanese firms operating in Thailand are motorcycle and automobile manufacturers and electronics manufacturers of products such as hard disks and electronic components. In addition, companies representing a wide variety of sectors from food products and distribution to daily necessities have expanded into Thailand, making it third after China and the US in the number of Japanese subsidiaries. Likewise for Thailand, Japan is an important source of direct investment, and the two economies are closely linked.

One of the reasons for this strong investment is the impact of Thailand's Board of Investment (BOI), which manages the country's investment regulations and has aggressively pursued a policy of introducing foreign investments into the country. For example, in the automotive industry, which is considered a key industry in the country, BOI allowed foreign automakers to enter the market beginning in the 1970s and concurrently rolled out import substitution policies for automotive parts to nurture domestic industry. As a result, many foreign parts suppliers built operations in Thailand, simultaneously leading to the creation of supporting industries, including domestic suppliers. In the 1990s, Thailand created incentives for foreign firms to promote auto exports. Although auto production volume dropped in Thailand in 1997 because of the Asian economic crisis, the auto industry, as the country's key industry, has steadily grown since 2000 because of policies aimed at aggressively attracting foreign capital (Ueda 2007). In contrast, Malaysia's policy since the 1980s has been to protect and develop its state-owned automaker, Proton, implementing strict regulations for foreign automakers. As a result, domestic automotive manufacturing base never sufficiently formed, limiting production volume at less than half of that of Thailand.

In 2007, the Thai government embarked on investment and tax incentives for "green" cars, which set out corporate and other tax exemptions for a set volume production of fuel-efficient compact cars. Many foreign firms led by the Japanese took advantage of this offer. Moreover, with cooperation from the Japanese government, the Thai-Nichi Institute of Technology opened its doors in 2007 to educate automotive manufacturing workers. Accordingly, the Thai government proclaimed its "Detroit of Asia" concept, steadily firming up its position as an automotive manufacturing base within the ASEAN countries.

Some view Thailand's unstable domestic political situation as problematic. A military coup overthrew the Thaksin regime in 2006, and Thailand continues to be

politically unstable. In April and May of 2010, the supporters of the Thaksin regime occupied central Bangkok in response to the anti-Thaksin Aphisit regime. The current government drafted concessions including an early general election, but the Thaksin supporters opposed. The situation was settled by forced removal of the protesters. In July 2011, the Puea Thai party (aligned with Thaksin) led by Thaksin's sister, Yingluck, emerged victorious in elections, with Yingluck becoming the Prime Minister of the Thai government. Yet political instability continues, which includes the granting of an amnesty for Thaksin himself.

The Thai government's political parties were originally formed through politicians' personal connections, and overall, the government is built on an extremely precarious foundation. However, many of the actual policy proposals are left to the bureaucrats, enabling basic economic policies to remain relatively unaffected by changes in government. For example, policies to attract foreign firms in the auto industry have been proposed since Thaksin's regime, and the anti-Thaksin government that followed maintained along those same lines. Thus, while the domestic political situation is unstable, some view that it has no great impact on foreign firms' investment risks.

13.3 Thailand's Science and Technology Policy and a NSTSDA Overview

Science and technology policies in Thailand are founded on the "2004–2013 National Science & Technology Strategy Plan." Until the 1990s, the Thai government promoted policies for economic growth revolving around a manufacturing industry based on natural resources and cheap labor. However, lower economic growth brought on by the Asian economic crisis as well as higher competition from nearby ASEAN countries caused a change in policy that recognized the need for higher value-added industry through innovation to achieve lasting growth. According to the Strategy Plan, the following four points are critical to the formation of a "knowledge-based economy and society":

- Creation of a national innovation system and industrial clusters: organic partnerships with universities, public research institutions, and industry
- Human resource development
- Improving the technology capabilities in four main areas: (1) information technology, (2) materials technology, (3) biotechnology, and (4) nanotechnology
- Creation of a development-oriented environment: laws and economic institutions that promote organic partnerships for innovation systems and the fostering of social values

The overall characteristics of the plan were twofold: (1) science and technology policy focusing on the demand side with innovation and industry, unlike the former supply side approach focusing on academic findings, and (2) setting forth national innovation system principles and organic partnerships between industry, academia, and government (JST R&D Strategy Center 2008).

