〈論　説〉

Task Overlapping Approach to Organizing R & D in Developing Countries:

From the Survey of 33 Japanese Multinationals

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1. Introduction

This paper analyzes Japanese manufacturing firms' international R & D organization in Japan and in Asian developing countries. These days, many multinationals started R & D activities in developing countries such as China, Thailand and India. However, there are only a small number of studies of it. Although many literatures about international R & D have already been published, most of them focused on R & D activities among well-developed countries and did not pay attention to R & D in developing countries. So I expect that this study would become one of the first footholds of researches about it.

A study of multinationals' R & D in developing countries may give us new organizational implications about international R & D. Although traditional R & D internationalization among developed countries is a horizontal specialization of each country's R & D site, multinationals' R & D direct investment in developing countries would be a vertical specialization between a home country site and a developing country site. For example, a Japanese electronics firm did basic research and product development in Japan, and did product improvement and process development in China. Such a vertical relationship between R & D sites has not been

examined before.

From the analysis of those vertical relationships between a Japanese home site and an Asian foreign site, this paper seeks to make one contribution to R & D organizational design studies. By surveying 33 Japanese manufacturing firms, this paper proposes a "task overlapping approach" to international R & D organization. Firms that took task overlapping approach do the same R & D tasks both in a Japanese home site and an Asian foreign site. Although task overlapping looks inefficient from the viewpoint of traditional Richardian FDI theory, it is reasonable for Japanese firms in order to achieve technical progress and its low-cost application simultaneously. Firms in the task overlapping form regard their Japanese home sites as "technical mother" that creates new technology, and their Asian foreign sites as "energetic children" that apply it to developing several new products and processes at low cost.

2. A shortage of studies of multinationals' vertical specialization of R & D between home country and developing countries

As mentioned before, a number of researchers have studied foreign direct investment (FDI) in R & D (Asakawa, 2001; Gassmann and Zedtwitz, 1999; Granstrand, Hakanson and Sjolander, 1993; Kuemmerle, 1999; Zedtwitz, Gassman, and Boutellier, 2004). Those researches have dealt with motives, logics, designs, problems or future directions of international R & D organization. But until late 1990s, they have mainly focused on the R & D internationalization among well-developed areas like North America, Western Europe and Japan. Considering knowledge concentration in developed countries in those days (Kuemmerle, 1999), it is natural that scholars exclusively paid attention to developed countries.

However, the situation has changed since around 2000. The more newly developing countries grew economically and technologically, the more multinationals did FDI in R & D in those countries like China, Brazil,

Singapore, Thailand and India (McKendrick, Doner and Haggard, 2000; Zedtwitz, 2004). From this point of view, we should consider FDI in R & D to newly developing countries.

Indeed, some researchers have started survey of multinationals' R & D in developing countries. Some of them used statistical methods to get an overview of the actual situation of R & D in newly developing countries (Chen, 2004; Motohashi, 2006; Zedtwitz, 2004). They had one common characteristic that they considered R & D sites in developing countries as if they located in well-developed countries. Most of researchers who analyzed developing country's R & D sites used the concepts and logics which were used for analyzing developed country's ones.

The other studies relied upon industry level or firm level case method (McKendrick, Doner and Haggard, 2000, Terwiesch, Bohnand Chea, 2001) to get rich insights of multinationals' R & D in developing countries. Although they have a limit of a generalization, they are valuable because they examined a new phenomenon: the *vertical* relationship between a home country site and a developing country site, which have not been considered in prior researches. They gave us basic findings about vertical relationship between home and developing country within a multinational: Multinationals did upstream R & D activities like basic research in home sites, transferred technologies from home sites to developing country sites, and did downstream R & D in developing country sites and commercialized new products and processes.

This paper tries to add more generalized vision to the findings of those pioneering studies of vertical specialization between a home site and a developing country site. Prior researches showed a firm's detailed vertical structure of a home site and a foreign site. But, because they focused on a small number of cases, they did not succeed in getting an overview of international vertical R & D specialization within a firm. By the analysis of 33 Japanese multinationals, this paper tries to find it and give some patterns of international vertical R & D specialization. Adding these findings to the prior researches, understandings about multination-

als' vertical R & D specialization structure would be updated.

