Carriers of Regionalization:
The East Asian Production Networks of Japanese Electronics Firms

Dieter Ernst

BRIE Working Paper 73

1994

Acknowledgments

This study reports on research undertaken as part of BRIE's research project on *Foreign Direct Investment and Technology Diffusion in East Asia,* and has benefited from the generous support of the Center for Global Partnership (CGP) and the Alfred P. Sloan Foundation. An earlier version was presented at the BRIE/Asia Foundation Conference *Japanese Production Networks in Asia: International Production Strategies in a Rapidly Changing World*, San Francisco, California, September 26-27, 1994.

I was fortunate to receive critical comments from Toshihiko Kinoshita (Research Institute for International Investment and Development, The Export-Import Bank of Japan) that helped me to correct some pitfalls and to sharpen my argument. I owe a special debt of gratitude to Masaru Yoshitomi (The Long Term Credit Bank Institute of Research), Ken-ichi Imai (Stanford Japan Center, Kyoto), Yasunori Baba (University of Tokyo), Kenji Okumura (Fujitsu Research Institute) and Dennis S. Tachiki (Sakura Institute of Research), all of whom helped me to understand some of the peculiar features of the Japanese industrial production system. I am equally grateful to François Chesnais (Université Paris Nord), Paolo Guerrieri (University of Naples), and Lynn Mytelka (Carleton University, Ottawa) with whom over the years I have continuously discussed some of the fundamental issues underlying this paper.

I have also benefited from stimulating discussions and criticism from colleagues and friends at BRIE, especially Michael Borrus, Manuel Castells, Stephen S. Cohen and John Zysman, and from Sylvia Ostry (Center for International Studies at the University of Toronto), You-tien Hsing (University of British Columbia, Vancouver), Richard Doner (Emory University), Peter Evans (University of California at Berkeley), Stephan Haggard and Barry Naughton (both from the Graduate School of International Relations and Pacific Studies, University of California at San Diego), Martin Kenney (University of California at Davis), David Mowery (University of California at Berkeley), Annolee Saxenian (University of California at Berkeley) and Steve Parker (The Asia Foundation). Finally, I would like to thank Greg Linden for his dedicated and outstanding research assistance and his comments on this manuscript. Naturally, responsibility for any errors is mine alone.

Introduction

Far-reaching changes are occurring today in the organization and location of production of industrial goods and services, and this is bound to have important implications for the welfare, the development potential and the competitive position of different countries and regions. Two changes are of particular importance. As competition cuts across national and sectoral boundaries and becomes increasingly global, firms nearly everywhere are forced to shift from exports to international production. At the same time, firms are under increasing pressure to rationalize their international production activities in order to reduce the substantial coordination costs involved and in order to improve their capacity to react in time to technological change and to changing market requirements.

Both changes occur simultaneously: international production expands at an accelerating pace, while firms attempt to reorganize and integrate their main business functions -- across different countries -- as part of increasingly complex international production networks. Both changes have raised a number of important new challenges for public policy, while at the same time creating new constraints for policy implementation. It is thus important to understand why firms are forced to shift from exports to international production, what factors shape the localization and organization of such activities and what impacts these changes are likely to have on both home and host countries of such investments.

There is a rich body of literature that addresses such questions.[1] This is not the place for a detailed discussion, but let me just summarize some conclusions that I have drawn from this literature:

First, decisions on strategy, organization and geographic location are closely interdependent. In essence, however, strategy conditions organization and geographic location. Suppose, for instance, that company A's strategic focus is on continuous market share expansion for relatively mature products, based on price competition and rapid product differentiation. Suppose further that company B's main objective is to develop new markets based on its capacity to define and control international product standards. Company A in principle is more concerned about production efficiency, especially for core components, while company B's main concern is to establish close interactions between product design and marketing, and thus may be more willing to outsource manufacturing activities. Both companies thus are likely to differ substantially with regard to the types of production activities they will locate abroad and where, with regard to the activities they keep in-house and the activities they source from other firms, and in how they organize these different intra-firm and inter-firm transactions.

---

[1] For useful overview surveys, see Dicken [1992, 2nd edition], Dunning [1993], Moran (ed.) [1993] and United Nations [1993], chapters V to VII. See also Krugman and Graham [1992], McCulloch [1992], Chesnais [1992], Blomström [1992] ,Yao-Su Hu [1992] and Safarian [1990].

Second, a company's strategic orientation is shaped by a variety of factors. Suppose two companies face roughly identical competitive pressures. Let's also suppose that their product mix is roughly identical and that their production processes share fundamentally similar techno-economic features. Even then, wide variations may exist in the strategies that these companies may choose at a particular point in time.

Third, such variations exist, because each company's history matters, as does its size and organizational trajectory. The same is true for key features of a company's home country. While factor endowments, in terms of the availability of key production factors, are of great importance, they are only part of the story. Of equal importance are specific features of the home country's institutions and organizations, as well as those of its industry structure and demand patterns, its policy framework and incentive system, and its human capital and technological capabilities.

Fourth, as firms may widely differ in their strategic response to identical competitive pressures, this poses a serious challenge to a cherished notion of mainstream economists. Is it really true that, as Raymond Vernon, Paul Krugman and others claim,[2] international investment strategies of multinational firms will converge over time no matter what their national origin? Is it really possible to assume that Japanese firms do not have any choice but to proceed in a way roughly similar to the pattern of international production that was established earlier on by American and European firms? Or are there not substantial differences in how Japanese firms develop their international production activities, with the result that the impacts of these activities may also be substantially different?

It is with these fundamental questions in mind that I have designed this study. These questions cannot be answered through logical reasoning but require empirical research. I start from the assumption that the organization of international production networks varies as much by industry and firm as by nationality. The current study is a first attempt to explore to what degree each of these three factors explains differences in international production networks.

I focus on the extension of Japanese electronics production into East Asia,[3] and analyze why the regional production networks that have resulted from this extension are now under pressure to open up and why they are forced to deepen their integration with some of the host country economies. The sole purpose of this exercise is to explore the forces and mechanisms that shape the gradual opening-up of these Japanese Asian production networks. I do not attempt to compare the level of openness of Japanese networks with that of competing networks established by U.S. electronics firms and those from Europe, Taiwan, South Korea, Singapore and Hong Kong. Such a comparative study

---

[2] Vernon [1971] and [1977] and Graham and Krugman [1992].

has to wait till we have collected sufficient information on each of these different regional production networks.[4]

I have chosen to concentrate on the electronics industry because, since the mid-1980s, this industry has been the main driving force behind Japanese manufacturing investment into the region and thus may help us to understand better possible future perspectives for other industries. Between 1985 and 1993, nearly half of the total increase of Japanese manufacturing foreign direct investment (FDI) in East Asia went into electronics (Yoshitomi [1994], p.16). And an earlier set of data, developed by the Japan Institute for Overseas Investment, shows that between 1986 and 1991, investments into the electronics industry were more than double the amount of investment into chemicals and nearly four times the amount spend on the transportation sector (Japan Institute for Overseas Investment [1993], table 5).

The first section of the study describes the methodology and information sources used. In section II, I briefly document three basic features of the East Asian production networks of Japanese electronics firms: their wide geographic coverage, their contribution to increasing regional specialization and their heavy reliance on intra-firm transactions. In section III, I introduce a conceptual framework for analyzing the closed nature of Japanese regional production networks and document how closed they have been in East Asia.

In section IV, I shift gear and analyze how new competitive pressures that have emerged since the early 1990s may force Japanese electronics firms to gradually open up their Asian production networks. While the yen appreciation has played an important catalytic role in determining the timing of such changes, I argue that more fundamental forces are at work. Japanese electronics firms thus will be forced to continue the expansion and reorganization of their East Asian production networks even after the yen will depreciate again. Seven of these structural pressure are of particular relevance: pressures to open up regional procurement patterns; changes in the role of Japanese component suppliers; substantial improvements in locational advantages of East Asian host countries; the rising cost of Asian labor; pressures to broaden the capability transfer; pressures resulting from the increasing importance of access to East Asian domestic markets; and, finally, pressures resulting from a broadening of the product mix of regional production networks.

Section V takes our analysis one step further and discusses how the proliferation of competing regional production networks may affect the options that Japanese electronics firms have in reorganizing their East Asian production networks. I distinguish three aspects: interactions with

---

[3] I define East Asia to include four first-tier Newly Industrializing Economies (South Korea, Taiwan, Singapore and Hong Kong), the ASEAN-Four (Malaysia, Thailand, the Philippines and Indonesia), China and Vietnam.

established production networks in semiconductors and disk drives; the entry of new players, from within the region, with new priorities and distinct organizational patterns; and the spread of hybrid forms of regional production networks that may result from the interaction between these different regional production networks.

I conclude with a brief assessment of the chances that Japanese regional production networks will become more open. While substantial implementation constraints exist, my overall assessment is that very little can stop this opening-up, but that the process will be painfully slow and difficult, fraught with a variety of potential conflicts. It would be quite unrealistic to expect that such opening-up will occur naturally, simply as a reflection of market forces.

