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R&D and innovation by the Japanese firms in Japan and foreign countries, especially in Asian countries

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I. Difficulty and inevitable change of Japanese firms' R&D and innovation strategy

(1) Introduction

Prominent performance of innovation shall be the most important engine for accelerating Japan's economy in the “growth stage of innovation driven” since 1980s (Porter, 1990). It is noteworthy that Japanese firms' R&D and innovation strategy has changed gradually in recent years. In general, they tried to shift the originally inward looking strategies into the direction oriented toward more outward looking ones in Japan and also in foreign countries. The noteworthy change in their R&D and innovation strategy is closely linked with their rather unsatisfied performance of R&D and innovation in comparison with that of Western firms in recent years. They have to seek now the reinforcement of their competitiveness in the R&D and innovation field through more diversified and outward looking strategies. Focusing on Asia, this paper try to clarify the sort of more flexible and open strategies in R&D and innovation can be necessarily done by Japanese firms in home and foreign countries for their achieving reinforcement of their R&D and innovation capability.

The contents of this paper are the following. The residual part of this section I describes, first, the Japanese firms R&D system and their prominent performance in the past, second, recent difficulties which they are facing now in the age of “ICT (Information Communication Technology) revolution” and “Modularity” and, finally, their changing strategy for aiming at

reinforcing the competitiveness. The section II shows a recent trend of Japanese firms R&D in foreign countries, including North America, Europe and Asia, where they indicate regionally specified characteristics. The section III compares Japanese firms R&D activity in ASEAN countries with that in China in relation to their FDI (Foreign Direct Investment) strategy in general. The section IV is a consideration regarding the R&D strategy in Asia as an effective tool for reinforcing the competitiveness of Japanese firms. The last section V is a conclusion and some policy implication of this paper.

(2) Difficulty and inevitable change of Japanese firms' R&D and innovation strategy

Japanese firms traditionally have preserved their R&D activity in their headquarters in Japan through the most period after the World War II. In many cases they established large-scale central research institutes for doing basic research and for developing new products or new production system. They could utilize well their own human resources effectively for achieving those works within their companies. On the other hand, they were not so eager to cooperate with other firms in R&D business because they could achieve enough good performance for creating new products through in-house R&D until the 1980s, especially, in the electronics and ICT industry.

It is noteworthy that, at the same time, Japanese automobile industry has established prominent R&D system in cooperation between assembling firms and parts suppliers for creating successfully new key components/parts (Asanuma etc.). while large-scale Japanese assembling firms have also succeeded in continuously developing new models of cars in their large-scale central Research Institute, where they have achieved good performance not only in development of new models of automobile but also in developing cutting edge technology of "hybrid system" for car and "electric vehicles." In this case, the cooperative R&D activity was implemented by automobile assembling firms in close communication with rather limited and specified parts suppliers,

which were regarded by the assembling firms as enough qualified partners to achieve the joint R&D works for developing new parts. This case of automobile industry is a successful result of good coordination of “integrated technology” between assembling firms and parts suppliers.

Japanese firms’ high R&D expenditure, accelerated growth of numbers of patent application/grant and growing productivity were clear evidences of their prominent Ownership advantages in R&D activity, which established much confidence among Japanese firms on their own R&D system in the 1980s. However, through the long-lasting recession in the 1990s, Japanese firms gradually lost their confidence on their R&D activity. According to Research report by Development of Japan (DBJ) (No. 63, 2004), real growth rate of R&D expenditure by Japanese private firms was 9.2% in the 1980s (FY 1981 to 1990) and the rate was declined to 1.2% in the 1990s (FY 1991 to 2000). By industry, the report says, electronics and telecommunication industry was the largest and most vigorously growing industry, which was followed by electric equipment industry and automobile industry in the 1990s in comparison with the 1980s while chemical industry and steel industry diminished the share on the 1990s.

An empirical result of the research report by DBJ (No. 63) concluded that the contribution of R&D expenditure in the 1990s on labor productivity in Japan was very weak while other empirical results found clear contribution of R&D expenditure in the period of 1980s and the 1990s.

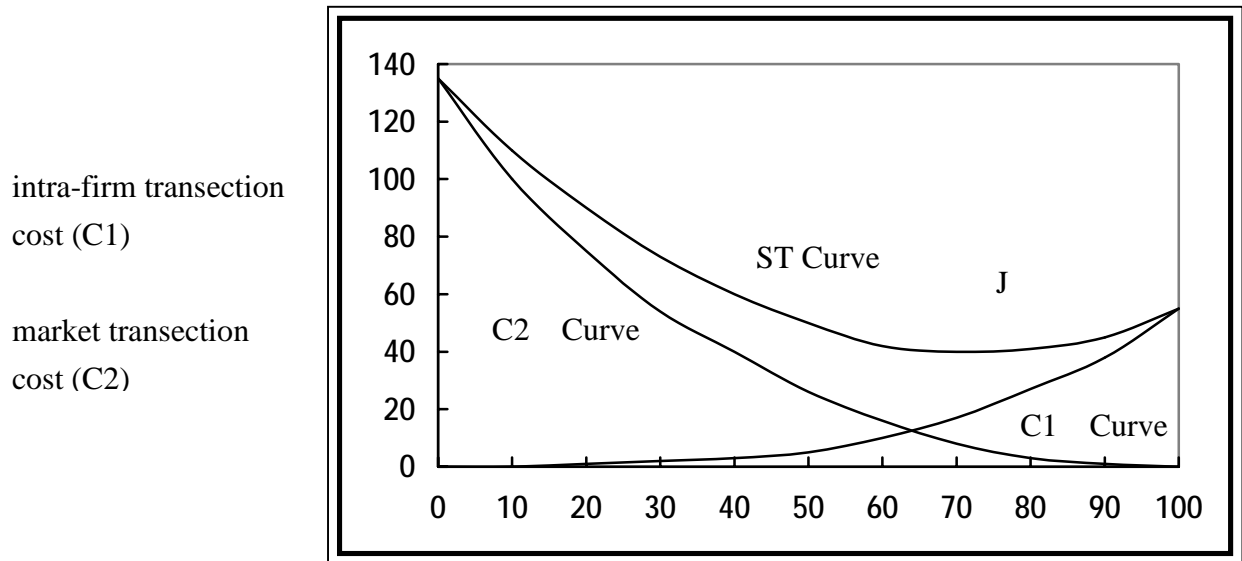
Total R&D expenditure in US dollars of Japan preserved the second position after the USA in the period from 1996 to 2002 (UNCTAD). However, the nominal value of the annual R&D expenditure was slightly declined from 130.1 billion US dollars to 124.0 billion US dollars in the same period while that of the USA increased considerably from 197.7 billion US dollar to 277.1 billion US dollar, according to UNCTAD.