3. Research method, key research question and data sample

This study dealt with internationalization of R & D in East Asia by Japanese manufacturers. Since late 1990s, Japanese manufacturers have

Table 1　List of 33 Japanese business unit, considered in this study

Sample No.	Product name	Product type	Location of foreign site	Year of foreign site establishment	Number of employees	Year and month of the research
X1	MMA monomer, polimer	Chemical	Singapore	1999	83	2009. 3
X2	Heat resistant paint	Chemical	Thailand	1996	150	2009. 5
X3	DVD media	Electronics	Singapore	1995	170	2009. 3
X4	PCB	Electric comp	Singapore	1974	1,069	2009. 3
X5	HDD media	Electric comp	Singapore	2003	1,150	2009. 3
X6	HDD magneto head	Electric comp	China	1986	45,000	2008. 2
X7	Printer	Electronics	Indonesia	1994	12,205	2009. 3
X8	HDD drive	Electronics	Thailand	1997	10,000	2008. 8
X9	Optical pick-up unit	Electric comp	China	1996	8,057	2005. 7
X10	Optical pick-up unit	Electric comp	China	1996	2,550	2005. 3
X11	DVD drive	Electronics	Philippine	1996	3,000	2006. 2
X12	LCD module	Electric comp	China	1996	6,150	2005. 3
X13	Air Conditioner	Electronics	China	1995	5,500	2005. 8
X14	HDD media	Electric comp	Singapore	1996	705	2007. 1
X15	Miniature bearing	Electric comp	Singapore	1972	800	2006. 12
X16	Multifunction peripheral	Electronics	China	1995	1,900	2007. 8
X17	Automobile component	Auto comp	Thailand	1974	2,906	2007. 11
X18	Automobile	Automobile	Thailand	1962	13,500	2009. 6
X19	Multifunction peripheral	Electronics	China	2002	10,800	2006. 11
X20	Automobile	Automobile	Thailand	1977	1,222	2009. 7
X21	HDD	Electronics	Thailand	1988	5,592	2007. 4
X22	Flat glass	Chemical	Thailand	1963	1,070	2009. 8
X23	Functional film	Auto comp	Thailand	2000	84	2009. 8
X24	Refrigerator	Electronics	Thailand	1989	2,850	2009. 8
X25	Air Conditioner	Electronics	Thailand	1991	2,800	2009. 8
X26	Refrigerator	Electronics	Thailand	1987	2,209	2009. 8
X27	Phenol-formaldehyde	Chemical	Indonesia	1995	60	2009. 12
X28	MBS resin	Chemical	Malaysia	1996	80	2009. 1
X29	Voltage converter	Electric comp	China	1994	10,000	2010. 2
X30	Automobile component	Auto comp	China	2001	1,233	2010. 3
X31	Petrochemical	Chemical	Malaysia	1999	50	2010. 7
X32	Functional film	Electric comp	Korea	2003	250	2010. 8
X33	Automobile component	Auto comp	Thailand	1993	90	2010. 9

started high level R & D activities in East Asian developing countries such as China or Thailand. But its actual situation has not been analyzed enough. Another target of this study is to get more understandings about it.

The analysis is based on the field based, interview and observation survey of 33 business units (BUs) within Japanese firms. The survey has been done in 2005–2010. The BUs were gathered from electronics, chemicals, and automobile industries (11 electronic product firms, 11 electric component firms, 2 automobile firms, 4 automobile component firms, and 5 chemical material firms). All of them operate R & D sites both in Japan and Asian developing countries which includes China, Korea, Thailand, Singapore, Indonesia, Malaysia and Philippines. About the details of all samples, see Table 1.

The object of the survey was to examine the organizational design of the BU's international R & D. In order to clarify the vertical relationships between the Japanese site and the Asian site, four components were checked in particular: R & D tasks done in the Japanese site, R & D tasks done in the Asian site, technology transfer from the Japanese site to the Asian site, and the reason for decision to make international R & D organization.

4. Analysis 1 : Task allocation and technology transfer

International location of R & D tasks by Japanese firms

First we investigate how Japanese firms located each R & D task in the home site or in the Asian site. Here I classify R & D process into 7 tasks: Basic research, core component development, new product development, product modification or variation, process design, process pilot-run or sample production, and process improvement. The former ones are upstream tasks of R & D, and the latter ones are downstream tasks.

Table 2 is the aggregate results of each BU's R & D task allocation. From Table 2 You can see three characteristics of Japanese manufac-

Table 2　How many firms did each R & D task in home or foreign site?