I Methodology and Information Sources

In order to understand changes in the international production networks, it is not sufficient to analyze just aggregate trade and investment data. Such an analysis needs to be complemented by a case-study approach. I thus attach great importance to the analysis of specific firm strategies in the context of a particular industry, or even better, a particular industry segment. In the study, I use a combination of both approaches. Without such a combined approach it would be difficult to understand what factors drive the organization and strategies of international production, and how these approaches to international production differ across countries and industrial sectors. I also found it very useful to complement the analytical framework developed by trade and investment theories by those developed in organizational and network theories.[5]

This study is based on interviews that I have undertaken in Japan and East Asia over the last 15 years. The most recent round of these interviews took place in November 1993. Together with Dr. Sylvia Ostry from the Center for International Studies at the University of Toronto, I have interviewed 11 major Japanese electronics companies, all of which have substantial overseas investment in East Asia. Our main interest was to establish some basic features of the regional production networks that Japanese electronics firms have established in East Asia. We also wanted to understand how Japanese firms are currently changing these production networks in response to new competitive requirements that have emerged since the early 1990s and how this will affect international trade patterns and the diffusion of technological capabilities within the region.

In addition to the company interviews, we conducted a total of 16 background interviews with government agencies, industry associations, international organizations, banks and venture capital

---

[4] For a related study on Asian production networks of U.S. electronics firms, see Borrus [forthcoming].

firms, and research institutes. Here our main concern was to collect information on Japanese overseas investment and trade patterns in East Asia and on current "industrial adjustment" requirements in Japan which shape the East Asian investment and production network strategies of Japanese electronics firms.[6]

In the choice of our firm sample, we have attempted to capture a reasonably diverse group of firms, in terms of their organizational structure and strategy, their product mix, their technological sophistication and their degree of internationalization. Our sample consisted of the five major diversified electronics companies (NEC, Toshiba, Mitsubishi Electric Corp. [MELCO], Hitachi and Fujitsu), the three leading consumer electronics and appliance producers (Matsushita Electric Industrial [MEI], Sony and Sharp), one producer of office equipment and computer peripherals (Canon) and two electronic component producers (Alps and Minebea). Most of our interviews dealt with consumer products and electronic components which reflects the importance of these product groups in the earlier rounds of overseas investment of Japanese electronics firms in East Asia. In some cases, however, we were also able to discuss some specific features of overseas investment and regional production networks related to computers and peripheral equipment, semiconductors, and telecommunications equipment (fax machines and switching equipment).

In addition to the interviews, my second source of information is a comprehensive data base, developed as part of the BRIE research project *FDI and Technology Diffusion in East Asia*. This data base collects information on how leading electronics firms from the United States, Japan, Europe, South Korea, Taiwan, Singapore and Hong Kong have organized their international production networks in East Asia, how they are readjusting them, and how these different production networks are overlapping and interacting. Apart from a detailed company profile, the data base provides, for each company, information on the location, the date of establishment, the product mix and the current number of employees for each of its East Asian production affiliates. For these affiliates, we have also collected information on ownership patterns, joint venture partners, sales and purchasing patterns, subcontracting and OEM (original equipment manufacturing) arrangements, R&D and related support services and training activities.[7]

II The Extension of Japanese Regional Production Networks

---

[5] See for instance Axelsson et al. (eds.) [1992], Forsgren et al. (eds.) [1992], Biemans [1992], and Whitley [1992]. For a useful survey, see OECD [1992], chapters 3 and 4. See also Castells [forthcoming].

[6] For both sets of interviews, I would like to acknowledge the generous support and help provided by the Research Institute of the Long-Term Credit Bank, Tokyo and JETRO Tokyo.

[7] For details, see Ernst and Linden [1994].

Over the last three decades, Japanese electronics firms have substantially extended their overseas production activities in East Asia. Originally, tariff-hopping and attempts to reap the substantial windfall profits available in highly protected domestic markets have been the main motivations. Since the late 1970s however, practically all the leading Japanese electronics firms have begun to invest in a variety of export platform production activities, often in a close symbiotic relation with their main small- and medium-sized Japanese component suppliers. Especially since 1985, periodic yen appreciations have played an important catalytic role, and have led to a massive expansion of such export-oriented FDI. Over time, the focus of such investments has shifted twice -- from Northeast Asia (Korea, Taiwan and Hong Kong) to the ASEAN region (primarily Singapore, Malaysia and Thailand) and, since around 1992, from the ASEAN region to China and (possibly) also now to Vietnam. Japanese electronics firms thus have substantially extended the geographic coverage of their East Asian production activities.

II.1 Regional Specialization -- the Increase of Intra-Industry Trade between Japan and East Asia

Official trade and investment figures indicate a certain progress in regional specialization, as reflected in an increase of intra-industry trade between Japan and East Asia.[8] Since 1985, intra-industry trade has grown most rapidly for home appliances and consumer electronics, with a clear trend towards an increasing sophistication of the products involved. More recently, similar increases have been discerned for electronic components (especially semiconductors and picture tubes) and office equipment (especially computer-related products and fax machines).[9]

MITI data on sales and purchasing patterns of East Asian subsidiaries of Japanese electronics firms clearly document an increase of regional specialization.[10] Within one year, the share of sales to non-Asian destinations (North America, Europe and ROW) declined from more than 20% to 9.4%. At the same time, the share of local sales increased from less than 35% in fiscal year 1991 to more than 45% in FY 1992, while sales to Japan increased from 24% to more than 27%. More than half of the exports of East Asian affiliates of Japanese electronics firms are now destined for Japan, with sales to East Asia trailing well behind as the second largest destination. Less than 20% of the exports of the Japanese electronics transplants in East Asia today go to the United States and Europe. Similar developments can be documented for purchasing patterns. East Asian affiliates of Japanese electronics firms procure hardly anything from extra-regional sources -- in 1992, this share was 1.5%, much less than the 5.5% share reported for all manufacturing industries. Probably the most important recent

---

[8] For details, see Yoshitomi [1994] and Graham and Anzai [1994].

[9] JETRO [1994], p.25.

[10] See table 8, in: Yoshitomi [1994] and tables 5 and 6 (Graham and Anzai [1994]).

change is that, between FY 1991 and 1992, East Asian affiliates of Japanese electronics firms have increased their procurement from Japan from less than 40% to nearly 47%. This is much higher than the average share of 38% reported for all industries. While the share of intra-regional procurement has remained fairly stable (increasing only slightly, from 14.7% to 15%), there has been a substantial decline in local purchases from nearly 44% to less than 37%.

II.2 Intra-Firm Trade Dominates East Asia's Trade Integration with Japan

These figures, in my view, can be interpreted in the following way: East Asian affiliates of Japanese electronics firms continue to rely heavily on Japan for production equipment, with the exception of relatively simple general-purpose machinery and jigs and fixtures. For components, procurement no longer depends exclusively on Japan, but increasingly involves now regional sources, especially for an increasing variety of general purpose components. At the same time however, Japan has been able to retain its dominant position as a supplier of leading-edge core components, such as active matrix LCDs (liquid crystal displays) and large-screen picture tubes.

Regionalisation of component sourcing essentially takes place in three forms: (1) the affiliate produces the component in-house; (2) the affiliate procures the component from one of its sister affiliates in the region; or (3) the affiliate requests its Japanese subcontractors to establish a plant within the region. Local procurement, i.e., component sourcing from independent local suppliers, only plays a very marginal role. In fact, the share of local procurement has clearly declined, as the focus of production has shifted from domestic markets to exports. This is borne out by empirical research on home appliances in ASEAN countries.[11] For TV sets, for instance, local content ratios vary substantially, depending on whether they are produced for the domestic market or for export, and this is true even for identical products. Invariably, "...products for domestic use have a higher local content ratio than export products." (Takeuchi [1993], p.44)

In short, the expansion of overseas production activities of Japanese electronics firms has been the main driving force behind the increase of trade integration between Japan and East Asia. It has also been the main driving force behind the shift towards intra-industry trade and to a large degree has shaped the form this shift has taken.[12] Most of the sales and purchases that result from these investments have remained confined to relatively closed intra-firm or intra-group production networks. MITI data on the shares of intra-firm transactions in sales and procurement of East Asian affiliates of

---

[11] For detailed empirical evidence, see Takeuchi [1994], Sunada et al. [1993] and Ikemoto [1991].

[12] For a detailed analysis, see Ernst and Guerrieri [forthcoming].

Japanese electronics firms provide some striking evidence.[13] In FY 1992, 90% of their sales to Japan were intra-firm sales, while for purchases from Japan, this share was nearly 85%. In the electronics industry, intra-firm trade thus clearly dominates East Asia's trade integration with Japan. Regional trade integration in this industry obviously is "... very different from inter-corporate... integration based on traditional international trade and investment." (Yoshitomi [1994], p.27).

III How Closed Are Japanese Regional Production Networks?

Let me clarify what I mean by a closed regional production network. My main concern is to understand how the spread of such networks affects the process of economic regionalization and the development of individual host countries.[13a] For any particular company, its international production network describes how the company attempts to organize, across different country locations, transactions that occur between its main business functions, i.e., procurement, manufacturing and support services, marketing and distribution, product and market development, research, the development of human resources and capabilities, and finance.

Such networks can have quite different impacts on local development, depending on how they are organized and depending on who are their main carriers. Networks may differ in their degree of openness, depending on what markets they serve and on the specific requirements of the products involved. The degree of openness will also be influenced by location-specific features of different host countries.[14]

III.1 Intra-Firm Regional Production Networks

For instance, if most of the interactions that constitute the network remain confined within the boundaries of the Japanese firm or a larger business group, one would expect a limited impact on local development, as most of the value-added and the accumulated knowledge would be drained off by the foreign firm. Local firms could participate in such networks as subcontractors, contract assemblers, OEM and ODM suppliers, distribution partners and local clients. As long as they are involved only at the margin, the network's integration with the host economy will remain quite shallow.

Weaknesses of local support industries are normally mentioned as the main reason for this slow process of increasing the share of component sourcing from local suppliers. Yet, some of our

---

[13] See table 10, in Yoshitomi [1994].