The National Science and Technology Development Agency is a national research institution managed by Thailand's Ministry of Science and Technology, and plays an important role in national science and technology strategy. The NSTDA was organized through the 1991 Science and Technology Development Act, and comprises four technology centers—BIOTEC, which is responsible for life-science-related research; MTCE, which is responsible for materials-related research; NECTEC, which is responsible for IT-related research; and NANOTEC, which is responsible for nanotech-related research—and a Technology Management Center, or TMC, which is responsible for technology transfers. As of 2008, the Agency had 2,400 employees and a budget of 3.6 billion baht, making it Thailand's largest public research organization. It formed a science park in northern Bangkok, with higher educational institutions like Thammasat University and the Asian Institute of Technology nearby. The NSTDA is also charged with managing and operating this science park.

As a public research organization the NSTDA not only conducts its own research, but is also distinctive in that it aims to improve technology levels of domestic firms through technology transfers and technical guidance to the private sector. Thailand's private firms have historically had low research and development capabilities, and thus, much of the research typically performed by corporations in advanced nations is conducted by the NSTDA. The Agency has also installed expensive testing and research facilities for joint use amongst the private firms. In addition to local firms, the Japanese companies and other foreign firms benefit from these facilities.

One of the merits of NSTDA as a joint research partner is the Agency's quality of personnel. Approximately 400 personnel with doctorate degrees belong to the organization, and many researchers from Thailand's leading universities participate in the NSTDA activities, in effect creating a top-notch science and technology pool in the country. The NSTDA also functions as a funding agency to provide research funds to universities and other research organizations and, in doing so, has created a database of domestic researchers, serving as an information source about research workers in Thailand.

Next, there is tremendous value in using both tangible and intangible NSTDA research assets, ranging from a variety of testing equipment to databases on biological resources. MTEC has equipment for component analysis of auto parts, which it provides as a part of a testing service for Japanese and other automakers. For manufacturers without R&D centers in Thailand, this enables them to use NSTDA testing equipment to analyze defects locally. Likewise, BIOTEC has a database of Thailand's biological resources and is working on joint researches with firms like Shiseido and Novartis, using this as a foundation for research.

Finally, the NSTDA is located in the North Bangkok Science Park (NBSP), and thus receives the highest level of investment incentive privileges from the BOI. Investment incentives for foreign firms are categorized by region, and the incentives typically increase with distance from the capital. However, even though the NBSP is located in a convenient location less than an hour drive from Bangkok, being inside the science park grants the companies with high-level privileges such as 8-year corporate tax exemptions and halving of corporate taxes for 5 years thereafter.

The NSTDA not only works in close conjunction with regional economies for researches such as developments of aquaculture technology for black tiger shrimp and multipurpose trucks for agriculture, but also conducts cutting-edge researches including metagenomic analysis of micro-organisms (genome sequencing methods for preparing genomic DNA directly from microbial populations to perform genetic analysis on bacteria that are difficult to incubate, such as bacteria in mushrooms). The technology resulting from this research is transferred to private enterprises via the TMC. Below are some of the main technology transfer activities of the NSTDA:

Industrial Technology Assistance Program (ITAP): assistance programs designed to improve shop-floor processes and product development capabilities of small- and medium-sized businesses

Company Directed Research and Development Program (CDRDEP): low-interest financing for R&D leading to commercialization

NSTDA Investment Center (NIC): an investment organization supporting technology ventures

Intellectual Property Services (IPS): a section of the NSTDA that manages agency IP and provides licensing services

Thai Science Park (TSP): management and operation of incubation centers for technology venture firms

13.4 NSTDA and R&D Activities of Japanese Firms in Thailand

Thailand has many Japanese firms conducting R&D in products such as automobile, chemical, food products, and daily necessities. Among these, automakers are particularly active. Most Japanese automakers such as Toyota, Honda, and Nissan have built R&D centers in Thailand and develop vehicles for the local market. Along with the local R&D of automakers, Denso and other large parts suppliers have also outfitted development structures in Thailand.

In this chapter, we describe the state of partnerships with the NSTDA using the cases of Shiseido and Polyplastics Co., Ltd., both of which conduct joint R&D with the agency.