One important issue is that “ICT revolution” in Western (the USA, Canada and the EU) countries, especially, in the USA,

has changed the basic framework of R&D and production system into the “Modularity” of products and the open and optimum combination (“Architecture”) of various modules into new products. In the view by the author of this paper, the Modularity means a continuous process of transforming complicated “Specialty,” which is originally differentiated for specified usage in the sense of O. Williamson, into “Commodity” products (for example, development of common parts, which can be used commonly by various assemblers). Naturally, in the trend of the “Modularity” R&D is continuously accomplished for creating new modules. Furthermore, creating good combination of independent modules in R&D can produce new types of high value added products. Development of new modules, designing new architecture and producing new final products, which are consisted of new modules and new architectures, are mutually independent works. In other words, “Modularity” based on “ICT revolution” disconnected R&D activity from the manufacturing activity, which is consisted of production of parts and assembling of those parts. Competent western firms can concentrate on the sophisticated works of designing new architecture of modules and/or developing new modules, leaving production of modules and new final products to foreign manufacturer, which do it with the lowest cost, for example, EMS firms.

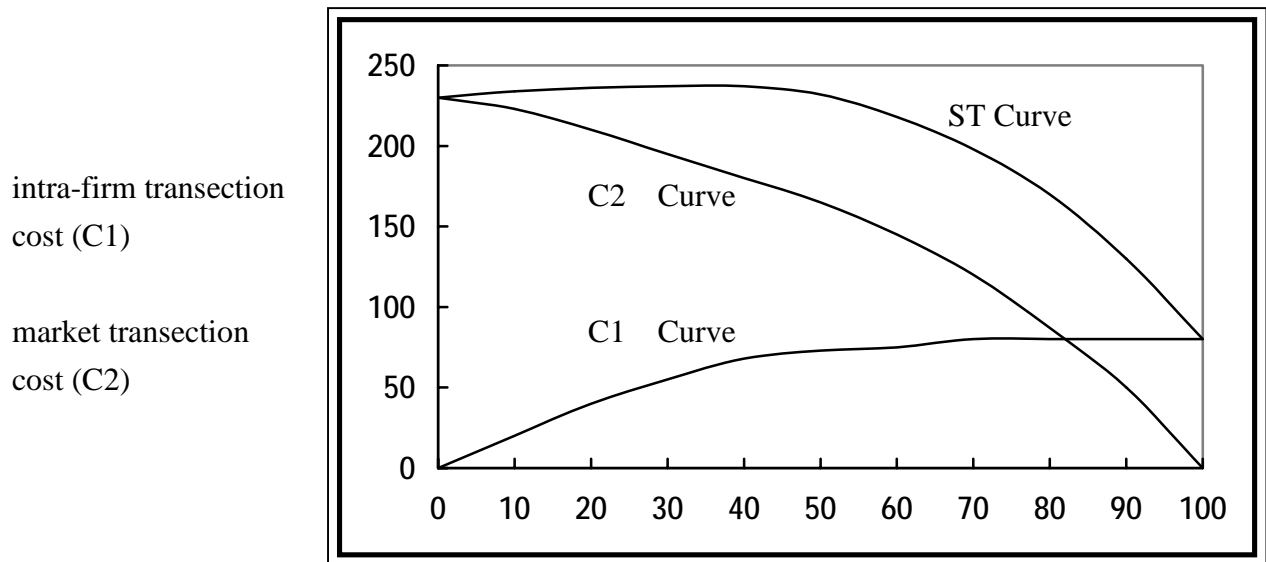
On the contrary, Japanese firms have their prominent “Ownership advantage” in producing well-qualified parts, which have nature of “specialty“, and in assembling those parts into well-qualified final products, which have also nature of “specialty.” Therefore, R&D was concentrated for developing those “specialty.” The ownership advantage of Japanese firms is originated from their system to minimize the sum of market transaction cost and intra-firm transaction cost through achieving stable transaction with their suppliers over the long-term period upon condition of periodical re-negotiation between the both parties from time to time (see Tejima, 1996, 1998, 2000 and 2002) (please see Figure 1 and Figure 2).