[13a] Interactions between Japanese regional production networks and those established by American, European, and Asian companies will be discussed in section 5.

interview partners indicated that this may only be part of the truth. According to them, the main reason may have been the strong inward orientation of the procurement departments who were trained to handle the multi-layered networks of Japanese suppliers, but had no incentive, and also lacked the relevant expertise, to search for, qualify and upgrade independent local suppliers in East Asia.

The MITI data on intra-firm purchases that I have quoted before clearly indicate that, until around 1992, Japanese regional production networks in the electronics industry have had very little interaction with local firms. This can be confirmed by company data. Take, for instance, the Matsushita group, whose core company Matsushita Electric Industrial (MEI) arguably is "... the company most deeply involved in East Asian electronics, and most representative of the Japanese approach...". (Abegglen [1994], p.221). Matsushita's involvement in East Asia started in the early 1960s with minority joint ventures strictly targeted at the heavily protected domestic markets, the so-called "mini-Matsus", that originally produced simple products like batteries, radios, electric fans, rice cookers and other low-end home appliances, small TV sets and some related components. As minority joint ventures, most of these local affiliates had considerable decision autonomy not only for employment , work practices and salary, but also on how to organize production, support services (quality control and maintenance) and procurement. Decision autonomy was probably most pronounced in the choice of marketing approaches and distribution channels. As a result, a considerable amount of local linkages was generated by these investments and local value-added increased within a relatively short period of time. This often however came at the expense of cost efficiency and quality which, due to the heavy protection provided to such import substitution markets, were only of secondary concern.[15]

Once the focus of production shifted to exports however, Matsushita increasingly relied on 100% affiliates or at least majority joint ventures. At the same time, local linkages have considerably declined as most of the required components have been procured either directly from Japan or from Matsushita's affiliates within the region. Today, the East Asian production network of the Matsushita group predominantly consists of the following interactions:

- between the parent company and its affiliates in East Asia;
- among MEI's affiliates in East Asia (with a special emphasis on MEI's regional headquarters in Singapore and the cluster of MEI activities centered on Singapore and Malaysia);
- among companies that are part of the Matsushita group (e.g., Matsushita Kotobuki, JVC, Matsushita Electric Works, Matsushita Refrigeration and many others) and their East Asian affiliates;

---

[14] For a conceptual framework, see Ernst [1994a].

[15] See studies quoted in note 11.

- and those interactions that MEI's East Asian affiliates have established with East Asian subsidiaries of Japanese subcontractors that participate in Matsushita's domestic subcontracting.

The first two interactions constitute intra-firm networks, while the last two are intra-group networks. It is fairly easy to decide whether an affiliate is part of an intra-firm network. Using the standard definition of a "Japanese-controlled company", I consider an overseas affiliate to be part of a Japanese firm when the mother company owns more than 30% of its equity. It is more problematic, however, to define the boundaries of an intra-group network. Especially in the electronics industry, suppliers are frequently shared by firms that formally belong to different business groups. Recent research on the Japanese subcontracting system has established beyond doubt that such cross-affiliations of suppliers to different business groups has been a common practice for quite some time: "A general myth (especially outside Japan) is that Japanese Keiretsu firms do business only with those in the same Keiretsu group. This is mistaken."[16] It is thus misleading to cite examples of such cross-Keiretsu affiliations as evidence for an increasing opening-up of Japanese regional production networks.

A typical example is Showa Plastics, a mid-sized producer of plastic casings for TV sets based in Osaka, which was founded as part of Matsushita's huge subcontractor pyramid. As early as the late 1960s, Showa also had acquired contracts from other TV manufacturers like Toshiba, Hitachi, Sony and Sanyo. This diversification of clients considerably accelerated during the last decade; from 75% in 1985, the share of the top three clients in Showa's sales fell below 40% in 1993 (Financial Times, 9/13/94, p.16). While Showa Plastics has increased the number of its suppliers, this does not change the fact that in each of these different production networks it remains locked into a fairly close relationship.

While intra-firm regional production networks have substantial exclusionary effects on local firms, they are not necessarily totally closed. They could still make a substantial contribution to local development, provided that key management functions in the affiliates are sufficiently localized; provided that these affiliates have sufficient decision autonomy for a variety of business functions; provided that there is a significant transfer of technological and organizational capabilities; and provided a substantial share of the funds required for new investment is raised from local sources. On all of these four counts, the empirical evidence that we have through the early 1990s is fairly negative.

III.2 Limited Localization of Management Functions

---

[16] Nishiguchi [1994], p. 115.

In the management of their East Asian affiliates, Japanese electronics firms make limited use of local engineers and managers. This is hardly surprising, given that the overriding concern of most of these companies is to transplant with as little change as possible their domestic production system that has proved to be so successful until quite recently. Japanese firms in general insist on retaining almost total management control over their overseas affiliates. Japanese firms continue to view their production activities in East Asia as mere extensions of their business empires in Japan. As a result, most decisions taken at the level of the affiliate require continuous interaction with the management of the mother company, which in turn means that local managers in senior positions need to be proficient in Japanese. Japanese firms claim that one major reason for not increasing more rapidly the share of local managers in East Asia is that very few local candidates know enough Japanese.

Rigid insistence on the "seniority principle" is another reason for the limited localization of management functions. In Japanese firms, an employee typically has to serve some 20 years before he can expect to move up to a senior management position. In Japan, everybody knows this and thus there is limited resistance and conflict. Not so in East Asian countries, where job-hopping is prevalent and where the dearth of management and engineering personnel has led to a highly competitive labor market. As a result, Japanese firms are losing their best local staff and they are unable to attract new high-level local recruits.

Since the mid-1980s, the localization of job positions has increased. The main issue however is that local managers and engineers are still confined to a marginal position in the process of decision-making. This can be seen in Figure 1, which constructs for some basic operational business functions a participation index of local managers in decision-making. The index distinguishes four types of participation in decision-making: (1) passive reception of reports and instructions that have been prepared entirely by expatriate Japanese personnel; (2) providing support and assistance to the implementation of such decisions; (3) participation in decisions which however are made by Japanese expatriates; and (4) independent decision-making. The figure documents that local managers in no case are entitled to make their own decisions and are typically confined to providing support and assistance to the implementation of given decisions. It is hardly surprising that this has led to a "... high propensity of [local] white-collar employees for frustration" (Shiraki [1993], p.96).

Probably one of the most serious problems that Japanese electronics firms are currently facing in East Asia is that the elite of local engineers and managers are normally absorbed by their American and European rivals. This has given rise to a *circulus vitiosus*: even once a Japanese firm has decided to fill a qualified position with a local citizen, it has to resort again to a Japanese expatriate. With but few exceptions, Japanese subsidiaries have a low reputation among local managers and engineers. One reason is the exclusion from decision-making that I have mentioned before. Of even greater

importance however is a widespread perception that Japanese firms are unwilling to pay a premium for higher

figure 1 goes here

education and formalized knowledge. The validity of this perception is backed by the findings of a study, conducted in early 1989, which compares the educational composition of local managers and engineers of foreign subsidiaries and local companies in Thailand and the Philippines.[17] The study shows that the ratio of university graduates to all employees was nearly 28% in U.S. and European subsidiaries, nearly 13% in non-Japanese Asian subsidiaries and more than 11% in local companies and that Japanese-owned subsidiaries were lagging well behind with a ratio of only 5.4%. Similarly, the share of managers who had graduated from university was highest for local companies, followed by U.S. and European subsidiaries, Asian companies, with Japanese subsidiaries displaying by far the lowest share. The study concludes that "...[e]ducational standards in overseas Japanese companies are clearly low." (Shiraki [1993], p.95).

III.3 Limited Local Decision Autonomy

In most of the firms that we interviewed, product or geographical divisions are responsible for the control of overseas affiliates. This has led to highly centralized and hierarchical forms of control over foreign affiliates. We were told that this applies more to affiliates in East Asia than to those in the United States and Europe where both the pressures and the prerequisites for an increasing localization of decision-making are much stronger. This is confirmed by the findings of a study prepared for the Japanese Machinery Export Association in 1992 that concludes that the decentralization of decision autonomy and the shift to regional forms of coordination is more advanced in the European and North American regional production networks than in East Asia.[18] The

[17] Sangyo Kenkyu [June 1989], quoted in Shiraki [1993], p.95. Note that both for Japanese and non-Japanese Asian companies, the share of SMEs is likely to be higher than for U.S. and European companies and that SMEs normally have a lower propensity to hire university graduates than large companies. The figures quoted above may thus give a somewhat too negative picture of the recruitment practices used in affiliates of large Japanese firms. Yet, given the magnitude of the gap reported, I am still inclined to argue that the basic message remains the same: Affiliates of Japanese firms by and large have recruited a smaller number of university graduates than their U.S. and European counterparts.

[18] Yamazawa (ed.) [1993]. The study is based on a questionnaire survey that took place in December 1991. Out of the eight product groups covered, five belong to the electronics industry: TV sets, VCRs, microwave ovens, copiers and fax machines.

study shows that decision autonomy is most advanced in Europe and argues that this is primarily due to aggressive and relatively consistent government policies, coordinated by the European Commission, that focus on upgrading the contribution of FDI.

In East Asia, expatriate Japanese managers play a dominant role in monitoring the behavior of local staff. But they have little authority to make decisions on day-to-day management issues and have constantly to refer back to their relevant headquarters divisions in order to get approval. This obviously has a number of negative consequences. It stifles local initiative and on-the-spot learning possibilities, it leads to costly duplication and over-lapping of activities, it limits the flexibility of subsidiaries to adapt to changing local market conditions, and it perpetuates a tendency towards a shallow integration of the Japanese regional production networks with the East Asian host country economies.