13.4.1 Shiseido Thailand

Shiseido has created a Southeast Asian research center within its local subsidiary, Shiseido Thailand, where research is conducted for the application of natural resources such as herbs found in Southeast Asia. An issue arose when an Indonesian NGO, critical of Shiseido's patent applications to use Indonesian organic plants in cosmetics, publicized the case in local newspapers. While Shiseido was in no way in conflict with the patent laws, as a result of this publicity, the situation developed

into a movement to boycott Shiseido products. As a result, Shiseido relinquished all patents relating to Indonesian plants, working to placate the issue. Around the same time, other Japanese cosmetics and pharmaceutical makers in Thailand were harmed by similar rumors from NGOs, which led to product boycotts. Events like these indicated that when an advanced nation conducts R&D activities on natural resources in resource-rich regions such as Southeast Asia, risks abound by the spreading of rumors even if the companies' procedures are all lawful. One reason Shiseido elected to begin a partnership with the NSTDA is to be better able to respond to risks of this sort. It deemed it paramount to avoid these risks by showing that in developing raw materials for cosmetics based on Thailand's natural resources, it would conduct joint research with a local public research organization, and jointly apply for patents, enabling the country with the natural resources to make use of the patents; moreover, Shiseido would share the appropriate profits that were earned through the products based on such research.

In 2005, Shiseido was moving ahead with plans to build R&D centers around the world as part of its global R&D strategy at the time. Against this backdrop, the company rented an office space within BIOTEC facilities, where a group was already conducting joint research on Thailand's herbs, and began operation as the Southeast Asia Research Center in October 2006. Its offices are in two locations, one within the NSTDA science park and the other inside its sales subsidiary in Bangkok (Shiseido Thailand Co., Ltd.). The main activities of the Southeast Asia Research Center are as follows: (1) basic research, (2) information gathering regarding cosmetics-related laws and regulations, and responding to various risks, and (3) local sales support.

Cooperation with the NSTDA (BIOTEC) mainly revolves around basic research including "Research of Thailand's Herbs" (and applications of materials in cosmetics) and "Indigenous Bacteria" (particularly the *P. acne* bacteria that is responsible for acne). Shiseido submitted a joint patent application with the NSTDA for the former, and held a joint press conference with the NSTDA and BIOTEC in attendance regarding the research. This press conference was held in an effort to be more aggressive in showing the public that the company's activities were intended to help the country, thereby preempting possible criticism by NGOs or other groups. For the latter research, Shiseido commissioned BIOTEC to perform the DNA analysis, and upon a joint review, would decide on the next steps. The company and NSTDA are also jointly deciding on research themes in areas where both sides have strong needs. The director of the center notes, "Regarding joint research with the NSTDA, the agency has many first-rate PhDs among its researchers. However, submitting joint patent applications took a long time, and we still have room for improvement on IP management" (from an April 2000 interview).

On the other hand, there are several merits of this arrangement for BIOTEC, such as "being able to learn about quality standards for developing plant extracts, methods for assaying cosmetics development, and other R&D methodologies of private companies" (from an April 2010 interview with the BIOTEC director). However, it took time to figure out the patent rights for the six types of plants that were submitted for patent application, as traditional usages of these plants were not to be

impaired by the issuance of such patents. In addition, as foreign firms obtain rights for domestic plant resources, it was also important for national research institutions to not damage the sentiments of the country's citizenry.

13.4.2 Polyplastics Technical Solution Center

Polyplastics is a joint venture between Daicel Polymer Ltd. (55 %) and the US-based Tekona Inc. (of the Hoechst Group, 45 %), and is a manufacturer of resin material for engineering plastics (high performance plastics used in automobiles and consumer electronics). The company has the world's largest factory used to manufacture POM (polyoxymethylene) and boasts the highest market share in Japan at 60 %, in addition to PBT (polybutylene terephthalate).

While Polyplastics manufactures and sells resin, its Technical Solution Center is responsible for technical support of resin products developed and manufactured by the company's customers. The company initially created a center in Japan (located in Fuji) and secured a domestic top market share through its technical support. In recent years, it has expanded overseas into China (Shanghai) and Taiwan (Kaohsiung), and, in 2008, into Thailand within NSTDA's MTEC. As ASEAN and, in particular, Thailand becomes the center for automobile manufacturing, Technical Solution Center provides technical support in manufacturing and defect analysis to "molders" who are subcontracted by the automakers.

The quality of high-performance plastic parts is dependent on the characteristics of the plastic material as well as the product design, molding equipment, and the settings of the equipment. Thus, the role of the Technical Solution Center is a four-step process of material selection, product and mold design, molding, and molded product analysis, where the two latter steps are focused in Thailand. When customers have issues, the center performs a defect analysis (for example, an analysis of impurities that may have been mixed into the plastic) and cross-section analysis to determine the cause of the defect and offer advice. It sometimes goes on-site to confirm the molding process and make suggestions for improvements.