Figure 1 Japanese firms' total transaction cost



The share () of internal parts production by the company itself in the total parts procurement (Made by Author of this paper)

Figure 2 Western firms' total transaction cost



The share () of internal parts production by the company itself in the total parts procurement (Made by Author of this paper)

The transaction cost amounts to a high level in the trade of

“specialty products” in the market transaction or intra-firm trade, according to O. Williamson. Social and institutional system of Japan supported the ownership advantage of Japanese firms in various aspects. The social and institutional system consisted of “life-time employment system”, official pension system beneficial for retired people after finishing “the life-time employment” and people’s taste of preferring stable transaction over the long-term period to short-term opportunistic profit in human resource market and intermediate goods market. The ownership advantage based on reduction of transaction costs is still the origin of prominent competitiveness of Japanese firms in automobile industry and some types of electronics and ICT industry

However, the appearance of “Modularity” based on “ICT revolution” has reduced Japanese ownership advantage through drastic transformation of the former-specialty goods to commodity goods. Ownership advantage of Japanese firms for reducing transaction cost has depreciated their value since the beginning of the “Modularity” age because the trade in “commodity” products does not incur much transaction cost. Rather, Western firms concentrated on R&D of “new modules” and “new architecture” of modules, leaving production of those products to manufacturer, which can do the business at the lowest cost in the world. “Modularity” gives much opportunity for Western firms to obtain good performance in R&D.

Therefore, Japanese firms have preserved their competitiveness only in specified industries, in which the transformation from “specialty” to “commodity” is difficult, for example, automobile industry.

Except the automobile industry, many Japanese firms in manufacturing industries in difficulty recognized that their traditional R&D system based on the resources of their own company was facing more severe competition with Western (US and European) firms, above all, US firms than before.

Reflecting prominent growth of US firms’ innovative capacity in the 1990s, Japanese firms have struggled to turn to

US R&D system, including more open and cooperative R&D with unrelated companies, involving strategic alliance and M&A with domestic and foreign firms in R&D field, while maintaining conventional R&D system between assembling firms and parts suppliers in automobile industry.

No doubt, accessing the latest technological know-how in the world and strengthening close communication of technology information with foreign firms are the most important and indispensable measures for any firms to be winner in the global competition. Certainly, synergy effects caused by close communication among different scientific and technology resources of different countries and firms may produce prominent innovation. It is said that many recent major innovations have occurred through cross-fertilization of different scientific discipline (Too, 2005).

In this context, Japanese firms have become more active to extend moderately their overseas R&D activity through their affiliates in foreign countries than before, because they seek more foreign resources and more communications with foreign firms for strengthen R&D globally. Although many Japanese firms are still maintaining the most important core of R&D function in their headquarters in the home country, all of the most advanced R&D may not be always achieved in the home country.

Certainly, the most advanced R&D may be achieved in other developed countries for developing the new products, which can be accepted globally by sophisticated consumers in the world, if the optimum center of excellence of the technology does exist in the foreign country and/or if the large market for the newly created high value added products actually exists.

On the other hand, in Asian countries, Japanese firms try to utilize the location advantage of host countries through employing abundant and lower waged human resources for local R&D works in their foreign affiliates. According to the idea of life cycles of technology systems, the latecomers like Singapore can take good opportunities for imitating and finally catching up with the original innovation (new technology) if the country has

enough pools of well trained human resources, especially in science and technology even though they are with little industrial experience (Too, 2005: Reddy 2000). However, most of Japanese firms' R&D works in Asia shall be mainly designing some types of products, which can be responding rapidly and appropriately to growing local market.

In the next section, we see the general trend of Japanese firms' R&D in foreign countries in more detail.

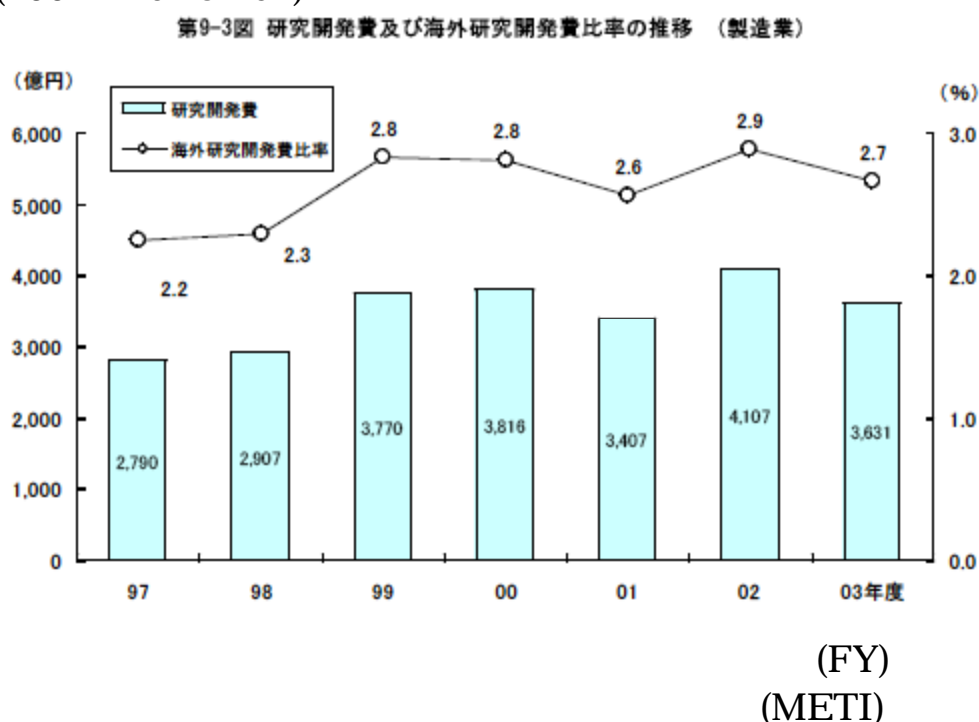
II. Recent trend of Japanese firms' R&D in foreign countries

According to the Survey of Overseas business by Japan's Ministry of Economy, Trade and Industry (METI overseas research), Japanese firms' overseas R&D expenditure has increased substantially from 279 thousand million Japanese Yen (about 2.8 thousand million US dollars) in FY 1997 to 363 thousand million Japanese Yen (about 3.6 thousand million US dollars) by 30.1 % in FY 2003 (Figure 3), if we assume that one US dollars is equivalent to 100 Japanese Yen for simplification. Still, the ratio of overseas R&D expenditure to domestic R&D expenditure plus overseas R&D expenditure is relatively low but it was gradually increased from 2.2% to 2.7 % in the same period (from FY 1997 to FY 2003), where we define that overseas R&D expenditure is implemented by Japanese firm's affiliates in foreign countries and that domestic R&D expenditure is implemented by Japanese parent firm's in Japan.