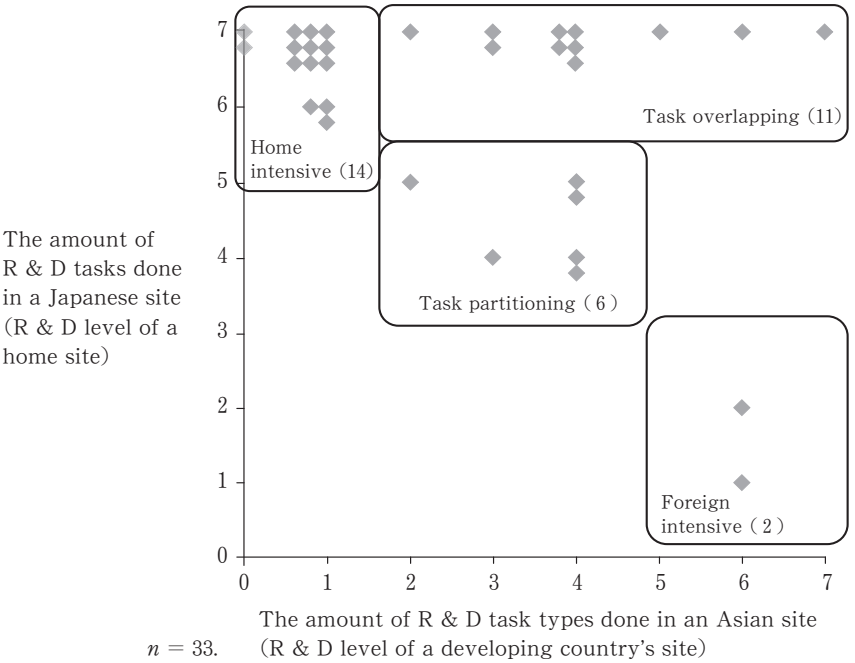
	Home base (Japan)	Asian subsidiary	Task overlap	Home only	Asian only
Basic research	33 (100%)	2 (6%)	2 (6%)	31 (94%)	0 (0%)
Core component development	32 (97%)	3 (9%)	2 (6%)	30 (91%)	1 (3%)
New product development	31 (94%)	5 (15%)	3 (9%)	28 (85%)	2 (6%)
Product modification/ variation	31 (94%)	16 (48%)	14 (42%)	17 (52%)	2 (6%)
Process design	28 (85%)	15 (45%)	10 (30%)	18 (55%)	5 (15%)
Process pilot-run/ sample production	26 (79%)	19 (58%)	12 (36%)	14 (42%)	7 (21%)
Process improvement	22 (67%)	31 (94%)	20 (61%)	2 (6%)	11 (33%)
(Commercial production)	22 (67%)	33 (100%)	22 (67%)	0 (0%)	11 (33%)

$n = 33$.

turers. (1)They kept many R & D tasks in their home sites, (2)especially they tended to put upstream R & D tasks in home sites and (3)downstream R & D tasks were often located in their Asian sites. Clearly we can reconfirm the prior research's finding that the home site covered upstream tasks and foreign did downstream ones.

In Table 2, also you can see the overlaps of the R & D tasks between the Japanese site and the Asian site. 42% of BUs did product modification/variation both in Japan and in Asian developing country. About process design and pilot-run, we can see overlaps in around 35% samples. Also we can see overlaps of process improvement in about 60% of BUs. Thus, we could say that Japanese firms tended to duplicate same R & D tasks both in home and Asian sites.

Figure 1 shows how many R & D tasks each sample do in the



$n = 33$.

Figure 1 Amounts of R & D tasks done by Home/foreign sites

Japanese site and the Asian site. The horizontal axis corresponds to the amount of R & D tasks in the Asian site and the vertical axis corresponds to that in the Japanese site. Here I define horizontal axis as "R & D level of a developing country's site", and vertical one as "R & D level of a home site". Analyzing a distribution of the samples, we classified all samples into four groups: 1) Home intensive group, 2) Foreign intensive group, 3) Task partitioning group, and 4) Task overlapping group.

Home intensive group includes 14 samples that are positioned in the upper left area of Figure 1 (Home R & D level ≥ 6 and foreign R & D level ≤ 1). This is the largest group in all 4 groups (42% of all samples). Firms in this group concentrated their R & D functions on the home site in Japan. Their Asian sites were mainly in charge of mass production. About R & D, they did process improvement (KAIZEN) at most.