III.4 Limited and Slow Transfer of Capabilities

There is a widespread consensus that Japanese electronics firms routinely engage in sound and systematic "on-the-job" training. Many firms have told us that, even before starting a particular investment project, they would make sure that they train a sufficient number of local staff, both in Japan or in their regional headquarters. Most of the training however remains restricted to simple operational capabilities required for production and maintenance. Problem-solving techniques and systemic knowledge receive a much lower priority.

Beyond the level of operational capabilities, the record is much less positive. Probably the best source on the limited scope of intra-firm technology transfer that characterizes Japanese East Asian production networks are the annual surveys of the Japanese Chamber of Trade and Industry Malaysia (JACTIM). The two most recent surveys for 1993 and 1994 document that Japanese firms are actively pursuing the transfer of production, labor management and financial management capabilities.[19] Their capability transfer however has remained very limited so far in marketing, management control and product development. It is thus hardly surprising that the Malaysian government complains about an insufficient transfer of technological capabilities.

In order to rectify this situation and in order to broaden and accelerate the capability transfer, the Malaysian government has made the following specific proposals: The Japanese government should support the Malaysian government's effort to establish a Japanese-Malaysian Technical Institute that would help to familiarize Malaysian industrialists with Japanese management approaches

---

[19] Tonan Nagamatsu, chairman of the trade and investment committee of JACTIM, and Vice president of the Sumitomo group in Malaysia, as quoted in Business Times [Malaysia], 8/12/94, p.1.

and that would also help to improve their technology scanning capabilities. Japanese firms are urged to overcome their reluctance to localize key management functions. They are also asked to increase the decision autonomy of Malaysian managers and engineers. Using the example of Matsushita's air-conditioner plants in Malaysia, the government furthermore suggests that, for a certain number of product groups, Japanese firms should transfer those R&D activities that are necessary for developing a regional or global product mandate.

Table 1 presents some empirical evidence for R&D activities of Japanese electronics firms in East Asia. I distinguish five categories:

(I) Adaptive engineering, i.e., engineering activities that go beyond basic manufacturing support services and include the incremental adaptation and improvement of products and processes. Basic manufacturing support services are defined to include activities like calibration and testing, die and tool services, (preventive) maintenance and repair, and quality control.

(II) Circuit design.

(III) Software engineering (which ranges from simple program reconversion to fairly sophisticated projects).

(IV) Product development, most of it for the local market, and a few projects for the regional market.

(V) Generic technology development, i.e., major innovations with a huge potential for productivity enhancement and the creation of new product markets.

The table shows that out of a total of 45 projects[20] only one falls under the category V, the audiovisual information research center of Matsushita in Singapore, established in 1990, which focuses on the development of compression technology for image transmission required for videophones and multimedia. Eleven projects are reported to involve product development. Yet, category IV is quite problematic, as we can not distinguish to what degree it might actually consist of simple tasks involved in category I.[21] To avoid double-counting, where category IV activities take place, category I has not been marked (unless these simpler activities occur for a different product line than the category IV activity). The result is that our classification probably underestimates to what degree Japanese electronics firms in East Asia concentrate on relatively simple adaptive engineering activities (category I).

The largest share of Japanese electronics R&D activities in East Asia falls under two categories -- software engineering (with 15 cases) and circuit design (with 11 cases). The essential point to stress is that in most cases both are essentially support services required to enter or expand the region's domestic markets. For software engineering for instance, the development of Chinese language programs plays an important role, with the objective to improve the market position in China

[20] For a detailed analysis of each of these projects, see Ernst and Linden [forthcoming].

for Japanese computer manufacturers. And most of the circuit design activities are dedicated to ASICs (application-specific integrated circuits) that are required for consumer devices or telecommunications equipment sold in the domestic or regional markets.

These findings need to be placed in a broader context: the still very limited internationalization of Japanese R&D activities.[22] In the electronics industry as well as in the car and chemicals industries, Japanese firms have only recently begun to gradually expand their overseas R&D activities. Compared to their American and European rivals, Japanese firms are still at a relatively early stage, and so far have very limited experience in organizing international R&D networks.

As a location for Japanese overseas R&D activities, Asia still lags well behind the U.S. and Europe where most of these activities remain concentrated. In Asia, the focus has been on five activities: training; some basic manufacturing support services; a certain amount of product customization to some idiosyncratic features of particular domestic and regional markets; the ad hoc adaptation of certain production processes to the specification of local materials or particular features of the local infrastructure, work organization and inventory management; and software engineering. Most of these activities are integrated into manufacturing affiliates, and thus do not show up in the officially reported number of "R&D centers". On the other hand, there is reason to believe that many of the reported "R&D centers" may not undertake any research at all. Japanese firms are now under increasing pressure from host country governments and firms to broaden the scope of transferred capabilities and thus have a tendency to use the term "R&D" in a rather loose way to include mundane and routine production-related engineering tasks.

III.5 Limited Equity Links with Local Investors

Let us consider one last indicator that can help us to understand whether a regional production network is closed or open: the sources of investment funding for its different activities. Japanese electronics firms in principle can fund their Asian production activities from three sources: through remittances from Japan to the overseas affiliates; through reinvestment from retained profits generated in the affiliates; or through capital raised by the affiliates in foreign financial and/or capital markets.

Until very recently, most of the funds required for the expansion of Japanese regional production activities in East Asia have consisted of remittances from the mother company in Japan. We were told in our interviews that, throughout most of the 1980s, both reinvestments and equity links

---

[21] This problem will be addressed in forthcoming interviews with the relevant affiliates.

[22] See the excellent analysis in Abe [1992].

with local investors had played a very minor role. We were also told that this pattern is now slowly changing and that, since around 1992, capacity expansion in ASEAN countries has been increasingly locally funded.

Let us first look at reinvestments. Until very recently, it was practically impossible to get hard data on affiliates' reinvestments; the main source on Japanese FDI, the MoF (Ministry of Finance), does not record reinvestments made by overseas subsidiaries. This has now changed, as the EXIM Bank annual survey on Japanese FDI has started to collect such information, starting from FY 1992 (Tejima [1994], pages 9 passim). This survey shows that Japanese affiliates in the ASEAN countries and in the first-tier newly industrializing economies (NIEs) have relied much more on reinvestments than Japanese affiliates in North America and Europe: the reinvestment ratio was 45% for ASEAN countries and around 38% for NIEs against 18% for North America and 17% for the European Union. Not surprisingly, the share of remittances from Japan has been highest for "frontier economies" like China (93% of all Japanese investment was funded by remittances), India and Vietnam.

The increasing importance of locally funded reinvestment has been documented for Malaysia and Thailand in a JETRO survey conducted in October 1993. This survey covered 19 subsidiaries in Thailand and five in Malaysia, most of them from the electronics industry.[23] When asked how they have raised their funds for their recent investments, the great majority in both countries responded that locally funded reinvestment had played an important role. This was the case for 13 out of the 19 companies in Thailand and for four out of the five companies in Malaysia. In Thailand, for instance, eight companies reported that the local subsidiaries had borne the full burden, and five that it had been split fifty-fifty between the Japanese parent and the local subsidiary.

A second possibility for Japanese firms to increase local investment funding would be to list on local stock markets. So far however only very few firms have used this option. Take for instance the case of Malaysia.[24] At present, only a small number of Japanese-controlled companies are listed on the Kuala Lumpur stock exchange (KLSE). There has not been any recent major listing of a Japanese-controlled company. Those already listed undertook their share flotations already quite some time ago. The pioneer was Matsushita Electric Co (M) Bhd, which was listed on the KLSE as early as 1966.

A recent questionnaire survey conducted by the Japanese Chamber of Trade and Industry in Malaysia (JACTIM) in March and April of 1994 clearly confirms this picture. Out of 150

---

[23] In Thailand for instance, 11 out of the 19 firms covered were from the electronics industry (eight in home appliances, two in computers and peripheral equipment and one in components). A brief summary of this survey can be found in JETRO [1994], p.21.

[24] Based on Business Times [Malaysia], 7/27/94, p.1 and 7/28/94, pages 1 and 4.

respondents, 115 companies, i.e., more than 75%, said that they had "...no plans for a public offering". While 25 companies replied that they wanted to do so in the future, only 10 companies, i.e., less than 7 %, showed a clear commitment, with eight scheduled to offer their stock and two companies making preparations for public offerings. As JACTIM declined to identify the last ten companies by name, we do not know whether these are large MNEs (multinational enterprises) that are willing to build up local partnerships or SMEs (small- and medium-sized enterprises) that are desperate to raise the funds required for their local investments. At this particular point in time, SMEs supposedly are under greater pressure to raise local funds than MNEs, which presumably have decided to wait until they get privileged conditions for listing at the KLSE.[25]

Most Malaysian affiliates of the large Japanese electronics firms are highly profitable (Business Times [Malaysia], 7/28/94, p.4), and thus can rely on their internal funds to undertake reinvestments and capacity expansions. They are thus under no acute pressure to engage in local stock listings and can afford tough bargaining to gain privileged benefits. One important concern relates to restrictions imposed by Bank Negara, the country's central bank, at the start of 1994 to combat currency speculators.[26] After various rounds of tough negotiations, with JACTIM playing a very active role, Bank Negara finally agreed on August 12, 1994 to withdraw the aforementioned restrictions (The Economist, 8/20/94, p.62).