When we focus on the trend of overseas R&D expenditure by region, according to the METI overseas research, 50 % or more of the total R&D expenditure was annually oriented toward North America in the period from FY 1993 to FY 2001. Europe was the second largest destination for Japan's overseas R&D expenditure and Asia was the third largest. In that sense, still Asia was far less important host region of Japan's overseas R&D expenditure than Western countries although the annual expenditure was steadily increased in the same period.

Figure 3 Japan's R&D expenditure and its overseas R&D

expenditure
(100million J Yen)



If we see the average R&D expenditure by one company, the past trend informs extremely small scale of R&D expenditure in Asia in comparison with North America and Europe (Table 1) although the expenditure in Asia gradually increased.

Table 1 Average R&D expenditure per one company by region

Region	FY	2000	2001	2002	2003
Total		415	385	405	344
North America		893	720	914	690
Asia		86	95	93	102
Europe		501	843	626	660

(METI overseas research)

It is also informed that North America and European Union shall be more promising destination in both basic research over the long term period and development for new products and improvement of existing products, based on annual questionnaire survey by the Research Institute of Japan Bank for International Cooperation (JBIC) of FY 2002. The survey says 6.4% of all

respondents of Japanese firms, which is investing in North America, answered that they will strengthen the basic research in the next three years and 11% of them answered to strengthen the development of new products and improvement of current products. 6.9 % of the respondents in European Union answered that they will strengthen the basic research and 12.1% of them will strengthen the development role. On the other hand, Japanese firms investing Asia had less positive motivation in R&D. The survey says that respondent rate for the basic research and the rate for the development were respectively 2.0% and 5.3% in NIEs (Korea, Hong Kong, Taiwan and Singapore in the JBIC survey), 2.3% and 3.5% in ASEAN (Thailand, Indonesia, Philippines and Malaysia in the same survey) and, finally, 1.2% and 3.7% in China. Those figures show that Japanese firms regards that Western countries have more prominent location advantages for R&D activity than Asia.

The annual survey of FY 2004 by the same bank announced again the similar results. It says that “the development of new products for local markets” was voted by 6.7% of respondents as the FDI motivation in China for next three years while the same figure was 4.8 % in Thailand, 3.8% in Malaysia and 12.2 % in the USA. The development of new product was still stronger FDI motivation in the USA than in Asia.

However, according to the report by Nomura research Institute, which is correcting Japanese newspapers' information, about 50% of official announcement of new R&D projects was concentrated in China in recent three years (2003 to 2005), while about one quarter of the new projects was planned in North America. Highly growing China may be correcting so many R&D projects by Japanese affiliates although the size of those projects is far smaller than that in Western countries.

We can find three types of R&D projects implemented by Japanese firms through their affiliates in North America, according to Nomura report.

First, basic research was intended in the field of medical

science, biotechnology and nanotechnology, with the strong expectation for commercialization of new products within five to ten years. Those types of R&D FDI are attracted by the location advantages of host countries, which can offer prominent human resources with much expertise in research, huge accumulation of technological basement, highly accumulated industrial cluster and large scale markets for expensive high value added products.

Second, R&D expenditure was achieved by automobile firms for achieving local development and commercial production of new products, which was in accompany with new R&D activity by Japanese parts / materials suppliers in North America.

Third, in general, R&D expenditure was done in many fields for developing new products, which are sensitively responding to the taste of local markets of developed countries, and which are more appropriately harmonized to the local standard and technological basement of host countries.

We can also find similar R&D expenditure in Europe in the first type R&D in biotechnology and industrial machine and second type of R&D by auto-parts firms.

In China, Japanese firms engaged in diversified R&D projects for achieving many purposes, which are different from R&D expenditure in Western countries.

First, R&D expenditure was implemented for developing new products, which are sensitively responding to the taste of local markets, and for developing new production process, which are based on the local resources and location advantages of a host country in electronics and ICT industries. In those industries Japanese firms' product differentiation strategy through developing new products accepted by local market is the most important in electronics and ICT industries, while avoiding severe price competition of "commodity" product with Chinese local firms.

Second, R&D expenditure shall be rapidly increased by automobile firms for accomplishing local development and commercial production of new products, which was in accompany with growing R&D activity by Japanese parts/materials suppliers

in China. Supplying modern model of automobile accepted by local market of China is the most important strategy for Japanese firms in automobile industry.

Third, some Japanese firms were proceeding in R&D projects under University-Industry Interactions with Universities in China.

Forth, some Japanese R&D center was established in China for preserving Chinese engineers, because Japanese firms faced with difficulty in preserving enough amount of Japanese engineer in Japan with such low cost as China.