Foreign intensive group includes only 2 firms. They are positioned in the lower right area (Home R & D level ≤ 2 and foreign R & D level ≥ 6). Those two firms did almost all R & D activities in Asian subsidiaries, and they did only basic research or core component development in the Japanese home site. This result would be directly related to the technology gap between Japan and the other Asian developing countries in several industry areas.

Firms that classified as task partitioning group are positioned at the center of the Figure 1 (Home R & D level is 3〜5, and foreign R & D level is 2〜4). 6 firms are included in this group. They divided their R & D tasks between a home site and an Asian site. In this sense I call this group as task partitioning (von Hippel, 1990). Typical pattern of "task partitioning" is as follows: a Japanese site does basic research, core component development and new product development, transferred those technology to the Asian site, and the Asian site does product variation, process development and process improvement.

Firms in those three groups (home intensive, foreign intensive and task partitioning) have one common feature. Firms of those three groups had no or a small portion of task overlaps between a home site and a foreign one (see Table 3). 8 firms have no overlaps, and 14 firms have small overlaps in one or two tasks. No task overlap is efficient in the sense of international division of lavor (Richardo, 1817; Dunning, 1979; Kogut, 1985). In Richardian comparative advantage theory, each country's site should specialize in different task and task duplication is costly. And the small size task overlap contributes to smooth technology transfer from one site to another. As Terwiesch, Bohnand Chea (2001) said, duplicated R & D section in the foreign subsidiary played a role of the receiver of technology from home site.

The fourth group is task overlapping, which consists of the firms positioned on the upper middle-right area (Home R & D level ≥ 6 and foreign R & D level ≥ 2). It includes 11 firms (33% of all samples), and it is the second largest group. Although firms in the other three groups had

Table 3 R & D task location of 33 Japanese business unit

Sample No.	Product type	Location of foreign site	Japan (home) headquarters								Asian (foreign) subsidiaries								Product technology from H to F		Process technology from H to F	
			Process improve-ment	Process pilot run	New process develop-ment	Product improve-ment	New process develop-ment	Core tech develop-ment	Basic research	Number of R & D activities	Process improve-ment	Process pilot run	New process develop-ment	Product improve-ment	New process develop-ment	Core tech develop-ment	Basic research	Number of R & D activities	Engineer transfer	Non-human transfer	Engineer transfer	Non-human transfer
X1	Chemical	Singapore	*	*	*	*	*	*	*	7								0		*		*
X2	Chemical	Thailand	*	*	*	*	*	*	*	7								0	*	*		*
X3	Electronics	Singapore	*	*	*	*	*	*	*	7	*							1		*		*
X4	Electric comp	Singapore	*	*	*	*	*	*	*	7	*	*	*	*	*	*	*	7	*		*	
X5	Electric comp	Singapore	*	*	*	*	*	*	*	7	*	*	*	*	*	*		6	*	*	*	*
X6	Electric comp	China						*	*	2	*	*	*	*	*		*	6	*	*	*	
X7	Electronics	Indonesia			*	*	*	*	*	5	*	*	*	*				4		*	*	*
X8	Electronics	Thailand		*	*	*	*	*	*	6	*							1	*	*	*	*
X9	Electric comp	China		*	*	*	*	*	*	6	*							1		*	*	*
X10	Electric comp	China				*	*	*	*	4	*	*	*					3		*		*
X11	Electronics	Philippine			*	*	*	*	*	5	*	*						2		*		*
X12	Electric comp	China	*	*	*	*	*	*	*	7	*	*	*	*				4	*	*	*	
X13	Electronics	China	*	*	*	*	*	*	*	7	*	*	*	*				4	*	*	*	
X14	Electric comp	Singapore							*	1	*	*	*	*	*	*		6	*	*	*	
X15	Electric comp	Singapore	*	*	*	*	*	*	*	7	*							1		*		*
X16	Electronics	China			*	*	*	*	*	5	*	*	*	*				4	*	*	*	
X17	Auto comp	Thailand	*	*	*	*	*	*	*	7	*	*	*	*				4		*		*
X18	Automobile	Thailand	*	*	*	*	*	*	*	7	*	*		*				3		*	*	*
X19	Electronics	China	*	*	*	*	*	*	*	7	*							1	*	*	*	*
X20	Automobile	Thailand	*	*	*	*	*	*	*	7	*							1		*		*
X21	Electronics	Thailand		*	*	*	*	*	*	6	*							1	*	*	*	*
X22	Chemical	Thailand	*	*	*	*	*	*	*	7	*							1		*	*	*
X23	Auto comp	Thailand	*	*	*	*	*	*	*	7	*							1		*	*	*
X24	Electronics	Thailand				*	*	*	*	4	*	*	*	*				4	*	*	*	
X25	Electronics	Thailand				*	*	*	*	4	*	*	*	*				4	*	*	*	
X26	Electronics	Thailand	*	*	*	*	*	*	*	7	*	*	*	*	*			5	*	*	*	
X27	Chemical	Indonesia	*	*	*	*	*	*	*	7	*							1		*		*
X28	Chemical	Malaysia	*	*	*	*	*	*	*	7	*							1		*		*
X29	Electric comp	China	*	*	*	*	*	*	*	7	*	*	*	*				4	*	*	*	*
X30	Auto comp	China	*	*	*	*	*	*	*	7	*	*						2	*	*	*	
X31	Chemical	Malaysia	*	*	*	*	*	*	*	7	*							1		*		*
X32	Electric comp	Korea	*	*	*	*	*	*	*	7	*	*	*	*				4	*	*	*	
X33	Auto comp	Thailand	*	*	*	*	*	*	*	7	*	*		*				3	*	*	*	*