The main reason however for the reluctance of large Japanese electronics companies to seek a listing on the local stock market is a more fundamental one. In essence, it reflects an important feature of the traditional Japanese production system: the desire of the mother company to retain total management control. According to the chairman of JACTIM's Trade and Industry Committee, Tonan Nagamatsu, "... the decision to make a public offering rests basically with the head office in Japan", which so far has seen "... no merit in it." (Business Times [Malaysia], 8/12/94, page 1).

Perceptive of the need to change this attitude, JACTIM is now organizing so-called "dialogue sessions" with the Malaysian Finance Ministry and related organizations to discuss measures that would enable Japanese companies to benefit from local public offerings of their stock, while at the same time retaining nearly total management control. One is thus forced to conclude that, even if the major Japanese electronics firms would decide to engage in local public stock offerings in Malaysia, this would hardly lead to an opening up of their regional production networks.

---

[25] So far, Japanese companies listing on the KLSE get exactly the same benefits as any other company. (Business Times[Malaysia], 7/28/94, p.1).

[26] As foreign money rushed into Malaysia during 1993, Bank Negara intervened heavily in the foreign exchange markets to prevent the ringgit, Malaysia's currency, appreciating too fast. That meant issuing ringgits to buy dollars. These measures have had the unintended (but predictable) effect of deterring foreign investors.

III.6 Relevance

We have seen that until quite recently Japanese electronics firms in general have kept their regional production networks fairly closed to local companies. In the management of their East Asian affiliates, they make limited use of local engineers and managers; they tightly control their Asian affiliates and leave them little scope for autonomous decisions; their transfer of technological capabilities is limited and hardly goes beyond "on-the-job" training and basic manufacturing support services; and, finally, they have developed limited links with local investors.

Why does this matter? Some argue that such insufficient domestic linkage effects are a natural result of existing gaps in comparative advantage and thus should not be a major concern.[27]

I come to a quite different conclusion. I argue that the closed nature of Japanese regional production networks has constrained the opportunities for host country firms to develop their own technological and organizational capabilities that are necessary for a continuous upgrading of their production efficiency and product mix, and that it constraints the development of local support industries. This, in turn, has resulted in serious regional trade imbalances which, if they would remain unchecked, will lead, sooner or later, to increasing regional trade conflicts.

This clearly would not be in the interest of Japanese firms, as this may lead to a substantial deterioration in the region's trade and investment climate. Today, East Asia has become "Japan's fastest growing market and investment destination."[28] The following figures speak for themselves: By September 1994, three-quarters of Japan's export growth came from sales to East Asia. During the first half of 1994, Japan's trade surplus with Asia rose to $31.4 billion. Japan's trade surplus with Asia has outstripped its surplus with the United States since 1993.

The electronics industry provides a striking example of the increasingly severe regional trade imbalances that result from the insufficient domestic linkages that Japanese regional production networks have developed in East Asia. Since the mid-1980s, Japanese producers of electronic components have substantially strengthened their position as the dominant supplier of the region.[29] From 24% in 1985, Japan's share of East Asia's component imports has increased to 30% in 1992. During the same period, the share of Asian electronics exports destined for Japan has risen only slightly. The result has been a dramatic increase in the trade deficit of Asia towards Japan in the

---

[27] See, for instance, Yoshitomi [1994], especially pages 9-28.

[28] Financial Times, 10/18/94, p.5, quoting a report by Barclays de Zoete Wedd in Tokyo.

[29] The following figures are taken from Guerrieri [1994] and represent constant U.S.-dollars.

electronics industry from $7 billion in 1985 to $19 billion in 1992. All countries of the region have experienced a significant deterioration of their electronics trade balances with Japan.

So far, this has not yet led to political problems and trade frictions similar to those that Japan experiences with the United States. Probably the main reason is that so far host country governments were content with the substantial growth effects resulting from Japanese FDI. Yet, there are clear indications that the climate is changing and that local governments are beginning to take a much more critical view on the role of Japanese firms, both with regard to the trade deficit and with regard to the insufficient transfer of technological capabilities. Clearly something must change in the way Japanese electronics firms have organized their East Asian production networks, and market forces alone will not be sufficient to correct such huge imbalances.

IV New Pressures to Open Up East Asian Production Networks

Recent developments since around 1992 may constitute an important watershed - we have reason to believe that Japanese regional production networks may now become more open. This change should not be understood to result from benign behavior of Japanese investors. Rather, its is a change forced upon Japanese firms, as recent developments have challenged the effectiveness of the traditional organization of their East Asian production networks.

IV.1 The Catalytic Role of the Yen Appreciation

Central among these new challenges is the continuous yen appreciation: from 239 in 1985, the yen's exchange rate to the U.S.-dollar has experienced a drastic decline to less than 100 during the last few months (Fall 1994). The result has been a substantial increase in the cost of exports. Japanese affiliates based in East Asia now have to pay a much higher price for components and production equipment imported from Japan. As most East Asian subsidiaries continue to procure most of their intermediate production inputs from Japan, the yen appreciation has played havoc with their cost competitiveness, often wiping out any cost advantages due to the much lower costs of labor.

For instance, rising import costs from Japan have drastically increased the export prices of CTVs and VCRs produced in Japanese transplants in Malaysia and Thailand, with the result that especially Korean chaebol were able to gain substantial market share both in regional markets and in the United States and Europe. With the won's 18% fall against the yen during 1993, Korean electronics firms are enjoying an export boom and are taking business away from Japanese competitors, particularly in price-sensitive market segments like DRAMs and lower-end consumer

devices.[30] According to a recent forecast produced by the Korean Ministry of Trade, Industry and Energy, a 10% increase in the yen's value boosts Korean exports by 8%. During the first half of 1993, the three leading Korean electronics companies (Samsung, Goldstar and Daewoo) have recorded an increase in their exports of 37.1% to U.S.$5.09 billion. Most noteworthy is that exports to Japan have grown even faster: during the first quarter of 1993, Korea's electronics exports to Japan rose by more than 40%.

At the same time, the cost of local sourcing has declined, as any appreciation of the yen relative to a local currency decreases the yen-denominated price of locally procured materials, components and machinery as well as that of wages. Japanese East Asian production networks are thus under increasing pressure to reduce their input imports from Japan and to increase their reliance on regional component sourcing. I will discuss these impacts of the yen appreciation in section in section IV.3. What I would like to stress here is the irreversible nature of most of these changes brought about by the yen appreciation. By generating a substantial amount of new sunk investment in East Asia and by imposing major changes both in the domestic Japanese production system and in the Asian production networks, the yen appreciation has acted like a ratchet. It thus would be very difficult for Japanese electronics firms to return to the status quo ante, once the yen starts depreciating again.

IV.2 New Competitive Pressures

Yet, one should not overestimate the importance of the yen appreciation. While periodic yen appreciations have acted as a catalyst in determining the timing of overseas investment, they are not sufficient to explain the East Asian investment strategies that Japanese electronics firms have pursued during different periods. This is borne out by a recent survey by the Japanese EXIM Bank, published in September of this year. This survey shows that Japanese firms consider the yen appreciation to be an important, yet temporary determinant of their current restructuring attempts. The yen appreciation has played an important catalytic role in accelerating the speed of restructuring, no less and no more. "While the yen appreciation is a major issue for the moment, its importance is expected to diminish gradually." (Tejima [1994], p. 52)

In essence, the yen appreciation helps to magnify some of the fundamental pressures that Japanese electronics firms are facing today. These pressures are structural in the sense that even if the yen would start to depreciate, they would still force Japanese electronics firms to proceed with an opening-up of their international production networks.

---

[30] For details, see Ernst [1994b].

One source of these pressures is demand-related: the domestic recession and the declining growth rates of demand in major export markets for the first time has hit simultaneously a variety of products.[31] The "fat" product portfolios of the heavily diversified Japanese electronics firms normally had worked as a cushion against demand fluctuations, but not this time. As demand remains muted for most their products, Japanese electronics firms are now confronted with the hidden costs of their established international production system. During the 1980s, all of these firms have invested heavily in capacity expansion, both in Japan and abroad. They are now saddled with substantial surplus capacities that seriously erode their cost competitiveness. At the same time, they are heavily overstaffed with high-cost labor and the productivity of both production and R&D lags well behind that of comparable American electronics firms.

A second source of these new pressures results from the globalization of competition, which has led in essence to a continuous erosion of established international market leadership positions through pervasive price wars and some gradual opening-up of proprietary product and system standards.[32] For most Japanese electronics firms, their earlier success was based primarily on their capacity to control the development of core components and on rapid market share expansion through continuous product differentiation. Concerned to sustain the status quo, they were thus slow to adapt to these new competitive requirements.

Finally, fundamental structural changes in the East Asian host countries that are likely to pose new opportunities and challenges for Japanese electronics firms are a third source of these new pressures. I will focus here on two aspects: (1) the continuos upgrading of locational advantages in some East Asian production sites, which may facilitate a gradual opening-up of Japanese regional production networks and (2) the rising cost of Asian labor, which may force Japanese firms to deepen their regional production networks.

Eight of these structural pressures are of particular relevance:

- pressures to open up regional procurement patterns (section IV.3);
- changes in the role of Japanese component suppliers (IV.4);
- substantial improvements in locational advantages of East Asian host countries (IV.5);
- the rising cost of Asian labor (IV.6);
- pressures to broaden the capability transfer (IV.7);
- pressures resulting from the increasing importance of access to East Asian domestic markets (IV.8);

---

[31] For an excellent analysis, see Okumura [1994].

[32] For an analysis of these new competitive challenges in the electronics industry, see Ernst and O'Connor [1992], chapters I and II.