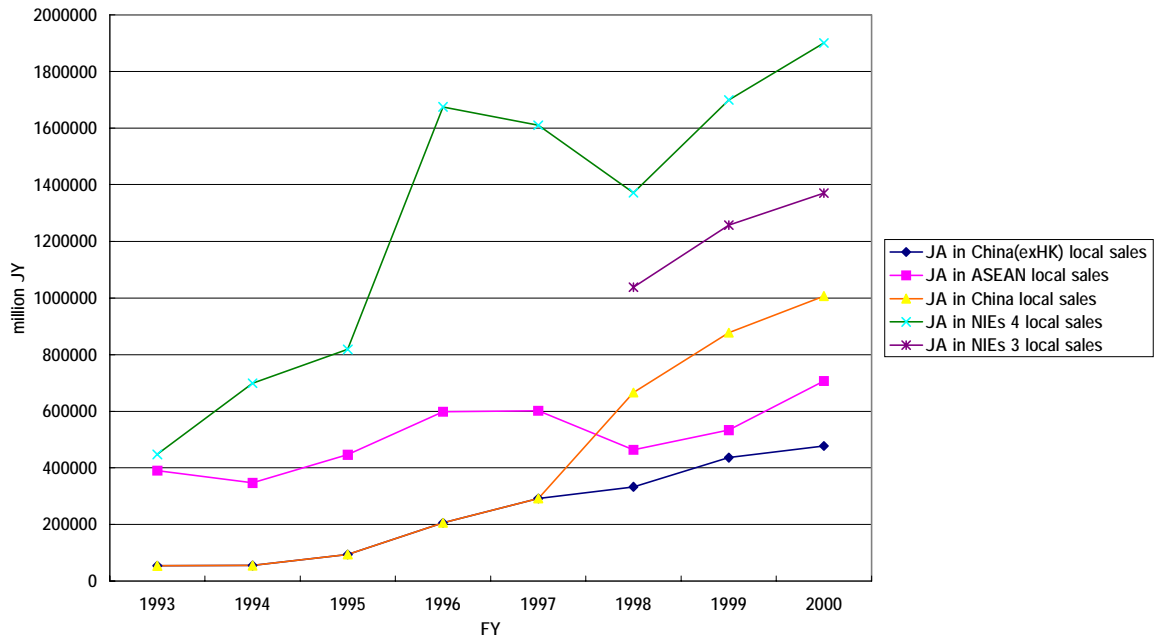
Finally, in Asia except China, we can find, first, R&D projects by Matsushita and Sony, both of which have constructed R&D facilities, and joint research projects by Olympus and Waseda University under University-Industry Interaction with Nanyang Technological University in Singapore (Too 2005; Nihon Keizai Sinbun), second, R&D projects of developing new products, which are accepted in local markets, for strengthen production and sales bases in Thailand, Malaysia, Vietnam and India and, third, R&D projects under alliance with local IT venture firms in Taiwan. In next section, we see Japanese firms' R&D in ASEAN in comparison with China.

III. Japanese firms' R&D in ASEAN Countries in comparison with China

When we consider international division of works by Japanese firms' in Asian region, we find that, first, the most advanced R&D, production and sales of the highest value added products are implemented by parent companies in Japan and, second, the production and sales of technologically established product are handled in Asia, especially, China and ASEAN countries. It is noteworthy that the function of developing and designing new products suitable for local market in host Asian countries is shifting from Japan to those Asian countries. The above development and designing is the most popular type of

Figure 4 Local sales by Japanese affiliates in China, ASEAN and NIEs in the electric machinery industry

JA sales by region (12) electrical machinery local sales



(Compiled with METI overseas research)

R&D, which is now prevailing in ASEAN and China.

In that sense, ASEAN countries are in competition with China for attracting Japanese firms' R&D activity, especially, in the transportation machinery (automobile) industry and electric machinery industry, including ICT, because ASEAN and China is competing in attracting Japan's FDI for constructing production and sales bases in the transportation machinery industry and electric machinery industry, including ICT industry.

According to the METI overseas research, Japanese affiliates in the electric machinery industry located in China, including Hong Kong, have recorded larger sales value for local market than Japanese affiliates located in ASEAN 4, including Philippines, Malaysia, Indonesia and Thailand since FY 1998 (Figure 4). On the other hand, Japanese affiliates in the same industry located in ASEAN 4 have recorded still far higher export performance to third countries (Western countries, other Asia etc.) than those located in China, including Hong Kong (Figure 5).

Based on the above argument, Figure 4 suggests that Japanese affiliates in China will extend more R&D expenditure

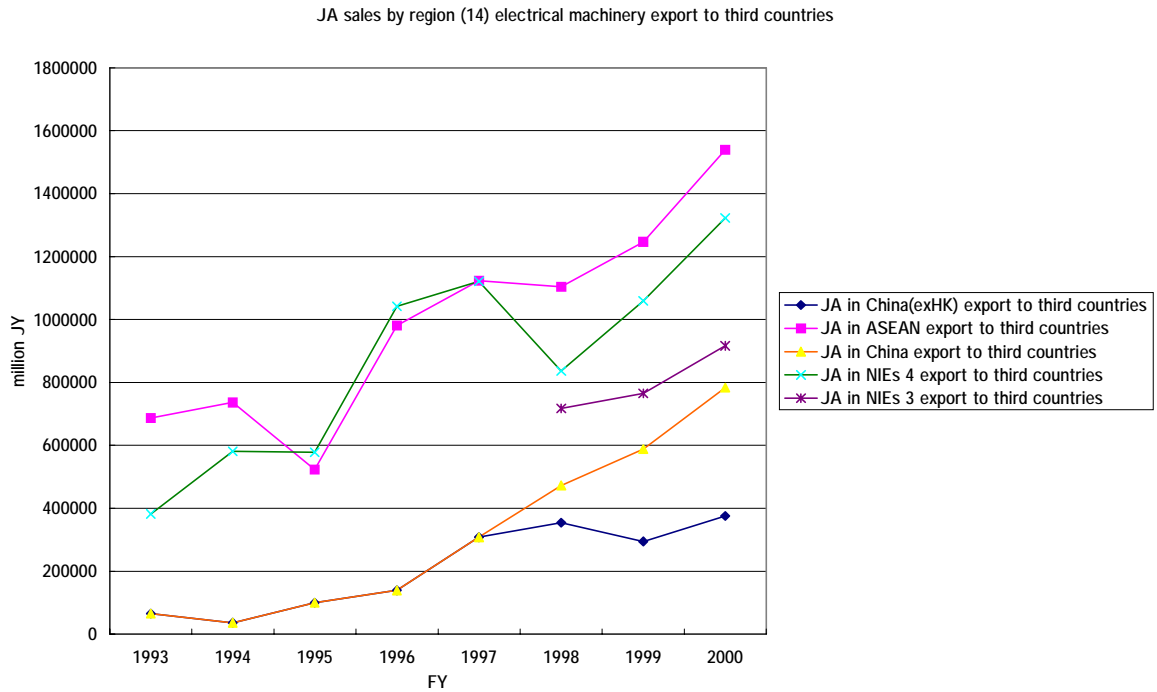
for development of new products adequate for preserving the local market than in ASEAN4 in the electric equipment industry. The good example is development of mobile phone in the third generation in China (NRI 2002).