no or small task overlaps, firms in this group had large portion of overlaps. So I defined this group as “task overlapping”. Firms in a task overlapping group had two characteristics: The first is that they kept all R & D functions in Japan, and the second is that they built up Asian subsidiaries' R & D functions simultaneously. As a result, their R & D activities are overlapping functionally in the Japan site and in the Asian site. For example, a Japanese electric component manufacturer (sample X5) did core technology development, product development and process development both in Japan and Singapore. As this group has second largest number of samples next after home intensive group, we can conclude that Japanese firms prefer keeping home sites' R & D capability when they make FDI in R & D to Asian developing countries. This is one of the chief findings of our field research (R & D location of all samples are shown in Table 3).

Technology transfer from Japan to Asian countries

Next, we check the technology transfer relationships from a Japanese site to an Asian site. We compare the transfer patterns among four groups defined in the prior section. Here we consider four types of technology transfer: product engineers' transfer, process engineers' transfer, product technology transfer by non-human way and process technology transfer by non-human way. Non-human transfer is the way to transfer technological information by sending trial pieces, equipment, videos and documents like manuals, drawings or technical papers. Transfer from Asia to Japan was not considered here, because there were few samples doing it.

The result is described in Table 4. First we can find that the linkage between the Japanese site and the Asian site is very strong. Every sample had transfer relationship. Especially non-human product technology transfers were done by almost all samples. Thus, we can say that Japanese firms regard their home sites' product technology as Asian basic one. Also other types of transfer were done by more than 50% of all firms.

Table 4 Technology transfer between home base and foreign subsidiary

	Product technology from home to foreign		Process technology from home to foreign	
	Engineers transfer	Non-human transfer	Engineers transfer	Non-human transfer
Home intensive (14)	4 (29%)	14 (100%)	6 (43%)	14 (100%)
Foreign intensive (2)	2 (100%)	2 (100%)	2 (100%)	0 (0%)
Task partitioning (6)	3 (50%)	6 (100%)	4 (67%)	3 (50%)
Task overlapping (11)	10 (91%)	10 (91%)	11 (100%)	5 (45%)
Total (33)	19 (58%)	32 (97%)	23 (70%)	22 (67%)

$n = 33$.

From these observations, Japanese firms considered their home sites as technology bases of their Asian subsidiaries. From the interview of Japanese managers, I found that some of them said their home sites as a "technical mother".

Firms in a home intensive group did not often let Japanese engineers go to their Asian subsidiaries. Instead, they transferred home base's technology to their subsidiaries by non-human way. Home intensive firms concentrated their R & D resources on their home site, and established both product and process technology. After that, those technologies were transferred to their Asian subsidiaries by sample pieces and documents (see Fig. 2).