- pressures resulting from a broadening of the product mix of regional production networks (IV.9);
- and, finally, pressures and new opportunities resulting from the proliferation of competing regional production networks (section V).

IV.3 Pressures to Open Up Regional Procurement Patterns

Fundamental changes are currently emerging in the East Asian purchasing patterns of Japanese electronics companies. The over-riding objective is to reduce the dependence of their various Asian production subsidiaries on high-cost input imports from Japan. The challenge is how to achieve these cost savings without losing too much in terms of quality, speed and reliability of delivery.

In more operational terms, this raises questions like: How can quality be improved without compromising the advantages of low labor-cost production? Will existing final assembly lines in the region be able to sustain and expand their reliance on just-in-time production which is considered to be essential for continuous international market share expansion? Will it be possible to increase the share of regional/local procurement without crippling the company's capacity to quickly obtain parts for maintenance purposes in case of a breakdown?

A questionnaire survey conducted by JETRO in October 1993 found that an overwhelming majority of Japanese firms with substantial overseas production activities, i.e., more than 80% of the JETRO sample,[33] indicated that during the next five years they would considerably increase their current levels of international procurement. About one-quarter of the responding companies in fact claimed that they were planning during this five-year period to double their current levels of international procurement. One quarter of the responding firms mentioned "cost reduction despite inferior quality" as their main motivation. This is in line with the fact that a majority of the firms identify the following three major implementation constraints: one third of the responding companies are primarily concerned with delivery dates and defect rates, more than 20% are concerned that they may not be able to obtain necessary items in an emergency case, and more than 15% feel that even for general purpose components, local and regional sources are unable to meet international standards.

Take the case of Hitachi,[34] a behemoth whose consolidated sales today equal roughly 2% of Japan's GNP, the world's second largest economy. While historically Hitachi started as a producer of heavy electrical equipment, today close to half of its sales are generated by its two largest divisions,

---

[33] The survey covered Japanese manufacturers capitalized at over ¥100 million that have overseas production affiliates, with 219 companies responding. For details, see JETRO [1994 b], Nihon Kigyo no Kaigai Jigyo Tenkai no Jittai Chosa (Survey of Overseas Business of Japanese Corporations).

information systems and electronics. Both divisions, since FY 1991, have reported sharply declining income. The situation is even worse for Hitachi's consumer products division, which has lost money since FY 1991. It is as a result of these pressures that Hitachi, since the beginning of FY 1993, has started to implement a major reorganization which is meant to shift its strategic focus and to improve its flexibility and capacity to innovate.

So far, the results have been mixed and Hitachi has not yet clearly indicated the areas on which it will concentrate in the future and those that it will abandon. Hitachi's difficulties to change course nicely illustrate that, while Chandler is right to emphasize the substantial advantages that a company can reap from superior size, the opposite is also true and that a company may become too big for its own good. This dark side of corporate size is captured in the following statement by Hitachi's president: "...[I]t is not easy to change the course of management at a company as large as ours."[35]

These disadvantages of corporate size manifest themselves in different ways. For instance, since FY 1991, Hitachi reported by far the biggest net interest revenue among Japan's leading electronics companies from its bank deposits and lendings. Hitachi's big net interest revenue partly reflects its decision to keep its money in the bank, instead of spending it on capital equipment like Matsushita or on product development like Sharp and Canon. Paraphrasing a term normally used for Siemens, one could thus describe Hitachi as a bank with some attached manufacturing activities. Other manifestations of the disadvantages of size can be found in the company's conservative approach to product innovation, especially its failure to react in time to changes in the computer market and to reduce its heavy dependence on mainframes.

There is one area however where Hitachi appears to stand out among Japanese electronics companies: its pioneering role in the development of its international procurement activities. Earlier than many of its Japanese rivals, Hitachi has gradually developed a fairly sophisticated approach to international procurement and it attaches a lot of importance to the continuous upgrading of these activities to changing competitive requirements.

In the early 1970s, Hitachi was among the first Japanese electronics firms to set up overseas procurement bases in the United States and Hong Kong. In 1979, a European procurement base was added in Germany. Following the Plaza agreement of 1985, Hitachi established an International Procurement Department which was separate from its Materials Department that traditionally had handled all purchasing activities. The original motivation was to soften trade frictions with the United

---

[34] The following is based on interviews with Hitachi in November 1993, JETRO [1994] and the BRIE Data Base "Corporate Profile Hitachi".

[35] Quoted in: Tsukiji, Tatsuo [1993], "Hitachi Seeks to be Agile Giant Amid Rapidly Changing Markets", The Nikkei Weekly, 8/30/93.

States by increasing the share of foreign imports. This focus on arms'-length imports is reflected in the fact that one of the first activities of this new department was to send import missions to the United States, China and Korea, the main purpose of which was to identify and check the quality of parts that Hitachi could import.

Since 1989, Hitachi has made a consistent effort to upgrade its international procurement function. Rather than relying on arms'-length imports from independent foreign suppliers, the focus shifted to reverse imports from foreign affiliates and to OEM imports from technical tie-ups with foreign companies, for instance Goldstar in Korea. At the same time, Hitachi established a number of new IPOs (International Procurement Offices) in San Francisco, Singapore, Seoul and Taipei. It also began to provide assistance to cut prime costs and to train foreign suppliers.

For quite some time, however, Hitachi's attempts to deepen its international procurement function remained fairly limited. It was only after the Hitachi group announced its major reorganization in August 1993 that this process of deepening really got under way in a serious manner. In the same month, Hitachi established a Center for the Promotion of Procurement in Asia in Singapore. While Hitachi's IPOs for all practical purposes have been commercial purchasing offices staffed primarily by buying agents, in the new Center engineers (both from Hitachi and its suppliers) will be involved throughout all stages of the procurement decision, including component design and materials specification. The Center thus would act as a mechanism for bringing in foreign suppliers into Hitachi's internal design processes and for shifting to longer-term supply arrangements. The Center is also supposed to provide training for local/regional materials experts and to coordinate Hitachi's procurement plans with the sales efforts of different host governments.

One important aspect relates to the role of policy incentives, provided by both the Japanese government and by various host countries in the region, which have induced Hitachi to open up its international procurement activities in Asia. For instance, tax incentives for import promotion developed by the Japanese government have helped Hitachi to reduce the cost of importing components from East Asia. The irony is that these incentives were originally developed in response to pressures from various U.S. administrations that were meant to increase the domestic market share for U.S. companies, while in reality they have facilitated some overdue organizational adaptations of Japanese firms.

At the same time, host country policies have been of great importance. In Malaysia, for instance, Hitachi as much as MEI and others have closely cooperated with the government's programs for promoting domestic industries. One example is the Human Resources Development Center of the Penang Free Export Zone, where Hitachi together with Japanese parts manufacturers participate in training programs for local parts manufacturers.

IV.4 Changes in the Role of Japanese Component Suppliers

As a result of the yen appreciation, Japanese electronics firms are under increasing pressure to reduce the component imports of their East Asian production affiliates from Japan and to increase their reliance on regional component sourcing. As much as possible, they have tried to induce their domestic component suppliers to set up shop close to their major Asian production sites or to expand their already existing production facilities. This has had two important, yet somewhat contradictory, consequences that, taken together, may accelerate the opening-up of Japanese regional production networks.

The first consequence is that those Japanese component suppliers that produce relatively complex and higher value-added components have substantially increased their investment in East Asia, primarily in Malaysia and Thailand, and increasingly also in China.[36] These firms in general are situated on the higher levels of the Japanese domestic subcontracting system, and have been able to raise the funds required for overseas production. Once these suppliers have established production in East Asia, they are much less inclined to stick to their traditional clients. In order to amortize as quickly as possible their substantial investment outlays and in order to gain economies of scale, these affiliates are under increasing pressure to look around for new clients and to move beyond their traditionally closed Keiretsu affiliations. "If the parent company can no longer give them enough work, the market principle will take over." (Miyashita and Russell [1994], p.201) As a result, East Asian affiliates of these higher-level Japanese component manufacturers frequently supply today a number of Japanese firms as well as American and some European firms. This constitutes an important departure from the relatively closed nature of existing Japanese regional production networks.

We also should note a second important consequence,which again leads to a gradual opening-up of Japanese regional supplier networks. The higher-level Japanese component suppliers that have set up shop in East Asia are now under increasing pressure to involve local supplier firms for lower-end subcontracting and contract manufacturing activities. This is due to the fact that many Japanese suppliers of low-end, general-purpose components have either been forced to close down production or cannot raise the funds required for overseas production. The affiliates of Japanese higher-level component suppliers thus increasingly have to rely on domestic Asian subcontractors, mostly through

---

[36] For detailed evidence, see Mukoyama [1994] and [1993], and Takeuchi [1993]. Most recent figures can be found in Tejima [1994].

a variety of contractual, non-equity arrangements such as consignment production and contract manufacturing.

Most lower-level Japanese subcontractors are relatively small firms that, since the recession started in 1991, have been under tremendous pressure by their customers and parent companies to lower prices. Most of them are reported to have "...a terrible time coping with the steps taken by their parent companies to deal with the higher yen"[37] and have reached the limits to comply to these requests.[38] They are thus "...faced with the choice of investing overseas or closing down."(JETRO [1994], p.20).