On the other hand, Figure 5 implies that Japanese affiliates in ASEAN 4 will extend more R&D expenditure for development of new products appropriate for obtaining export market than Japanese affiliates in China in the electric manufacturing industry.

It is noteworthy that Japan's FDI in China in the electric manufacturing industry has grown up in accelerated pace while that in Thailand has been rather stagnant since FY 2000 (Figure 6). The positive FDI attitude of Japanese firms was far more prominent in China than in Thailand although sales and profit performances of Japanese affiliates in China, excluding Hong Kong, are mostly same level with them in Thailand in the electric equipment industry. The situation is more drastic in the automobile industry. The sales performance of Japanese affiliates in ASEAN 4 was far more prominent than that in China both in local market and export market (Figure 7). Even in that case, Japan's FDI in China was accelerated, while FDI in Thailand was stagnant (Figure 8). The more positive FDI attitude in China reflects Japanese firms' much expectation for the potentiality of market growth in China.

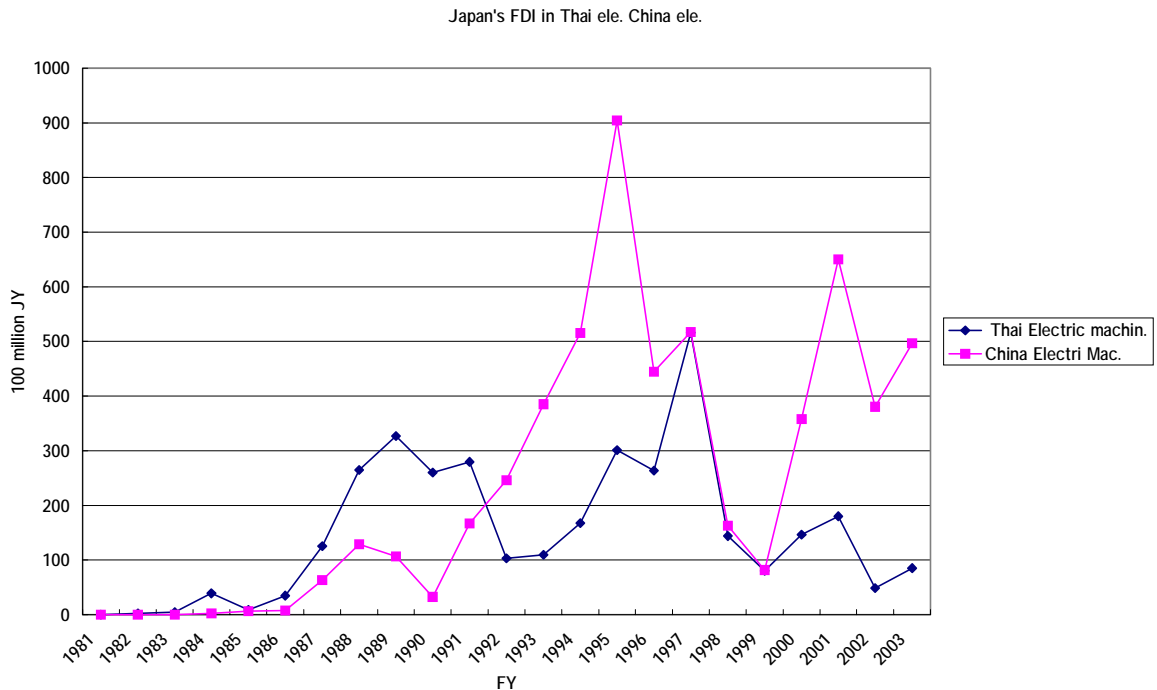
In other words, Japanese firms may have a brief, in recent days, that they have to take an advantageous position in the high growing markets of China for their taking advantages in competition with Western firms, because Japanese and Western firms have already established considerable production and sales networks in the large-scale market of developed countries.