Foreign intensive firms have strong ties between the home site and the foreign site. Product and process engineers' transfer could be seen in both firms. Such a strong relationship between home site and foreign site could be explained by the logic of monitoring. Foreign intensive firms only had basic research laboratories in Japan, so they relied heavily on their Asian subsidiaries about product and process development. In order to check Asian subsidiaries' development activities, firms intentionally connected Japanese home base to their Asian subsidiaries, by sending Japanese engineers to them. But, we cannot generalize those findings

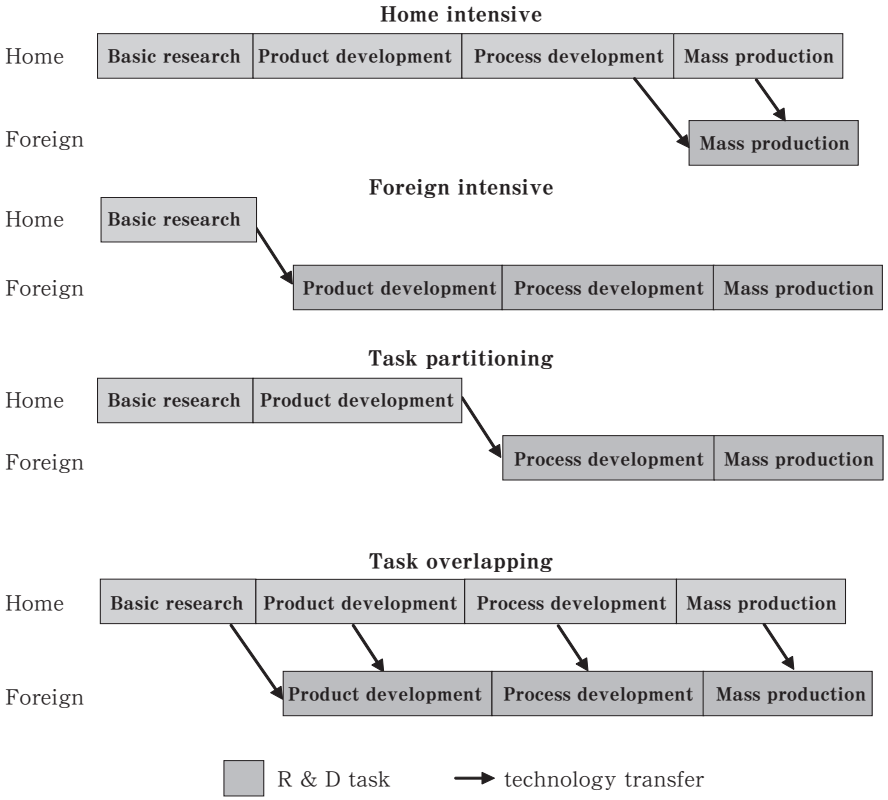


Figure 2　Task allocation and technology transfer of Japanese and Asian manufacturing sites

because foreign sample number is only 2.

Compared to the other groups, firms in the task partitioning group had small degree of technology transfer. Except non-human product technology transfer, the number of firms transferring technology in task partitioning group is smaller than that of firms in other groups. As task partitioning firms usually made clear distinction between the Japan site's task and the Asian site's task, they minimized the amount of technology transfer. For example, when the Japan site does basic research and new product development and the Asian site does process develop-

ment, a firm has only to transfer product technology from the Japanese site to the Asian site. It does not have to transfer other kinds of technology, such as process technology or product core component technology.

Firms in task overlapping group transferred technology more than those of other groups. Many of them did all four patterns of technology transfer (product/process, and human/non-human). Compared to firms in other groups, engineer transfers were frequently done by firms in task overlapping group in particular. Almost all samples of task overlapping group did engineer transfer for both product and process technology. As tacit and detailed knowledge can be transferred only by direct human communication (Kogut and Zander, 1993), we can conclude that firms in task overlapping group are more concerned about transferring tacit and detailed technology from Japanese home base to Asian subsidiaries than firms in the other groups.

5. Analysis 2 : The strategic reason behind four patterns of R & D internationalization

Analysis 2 deals with the strategic logic behind the international R & D organization. In analysis 1 we found four patterns of R & D internationalization. Then, how did firms determine their internationalization patterns? By interviewing managers in both or either Japanese site and/or Asian site, I tried to confirm the reason of their R & D organizational design.