Many of these lower-level Japanese component suppliers may however not be able to raise the funds required for such investments. The cost of domestically raised investment capital has substantially increased and this affects especially SMEs which, in contrast to the big MNEs, have to rely on bank loans for funding their overseas production. For instance, the average interest rate on new loans by Japanese banks, which best indicates the level of prevailing interest rates, has increased from 4.296% in FY 1988 to 8.126% in FY 1990. In FY 1991, it fell again to 6.877%, which however still constitutes a historically high level. Banks that are burdened with a high share of bad debts have been much more reluctant to provide new credit, especially to SMEs. Finally, SMEs have also lost much of their credit worthiness due to the fall in the value of collateral due to plummeting land prices.

Given such severe financial constraints, most lower-level Japanese component suppliers have not been able to invest on their own in overseas production affiliates. Many of them went out of business. Others have tried to upgrade their product portfolio and their technological capabilities, while still others are trying to survive as part of joint investment cooperatives. Finally, a few of these firms have established informal arrangements with local East Asian firms, like consignment contracts and contract assembly. Taken together, these developments are likely to lead to a further erosion of the tight linkages that traditionally have bound together Japanese electronics firms and their suppliers.

IV.5 Improved Locational Advantages of East Asian Host Countries

Since the mid-1980s, substantial improvements have occurred in the locational advantages of East Asian production sites. Clearly such improvements have acted as an important enabling factor for Japanese electronics firms which allows them to gradually open up their regional production networks. The overall picture is quite encouraging: investment in infrastructure is booming; all countries have increased their efforts to educate and train people on all levels of the occupational

---

[37] Central Bank for Commercial and Industrial Cooperatives [1993], Survey of the Effects of the Yen Appreciation on Small- and Medium -Sized Enterprises (in Japanese), p.5.

ladder; financial systems have been gradually liberalized; domestic firms have strengthened and broadened their technological capabilities; especially in the export sector, domestic firms have drastically improved their organization and management approaches; and, finally, government policies overall have become much more pragmatic in dealing with foreign investment and are attempting to foster closer links between foreign investors and domestic firms.

Given the rapid growth that has occurred in these economies since the mid-1980s, it is hardly surprising that Japanese firms continue to complain about substantial bottlenecks and difficulties. These difficulties are real, but one could certainly not argue that they constitute an insurmountable barrier to an expansion of domestic linkages. During our interviews in November 1993, a broad consensus emerged that, in most countries of the region, improvements in the above enabling conditions have now reached a critical threshold level. Yet, on their own such improvements of locational advantages would probably not be sufficient to induce Japanese firms to increase their domestic linkages.

IV.6 The Rising Cost of Asian Labor

This brings me to the second important structural change, the rising cost of Asian labor, which Japanese electronics firms perceive will become a major concern during the second half of this decade. Labor costs in the region began to rise during the 1980s, first in Hong Kong and Singapore, then in Taiwan and Korea, and now also in Malaysia and Thailand. Japanese firms are convinced that, within the next few years, labor costs will also rise in the rest of East Asia, especially in China. They have already factored these rising labor costs into their long-term regional production planning.

Rising labor costs will have a dual effect on Japanese regional production networks. On the one hand, they will force Japanese firms to continuously upgrade the mix of the products that they produce in Asia, as higher labor costs require higher local value-added. Rising labor costs will also expand the domestic market volume and increase the demand for more sophisticated products. At the same time, rising labor costs will force Japanese electronics firms to improve the productivity not only for each of their individual affiliates but also for their Asian production networks as a whole. This implies that existing production facilities, especially in Malaysia and Thailand, will become increasingly automated.

But this is only part of the story. In order to improve their regional specialization, Japanese firms will strive to consolidate their production activities in a few major locations, and will attempt to rationalize their procurement and sales patterns. Without such "systemic rationalization" of their

---

[38] For evidence, see JETRO [1994], p.18 and Miyashita and Russell [1994], pages 199 passim.

regional production networks, Japanese firms would be hard pressed to reduce their substantial coordination costs and to improve their capacity to react in time to changing market requirements. There is evidence to suggest that these changes may open up new windows of opportunity for local suppliers and support industries to build up their own technological and marketing capabilities. These opportunities are well summarized in the afore-mentioned report of the EXIM Bank of Japan: "Wage and salary increase is, to some extent, inevitable for Japanese subsidiaries in Asia. Therefore, they must endeavor to produce higher-value-added products with higher sales prices, using better-trained Asian personnel educated in-house..." and develop local support industries (Tejima [1994], p.52).

IV.7 Pressures to Broaden the Capability Transfer

While Japanese electronics firms traditionally have been reluctant to move beyond the transfer of basic operational capabilities required for production and maintenance, they are now under increasing pressure to broaden their capability transfer. In order to understand why, I suggest to distinguish five such motivations:[39]

- To support local or regional production activities;
- To improve the capacity to respond to idiosyncrasies of and changes in major growth markets;
- To tap into pools of high-quality human resources;
- To access "world-class" science and technology infrastructure clusters;
- And to strengthen worldwide technology scanning capabilities through improved integration into international scientific networks.

Whether or not a firm decides to expand its overseas R&D activities is primarily a reflection of its competitive strategy. Home and host country government policies obviously play an important role, as they influence the direction and the implementation of these strategies. In order to demonstrate this close interaction between government policies and firm strategies, let us look at local content requirements which today are a routine element of most host country policies. If a firm concludes that non-compliance with such policies would have negative implications, it will have to increase sooner or later the amount of locally purchased components. This in turn requires changes in the overall organization of production of the foreign company which go well beyond simple changes in the purchasing function. The main concern of the foreign company is to ensure that the use of locally purchased parts will not compromise the performance and quality of its products. In most cases, this requires changes in the original product design that has been approved in Japan. Such local adaptation of product design "...requires direct negotiations with local parts manufacturers, frequent testing and evaluation of the quality of local parts, research cooperation with local parts manufacturers, and

guidance and assistance to these manufacturers. In order to carry out those activities efficiently, local design and development offices have to exist to accommodate Japanese engineers full-time."(Abe [1992], English translation, p.9)

Our main interest here is to understand why Japanese firms have decided to expand their overseas R&D activities in Asia and to what degree these activities differ from those they pursue in the United States and Europe. Let us start with the latter two regions, where all four motivations reportedly have shaped the overseas R&D activities of Japanese firms. Recently, however, the last motivation appears to have gained considerably in importance. Both in the United States and in Europe, the main objective of Japanese electronics firms is to improve their access to international technology networks by pursuing two complementary approaches: (1) an expansion of overseas basic research centers and (2) the establishment of an increasing variety of "satellite R&D centers" that conduct cooperative research with foreign companies, universities and research institutes. There are a number of reasons for this. In the electronics industry, for instance, Japanese firms today are under increasing pressure to speed up the growth of their accumulated patent portfolios. They all know that the fastest way to do this is to complement their domestic R&D activities by establishing a center in one of those "regional clusters" (Porter [1990]) where the innovation capabilities and the R&D infrastructure for a particular product or for a particular group of generic technologies are concentrated.

In Asia, the innovation management strategies of Japanese electronics firms are shaped by a very different set of objectives. In this region, the primary concern is to provide adequate support activities for their expanding international production activities. Overwhelmingly, these production activities consist of mass production-type assembly and related component manufacturing. Today, the main driving force for relocating R&D activities to East Asia is the current shift from proprietary components to standard components that can be sourced at lower cost from local or regional suppliers. In order to achieve this goal, Japanese electronics firms are all forced to upgrade their regional and local support services. At the same time, they need to establish on the spot a capacity for continuous re-design (adaptive engineering).

The new development since the early 1990s is that Japanese firms now also attach much greater importance to market intelligence and product customization. Japanese firms are increasingly conscious of the fact that Asia is characterized by very heterogeneous demand patterns and highly segmented product markets. At the same time, the variety of production sites has kept increasing, with

---

39 There is now a rich literature on why a firm would want to engage in overseas R&D activities. Important contributions are Granstrand, et al. [1993], Chesnais [1994], Howells[1990], Bell and Pavitt [1993], Pearce [1990], Porter [1990], Archibugi, Freeman and ...[...].

the result that Japanese firms have now to adapt their production system to the idiosyncrasies of each of these locations. Both of these developments "...require high degrees of local adaptation of products, integration of products with local services, and close relationships with component suppliers." (Branscomb and Kodama [1993], p.86). This, in essence, is the main reason for the recent expansion of so-called "Design & Development (D&D)" activities of Japanese firms into East Asia.

As a result, local affiliates need to have a capacity for continuous product customization. Adaptive engineering and some development activities will become increasingly decentralized and take place in engineering departments of Asian manufacturing affiliates. Most of the leading Japanese electronics firms agree with this conclusion, and this applies to product innovators like Canon as well as to a more conservative firm like NEC. According to Kuniji Osabe, the head of Canon's R&D Planning Center, "...the best way to create products which meet local market needs is to perform local research with local talent." And Branscomb and Kodama [1993], (p.87) quote an NEC R&D manager: "NEC sees new products becoming increasingly dependent on the ability to adapt to local culture and customs."

A third important objective for Japanese electronics firms to expand their R&D activities in Asia is to tap into existing pools of lower-cost human resources. Most countries of the region in fact pursue quite aggressive policies to increase the supply of engineers and scientists. The following areas are of particular importance: software engineering; certain basic assembly technologies; some areas of circuit design; and certain areas of system engineering and integration.

While Japanese electronics firms are clearly under increasing pressure to broaden their R&D portfolio in East Asia, it may still take quite some time before these intentions will materialize. This is due to some basic weaknesses of the international innovation management strategies of Japanese electronics firms.[40] In most cases, these strategies lack a clear focus. "Trial and error remains the method of choice." (Abe [1992], p.7) Such strategic drift is a reflection of a more general uncertainty prevailing in many of these firms on how to adjust their overall business strategies to the recent drastic changes in the international competitive environment.