Figure 5 Export sales by Japanese affiliates in China, ASEAN and NIEs in the electric machinery industry



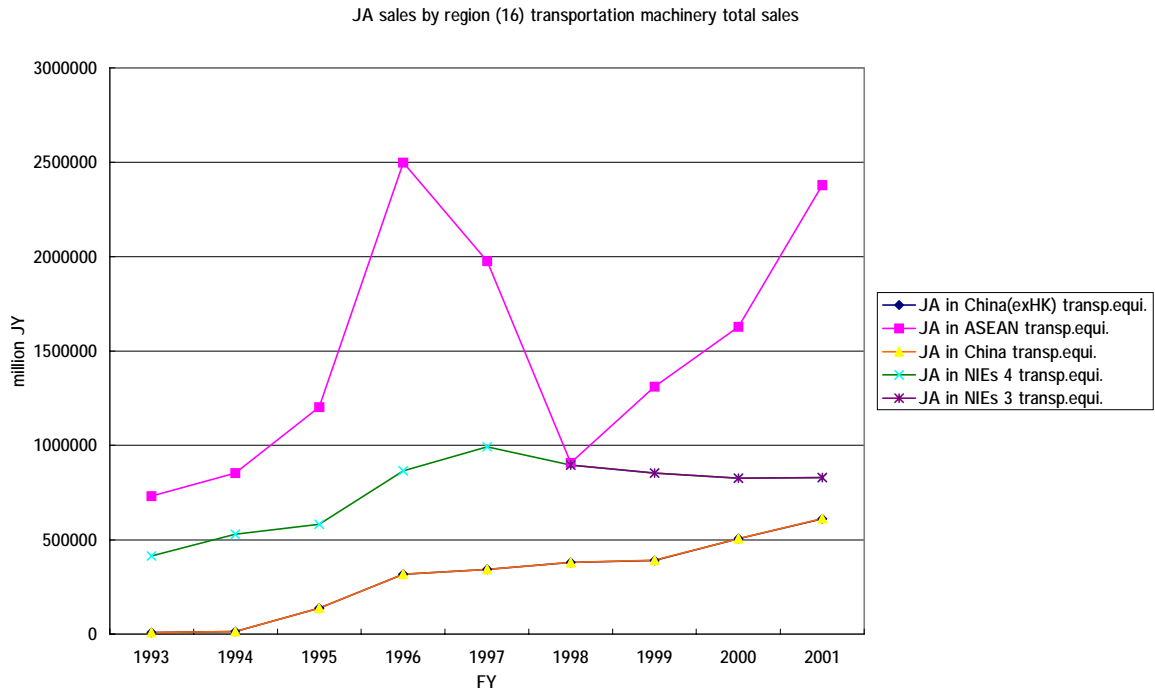
(Compiled with METI overseas research)

Figure 6 Japan's FDI in Thailand and China in the electric machinery industry



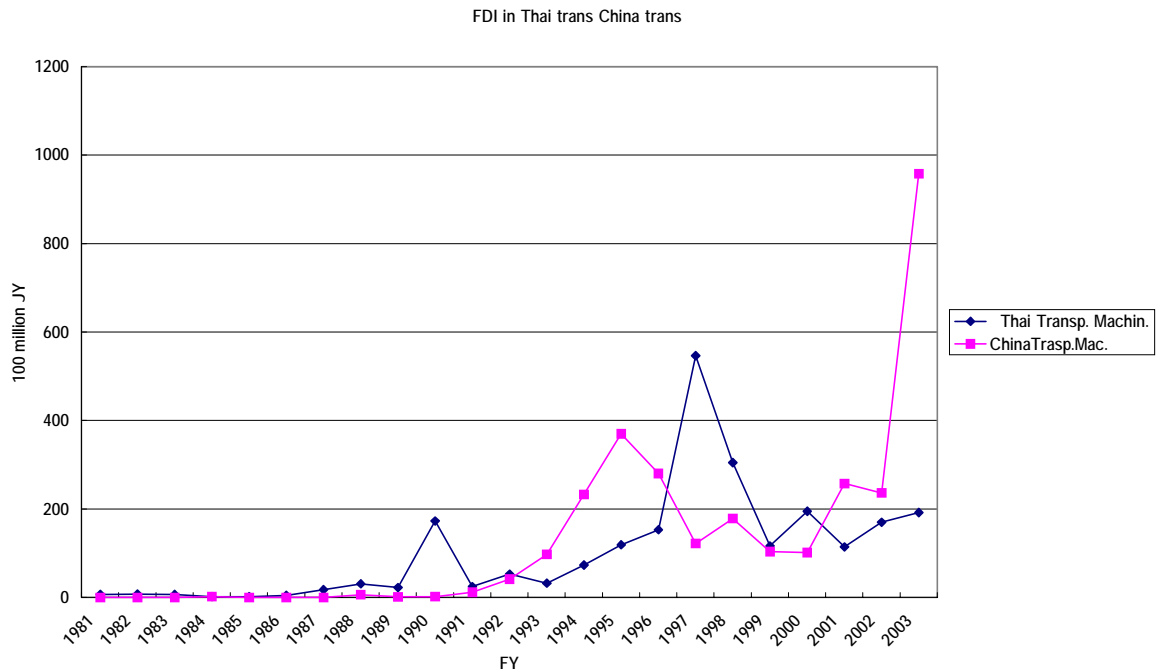
(Compiled with MOF FDI statistics)

Figure 7 Total sales by Japanese affiliates in China, ASEAN and NIEs in the transportation machinery (automobile) industry



(Compiled with METI Overseas Research)

Figure 8 Japan's FDI in Thailand and China in the transportation machinery industry



(Compiled with MOF FDI statistics)

Therefore, more FDI in China, which is stimulated by Japanese firms' strong expectation for growing China markets, cause more R&D FDI in China than in ASEAN, because most of R&D projects implemented by Japanese firms is aiming at increasing production and sales in Asian market. In that sense, China is in a good cycle of more FDI for production and sales closely connected with more R&D expenditure while ASEAN is in a disadvantageous cycle.