At present, many Japanese automakers including Toyota and Honda have development centers in the Bangkok vicinity. The large parts supplier Denso also established a development center, using it to work with automakers on local development projects. As auto design and development procedures previously done in Japan are transferred to Thailand, Polyplastics deems it important to build relationships through its technical support during product development, so that its materials can be used. In the future, it will need to support processes such as material selection and product and mold design through computer-aided engineering.

The three key benefits of creating a center within NSTDA's MTEC are as follows: (1) information, (2) personnel, and (3) equipment. In regards to information, Polyplastics can detect development needs of the nation and customers through its NSTDA contacts and develop ways to roll out its business in foreign markets. For technical information, the company is in an environment where it can easily interact with advanced technologies sponsored by the NSTDA. Regarding personnel, the

company can expect to gain motivation in technical matters by working with NSTDA staff. In addition, one can expect a stable pool of employees because the NSTDA's image (i.e., an elite organization with many PhDs) and geographical benefits (short commute times and Bangkok vicinity location) make it easy to attract quality workers. In regard to equipment, private firms can borrow low-usage but expensive equipment such as molding and measuring equipment. The NSTDA also has large conference rooms, which Polyplastics is considering using for the company-sponsored seminars. However, according to the director of the center, these merits "cannot be realized by simply creating a center within NSTDA's MTEC. It is important to build good relationships with the NSTDA's research center and to closely share information with them" (from an April 2010 interview).

There are merits for MTEC as well. By working with Polyplastics, MTEC can gain technical expertise about industrial applications for high-performance chemical materials. Polyplastics provides opportunities for internships in its Japanese technical centers to NSTDA employees, providing a valuable opportunity for NSTDA researchers to learn about the industrialization of the center's technology.

13.5 Thailand's R&D Environment from the Perspective of Foreign Firms

Thailand has continued to grow economically at a relatively steady pace alongside the ever-increasing agglomeration of the automobile industry. However, the country lags behind when it comes to R&D focusing on a knowledge-intensive economy. As of 2006, R&D as a percent of Thailand's GDP was 0.25 %, unchanged since 2000, indicating a lack of improvement in economy's accumulation of knowledge. Among the ASEAN nations, Singapore's R&D as a percent of GDP is the highest at 2.5 %, followed by Malaysia and Thailand. Even compared to China (1.5 %) and India (0.8 %), Thailand's level of R&D spending is low. As for R&D costs on a sector basis, government and nonprofit organizations have high percentages, whereas R&D costs in the private sector are low at about 40 %. Thus, it is evident that the lack of R&D activities amongst the private firms is holding back the country overall in moving toward a knowledge-intensive economy (Fig. 13.1) (Table 13.1).

Furthermore, the government has historically considered academic research and the industrialization (or innovations) of such research separately, establishing the NSTDA as a pure research organization. Accordingly, academic research constitutes the main type of research conducted within the NSTDA, making it difficult to effectively conduct joint research with industry (Intarakumnerd and Chairatana 2008). From this perspective, Intarakumnerd's 2010 research, in which he compared the NSTDA with Taiwan's Industrial Technology Research Institute (ITRI), which played an important role in building the electronics industry of that country, is interesting. The biggest difference between the two is said to come down to whether there exist strategies for "technology industrialization." ITRI was given a clear mandate to build the electronics industry, acting as a coordinator for private consortiums in projects such as development of notebook computers. It also hired