Managers of home intensive firms said they organized their international R & D as home intensive because of 1) preventing technology leakage, 2) need of a consistency from basic research to commercialization, 3) Japan's technical lead (Granstrand, Hakanson and Sjolander, 1993) and 4) proximity to lead users in Japan (von Hippel, 1986). Their comments are shown below:

—Process technology is our important intellectual property. It has to be

protected strictly. To avoid technology leakage, we prohibited our oversea plant from engineering activities. (X1, general manager of Singapore subsidiary)

—Information about user needs is important for our new product development project. Japanese lead users always give us useful information, so we put our R & D function in Japan. (X2, business unit manager)

—Our business is truly technology intensive. I think all technologies can be developed only in Japan. (X9, vice president of China subsidiary)

—In our business area, Core technology, product technology and process technology are interconnected. All of them should be developed at the same time and at the same place, in Japan. (X21, Vice president of Thailand subsidiary)

Foreign intensive firms are X6 (HDD magneto head) and X14 (HDD media). Both of them worked in HDD industry. About HDD, technical forefront was not in Japan but in America and in Singapore. So X6 acquired Hong-Kong venture business which had been established by American scientists, and X14 started HDD media business in Singapore by FDI, in order to get HDD technology. Thus, those two firms chose foreign intensive R & D organization because they compensate home base's weakness with foreign high technology (Lehrer, Asakawa and Behnam, 2011).

All of six firms in task partitioning group have one same reason for their R & D internationalization. That is, the Asian site was more efficient than the Japanese site in doing downstream R & D tasks. Then, they abandoned downstream R & D task in Japan and built up new R & D organization in Asian subsidiaries. The reasons of efficiency of the Asian site were several: 1) lower labor cost, 2) proximity to the foreign customers (Granstrand, Hakanson and Sjolander, 1993; McKendrick, Doner and Haggard, 2000) and 3) proximity to mass production plant (Terwiesch, Bohn and Chea, 2001):

—In 1990s, we stopped manufacturing in Japan, because of the cost disadvantage. After closing the plant in Japan, we established new one in Thailand. We moved the process development section from Japan to Thailand, as it is convenient that the process development section set near the mass production section. We continued basic research and product development in Japan. (X25, general manager of Thailand subsidiary)

—To heighten the organizational capability of our manufacturing site, value engineering activity is essential. So we built product engineering section next to the plant in Indonesia. In Japan we focus on core technology and new product development. In Indonesia, we modify and improve the product design to match Indonesian customers' needs. (X7, president of Indonesian subsidiaries)

The reason that firms took task overlapping R & D internationalization is a little bit complex. First, all of them had an unchangeable policy that all technologies were kept in their home sites in Japan. As wrote before, Firms in task overlapping group often called the Japanese R & D site as "technical mother", because they expected the Japanese site played a role of global technical base which supply several technical information to all foreign subsidiaries. In addition to this policy, firms in task overlapping group felt they should make use of Asian low-cost and rich labor. So they developed basic product and process technology in Japan at first, then they improve and vary those technologies in Asian subsidiaries for 1) making variation design for global market, 2) speedy design change to respond to customers' requests or 3) improving manufacturability.

—I think all technologies have to be kept in Japan. I'm afraid that we cannot manage the foreign site if we abandon the home site. So we continue product and process development and mass production in Japan, in spite of high operation cost. In our Chinese R & D site, engineers improve and vary the basic product or process design trans-

ferred from Japan. (X16, president of China subsidiary)

—To modify product design for fitting in customer needs in Thailand, Product and process development sections are essential for Thailand subsidiary. But, the technical capability of Thailand subsidiary is not enough to create truly new product. It can be done only in Japanese headquarter, which has higher technical capabilities than Thailand subsidiary. (X17, R & D manager of Thailand subsidiary)

—In Japan, we try to upgrade our technical horizon. In Korea, we developed a new product which is wanted by customers, by using new technologies created in Japan. (X32, general manager of Korean subsidiary)

6. Discussion

Task overlapping: Japanese' specific approach to R & D in developing countries

In the Analysis 1, we researched the actual situation of Japanese firms' R & D internationalization in East and Southeast Asian area. In that section we found four types of R & D international organization: home intensive, foreign intensive, task partitioning and task overlapping. Among them, we must pay attention to "task overlapping" because it seemed to be a specific approach to Japanese manufacturers. As prior researches suggested, when multinationals constructed vertical relationships between the home site and the developing country site in R & D, they basically partitioned R & D tasks clearly: they gave upstream tasks to a developed county site, downstream tasks to a newly developing country site and made small overlaps to transfer technologies smoothly (McKendrick, Doner and Haggard, 2000, Terwiesch, Bohn and Chea, 2001). However, in this study comparatively many firms (33%) had task overlapping approach. Many Japanese firms kept full R & D functions in Japan, and they also built up high level R & D in Asian subsidiaries. As a result, several R & D activities were overlapping between Japanese

home base and Asian subsidiaries. A discovery of task overlapping approach by Japanese firms would be one of the chief contributions of this study.