Naturally, it seems that the actual performance of sales and profit will affect FDI policy of Japanese firms over the long-term period. Additionally, reflecting the country risk of China as a host country, Japanese firms may have taken more balanced policies for maintaining both production and sales networks in both ASEAN and China over the long-term period. It suggests that more balanced R&D expenditure is also assigned by Japanese firms between ASEAN and China.

However, in order to make it sure this prospects of Japanese R&D expenditure in Asia over the long-term period, ASEAN need to make efforts for developing confidence of Japanese firms of the high potentiality of local market of ASEAN. For the further consideration, we will see further Japanese firms R&D strategy in Asia.

IV. How to manage R&D expenditure for developing competitive products in Asia

In recent years one important issue for Japanese firms is how to compete or not to compete with Chinese firms in Chinese market and other Asian market. Chinese firms have developed their strong price/cost competitiveness, first, through receiving effectively technology transfer from Japanese and Western firms, second, through outsourcing standardized modules and architecture from foreign firms, including Japanese, Western and Taiwanese firms, and third, through utilizing well abundant and low waged human resources in production. In order to clarify the competitiveness of Chinese firms, we can assume a kind of "China production business model" (Nobeoka/Ueno 2005; Ueda

2005), where Chinese manufacturers can imitate high value added products made in Japan and produce more simplified imitations of products with lower price than Japanese firms. They accelerate “transformation to commodity” of new “specialty” products, which are developed by Japanese firms as “differentiated goods”, and offer their “standardized commodity product” with far lower price in Asian markets. They can offer far lower price because they utilize skillfully human resources and many local and foreign parts suppliers in China, which produce “standardized parts” with low cost.

Their production system is quite opposite to that of Japanese manufacturer, which produce high value added products with reasonable prices. The high value added product is produced through the effective coordination between assembling firms and parts suppliers in Japan. The assemblers have prominent capability of skillful integration of sophisticated parts, which are produced by Japanese parts suppliers. The both parties frequently achieved joint R&D for developing newly “specialized parts”. Japanese firms naturally offer far higher qualified yet more expensive products than Chinese firms in Asian markets. It is noteworthy that in many cases, Asian markets prefer lower price and standardized quality of new products to sophisticated yet expensive product. It causes much difficulty for Japanese firms. Japanese firms are achieving three types of strategies, responding to the difficulty in China market

The first strategy for Japanese firms to overcome the so called “Chinese business model” is to develop continuously higher value added and more sophisticated products than before and to offer continuously those new valuable products in Asian market as far as possible, avoiding to be involved in price competition of “standardized” products (or “commodity” products) with Chinese local firms (Marukawa 2005, Kuniyoshi 2005). This strategy is valid if Japanese firms can preserve large-scale and growing market in Asia, which is seeking for the higher value added products. Actually, it happened in home electronics products market at present and, may be, automobile market in future in

China. However, if Japanese firms cannot find enough sophisticated market for high value added products in Asia, they have to take another strategy.

The second strategy is developing new models of products, which have more price competitiveness than original Japanese products. For example, one Japanese TNC achieved the development of low cost production system of motorcycles in Japan and produced them in Vietnam and south China, using more local or other Asian parts than before, responding to local taste of Asian market, which prefer lower priced motorcycles to expensive and sophisticated luxury motorcycles. In order to preserve the success of this strategy, the company established R&D center for developing new products, which are responding more effectively to the preference of local market in Vietnam.

The third strategy is constructing global export bases in Asia, which supply global products to global markets. In this strategy, Japan's firms have to produce highly qualified yet reasonably priced products with their global brand, which can be accepted in global market. Naturally, this strategy is not influenced by "Chinese business model." For example, according to the announcement by Toyota, the company has established production bases as well as R&D center (TOYOTA Technical Center Asia Pacific Thailand: TTCAP) in Bangkok, in order to supply an international strategic car "IMV" for the world market. TTCAP is in charge of developing product, responding well to the need of world market for IMV.

V. Conclusion: Some Policy Implications for Japanese firms and Asian host countries

Reflecting the above argument, we can find some policy implications for strengthen R&D and innovation capabilities of Japanese firms and strengthening of R&D expenditure by Japanese firms in Asia.

First, Japanese firms can and should utilize fully the location advantage of national innovation system of Asian host countries, where technically qualified human resources are

continuously grown up and the accumulation of clustering in ICT industries and automobile industries are steadily developed, for achieving the objective of their complementary reinforcing production, sales, R&D and innovation capability through positive FDI in the field of R&D expenditure in the framework of the three strategies explained in the previous section.

Second, ASEAN countries as well as China can be promising destination of Japan's FDI, including R&D expenditure, if they can offer, first, the growing large-scale markets for higher value added products, second, substantial accumulation of parts suppliers, which offer wide variety of well qualified and reasonably priced parts and, third, well-trained human resources. In other words, Asian countries' various policy tools for achieving the growing economy and national innovation system shall be absolutely necessary for attracting FDI, including R&D. Some ASEAN countries, including Singapore and, to some extent, Thailand, are succeeding in that policy as well as China.

Third, ASEAN integration of regional market shall be achieved completely for forming large-scale market for high value added products for attracting more production FDI and R&D expenditure.

Forth, constructing the accumulation of parts suppliers in transportation equipment, electronics and ICT industries is an effective policy measure for each host country to attracting FDI and R&D projects for building export bases for global market.

Fifth, naturally, development of human resources, especially in the field of Science and Technology stimulated by host government is absolutely necessary to implement all three types of strategies by Japan's firms described in the previous section.

Sixth, University-Industry Interactions shall be more extended between Asia and Japan.

All those policy tools shall strengthen the position of Asian countries as host for R&D by Japanese firms in the world and it also strengthen the R&D and innovation capability of Japanese firms.

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