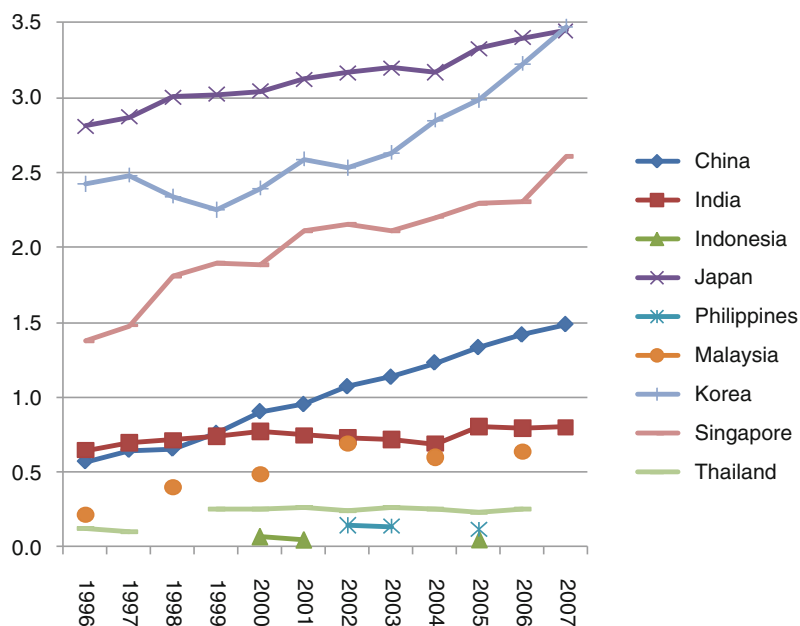


Fig. 13.1 R&D/GDP by country (%) (Source: UNESCO statistics)

Table 13.1 R&D share by sector (%)

	Year	Business	Government	Other non-profit
China	2007	72.3	19.2	8.5
India	2004	19.8	75.3	4.9
Indonesia	2005	3.7	96.2	0.0
Japan	2007	77.9	7.8	14.3
Korea	2007	76.2	11.7	12.1
Malaysia	2006	84.9	5.2	9.9
Philippines	2005	58.6	18.6	22.9
Singapore	2007	66.8	12.2	21.0
Thailand	2006	40.9	17.2	41.9
Vietnam	2002	14.5	66.4	19.0

many personnel with experience in private sector. On the other hand, the NSTDA has many PhDs, but focuses on academic work with fewer opportunities to interact with the private sector. In Thailand, the technology level within private firms is still rather low, an apparent contradiction against the goal of becoming a high-level science and technology center.

However, since 2002, the NSTDA has created and implemented a new strategy that incorporates innovation and is moving in the direction of R&D with the aim of industrialization as well as joint research with private corporations. The Technology Management Center was created in 2005 to enable technology transfer of research

results throughout the NSTDA as part of the above described goal. In addition, the share of government-related organizations' investments in R&D costs is high, with NSTDA constituting a significant portion, making it an attractive partner for foreign firms including Japanese firms to localize R&D activities. Competition with western firms is expected to become more intense within emerging markets in the future, and Japanese companies must make strategic decisions regarding global R&D. They must make crucial decisions regarding the strategy they will pursue in Thailand, where they have an advantage over western firms, as well as methods in utilizing government research organizations such as the NSTDA.

13.6 Main Themes of This Case Study and Points for Consideration

This case study was created to help readers consider the appropriateness of Thailand, where Japanese companies have a long history of operations, as a destination for an R&D facility, and the effectiveness for companies to establish partnerships with the state-run NSTDA. In expanding R&D facilities overseas, it is necessary to survey the R&D infrastructure (such as technology level, research personnel, intellectual property systems, industry–academia partnerships, and various policies like science parks) of the country in question. However, depending on the R&D goals, it may be more appropriate to co-locate operations within already existing overseas facilities (for example, factories) rather than build new, independent R&D centers.

In addition, it is important to consider the utilization of ideas and research resources for products and services available in the target country by strengthening partnerships with innovation systems within its borders (innovation network such as universities, public research organizations, and corporations). In doing so, it is often effective to collaborate with universities or public research organizations that invest in partnerships between industry and academia. In this chapter, we have provided points to consider when implementing open innovation overseas.

The consideration points for this case study are as follows:

- What were the various reasons Shiseido and Polyplastics had for creating R&D centers within the NSTDA? Explain these reasons using the six categories given in Chap. 12, summarized below.
 - Technology-centric (incorporating advanced foreign technology)
 - Market-centric (incorporating local consumer needs and product localization)
 - Policy-centric (responses to local regulations, R&D incentives, and participation in local standardization activities)
 - Production-centric (technical support for local production facilities)
 - Cost-centric (utilization of cheap local personnel)
 - Innovation-centric (acquisition of local ideas for new products, strengthening of global products development structures through optimal division of labor)

- It is critical that joint R&D be undertaken so that there are merits for both sides. What were the merits for NSTDA in the joint research performed with Shiseido and Polyplastics?
- Compare the R&D environment in Thailand with those of the ASEAN nations such as Indonesia, Malaysia, and the Philippines. What industries are best fits for R&D in Thailand? Why?
- When the industries in the previous question conduct R&D in Thailand, is it appropriate for them to engage in joint research with the NSTDA? List the various merits and demerits in doing so and discuss which are greater.

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