We should focus on task overlapping organization because it cannot be explained by the existing logics of FDI. As we saw in the Analysis 1 and 2, another three types of internationalization can be explained by the existing researches, but only task overlapping firms cannot. Rather, task overlapping was regarded as waste of limited R & D resources by some existing literatures. Basically prior researches, especially ones which were based on Richardo's theory of comparative advantage, have the logic of a "choice" of locations: Which home or foreign should a firm do each R & D task in? According to this theory, a firm should choice either home or foreign, with considering several merits and demerits of the location (Kogut, 1985; Rugman, 1986). Setting the same R & D functions in two locations is not efficient from that point of view. Then, why did Japanese firms overlapped R & D activities in spite of the inefficiency of functional duplication?

The logic of a task overlapping

Task overlapping is a suitable form that affords to progress technical horizon and to develop many variations of product and process at low cost at the same time. For the firms in a task overlapping group, while the home site's R & D tasks are the same as the foreign site's ones, the "role" of the home site's R & D is different from that of the foreign site's. The home site is in charge of technical progress as an innovator, to keep up with global technological competition. Some firms explained the role of their home sites as a "technical mother", because the home site brings about new technologies and gave it to their children: foreign subsidiaries.

In task overlapping approach, the Asian foreign site is in charge of low-cost and a great deal of product and process development, to respond to global customers' needs that vary all over the world and request lower prices. Task overlapping firms regarded their foreign sites as an "ener-

getic children". They could make much more variations of product and process by plentiful and low-cost human resources than home sites. But they had to rely on the technology transferred from Japan, because their technical capability was not as high as that of their Japanese home base. Thus, they are "children" of Japanese technical mother, but they are more energetic than their mother because they had much more and low-cost human resources.

The key point is a technology transfer from the Japanese site to the Asian site. As we checked in analysis 1, task overlapping firms have more flourishing technology transfer relationships than the other firms. Figure 2 shows why task overlapping transferred more. The more R & D tasks are overlapped, the more opportunities to transfer technology increased. While firms in other three groups have only one contact point in which transfer occurs, firms in task overlapping group have several contact points. In other words, task overlapping is the mechanism that promotes technical transfer from a Japan site to an Asian site. They aim to compensate for the potential loss of task duplication with the merit of plentiful technical transfer.

Thus, the logic of task overlapping is as follows: First, firms innovate new technology in Japan with the home site's high R & D capabilities. Next, they transfer it to their R & D site in developing countries. Finally they develop several product and process in an Asian site with inexpensive and plentiful human resources.

However, one condition must be held in order to make a task overlapping form run. It is that the Japanese site always keeps the technical leaders in the global competition. If the Japanese site is on a technically disadvantageous position, or if the Asian site (or competitors) can easily catch up with the Japanese site, task overlapping is not efficient form. In such situations firms should take the other organizational options like home base compensating FDI (Lehrer, Asakawa and Behnam, 2011). In this sense, even if the Japanese site is still a technical leader now, it has to make much effort to upgrade their technical horizon to take advantage of

task overlapping approach.

7. Conclusion

This study mainly considered the vertical relationships between a home R & D site in a developed country and one in an Asian developing country within Japanese multinationals. The trend that firms built up R & D facilities in developing countries will accelerate continuously. Thus, the more studies of it must be done in the future. For future research, here I indicate the limitation of this study. First, this study dealt only with Japanese manufacturers' FDI to East and Southeast Asian developing area. Firms in other country or in other industries, and FDI to other area have to be tested in the future. From such researches we will find a new approach or logic of vertical relationships in R & D between developed and developing country. Also we have to consider the managerial problems of the vertical relationship as well as its merits. To solve those questions, much more attention must be paid to this phenomenon.

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