The lack of clear goals for international innovation management has led to haphazard patterns of R&D internationalization. At the same time, firms have made only limited progress in their attempts to reduce some of the substantial constraints to an effective implementation of their strategies. Probably the most important implementation constraint is that in their attempts to internationalize R&D, Japanese firms face even greater cross-cultural communication problems than

---

[40] The following account is based on Abe [1992], and interviews in the Japanese electronics industry, November 1993.

for manufacturing.[41] This, in many cases, has stifled attempts to use and integrate ideas and concepts developed abroad into the firm's domestic R&D agenda. In addition, Japanese firms by and large are finding it more difficult than their American and European counterparts to recruit first-class non-Japanese researchers. Japanese firms in general have been reluctant to localize the management of their overseas R&D activities. This in turn has certainly not been conducive for their attempts to tap into the local and regional S&T networks.

Japanese electronics firms are thus under increasing pressure to rationalize their diverse overseas R&D activities and to improve the coordination and control mechanisms. The more they get exposed to overseas R&D activities, the greater are the chances that this will slowly change established Japanese innovation management practices.

IV.8 Access to East Asian Domestic Markets

Pressures to open up regional production networks may also result from demand-related factors. For a number of reasons that I will explain in a moment, Japanese electronics firms are forced to increase their share of East Asian domestic markets. Most of these markets remain heavily protected. As a *quid pro quo* to improved market access, Japanese firms may thus face increasing pressure to comply to host country government requirements to open up their supplier networks and to localize component sourcing, key management functions and R&D.

The pressure to penetrate East Asian markets is unlikely to be a transitory phenomenon. Most Japanese electronics companies traditionally have focused on rapid market share expansion based on a shortening of the product cycle and a reliance on "product variety wars". Constant product differentiation has been the main vehicle of market share expansion. This has been a tremendously successful strategy -- as long as rapid demand growth could be taken for granted. This is no longer the case today, as most electronics markets have shifted from sellers' to buyers' markets[42] as demand for consumer electronics remains muted both in Japan and Europe and as competition for the U.S. electronics market has intensified considerably. Under such conditions, Japanese electronics firms are now confronted with the hidden costs of their established international production system. During the 1980s. all of these firms invested heavily in capacity expansion, both in Japan and abroad. They are now saddled with substantial surplus capacities that seriously erode their cost competitiveness. As a result, Japanese firms, which invented the concept of “lean production”, “...are now suffering from the

---

[41] An interesting account of such cross-cultural communication problems and an agenda for required changes can be found in Hitachi Research Institute [1994].

[42] See Ernst and O'Connor [1992], chapters I and II.

opposite, i.e., the 'fat production' system, while foreign firms are quickly learning Japan's 'lean production'." (Yakushiji [1993], p.25).

This clearly indicates that the once predominant strategy of market share expansion through "variety wars", which focuses on the rapid introduction of new products or of new features to existing products, is running into increasing constraints. It is bound to lead to overproduction -- unless Japanese electronics firms are able to develop new markets. One possibility would be to create new product markets. Yet, despite continuously high investments into product development, only a few potentially successful "high-growth products" have emerged.[43] The main emphasis thus has to be on geographic market diversification, especially into the rapidly growing markets of East Asia.
This is why Japanese electronics firms today are all quite anxious to expand their market shares in East Asia. Compared to the second half of the 1980s, when supply considerations were by far the dominant concern, today Japanese overseas investment in East Asia is driven by "...a completely new logic" (Kinoshita [1994], p.4), and market share expansion within the region is now a much more prominent objective. Almost all the firms we interviewed are committed to major new investment projects in China, and all of them clearly indicated that getting a foot into this potentially huge growth market has been the main motivation for such investments, over-riding the still quite substantial concerns about political and macroeconomic instability and the huge investment risks involved.

IV.9 Pressures Resulting from a Broadening Product Mix

Until the late 1980s, most of the East Asian production activities of Japanese electronics firms covered only a limited variety of products, market segments and production activities. In most cases, the focus has been on the final assembly of low-end household appliances and consumer goods that require fairly conventional mass production techniques. This has been complemented by the production of a variety of electronic components that are not leading-edge, but scale-intensive and essential for the performance for the final products, with small-screen TV picture tubes being a typical example. The same applies to some parts forming and die- and tool-making activities.

Over the last few years, substantial changes have occurred in this traditional product mix which is likely to impose new pressures on Japanese electronics firms to open up their East Asian production networks. Take the case of telecommunications equipment (ranging from fax machines,

---

[43] Some important examples are: Canon for compact copiers, laser and bubble-jet printers and a new enabling technology for liquid crystal displays, called ferro-electric LCD; Sony for walkmans and camcorders; Sharp for active matrix -LCDs, a miniaturized and user-friendly camcorder based on Sharp mini liquid-crystal video displays, called VideoCam, and refrigerators based on "neural network" technology; and Fuji Photo Film's new 3.5 inch floppy disc which is capable of recording 50 times as much data as those currently in use, opening up the possibility for floppy discs to dominate future markets for portable recording media for digital data.

pagers, cellular phones, to switching and transmission equipment) where East Asia has now overtaken Europe as the most important growth market. Competition for these markets is extremely intense, with the result that all major manufacturers of telecommunications equipment are now expanding their production in the region. In order to penetrate for instance the closed public procurement markets for transmission and switching equipment, foreign firms are required to establish domestic production. The typical entry strategy into such markets requires the foreign company to accept offset production agreements that allow local firms to participate in production. For most of the necessary support services required to install and upgrade telecommunications equipment, it would simply be too costly and time-consuming to provide them from abroad. As a result, Japanese firms have had to expand those circuit design and software activities in East Asia that are required for the installation of telecommunications systems.[44]

Probably the most dramatic pressures for an opening-up of regional production networks may result from the relocation of production of computer-related products. This process has started only very recently. During the fall of 1992, U.S. firms such as Compaq and Dell, followed later by Apple and others started a blistering price war in Japan, offering Japanese-language machines for roughly half of the price of NEC machines. This for the first time posed a serious threat to NEC's 50% market share of the heavily overpriced Japanese PC market that so far had appeared to be invincible.

NEC's immediate reaction was to gather its main subcontractors, just before Christmas 1992, for a secret meeting in rural Gumma Prefecture north of Tokyo, asking them to come up, within three weeks, with "...50% cuts across the board, all parts, all assemblies, everything." (Miyashita and Russell [1994], p.200).

During the following months it became clear however that many of NEC's suppliers had no more leeway to cut costs, and some were even starting to rebel. The traditional response to price competition, i.e., shifting the burden of cost reduction onto the shoulders of subcontractors, clearly had reached its limits. As a result, NEC was forced to shift, fairly ad hoc and without much preparation, a growing share of its production abroad, especially to lower-cost locations in East Asia.

For its main product line, the PC 9800 series, NEC has chosen a two-pronged approach. In April 1994, it has shifted the design of the motherboard (the main circuit board for PCs that contains the central processing unit) to its Hong Kong subsidiary NEC Technologies Hong Kong Ltd. The main objective is to redesign the board so that it can use more of the cheaper standard components available from Korean, Taiwanese and possibly also Chinese producers. By 1995, NEC expects to increase the share of these East Asian components to around 70% of the board's value. For the time

---

[44] See our earlier discussion in section 3.4.

being, these boards are sent back to Japan and are assembled there into NEC's new PC 9800 Fellow and Mate models that NEC claims are more powerful and cost 50% less than previous models. Starting from around mid-1995, NEC is planning to assemble an increasing number of these new PC models in its new joint venture in Shanghai that originally was established to assemble NEC workstations for China's domestic market.

This example clearly indicates that, confronted with an increasingly pervasive price war, Japanese computer manufacturers have cast aside most of their earlier inhibitions to forge close ties with Asian suppliers and that they are now engaged in a somewhat belated attempt to replicate the international inter-firm production networks that U.S. computer manufacturers have established much earlier. Japanese computer firms are under such intense pressure that very little is likely to stop this opening-up of their international production networks.

Whether this will help them to regain market share at home and in the main international computer markets, however is a different question. As discussed elsewhere, most Japanese computer manufacturers have been quite stubborn in their resistance to adapt to the two most important changes of the computer industry, i.e., the shift to open system architectures and the spread of computer networking (Ernst and O'Connor [1992], chapters I and II). Take again NEC. Both with regard to open system architecture design and networking, NEC pursues a defensive "rearguard" strategy and continues to stick to its proprietary PC architecture. With regard to computer networking, NEC is only now starting to move. In late August 1994, it declared its intention to study "...the possibility of introducing IBM-compatible high-end servers based on the Pentium microprocessor made by Intel." (Financial Times, 8/25/94) The company however emphasized that it had no plans to develop IBM-compatible PC servers, a major growth market for computer networks. And for its own PC9800 series, NEC began to change its architecture for networking only two years ago, in 1992.

As Japanese electronics firms have broadened their product mix in East Asia to include an increasing variety of industrial electronics products, this has substantially increased the complexity of their regional production networks. All of these new redeployment activities have to be implemented simultaneously and as rapidly as possible. Japanese firms are finding it much more difficult today to control and coordinate these manifold activities as part of a closed regional production network. Time to market, for many of these products, has become the most important determinant of success. Japanese firms thus simply cannot wait the roughly nine months that are normally required to establish a new production facility, nor can they wait till their domestic suppliers have set up shop within the region. As a result, they are forced to rely on regional OEM suppliers, primarily from Taiwan but also from Korea. NEC, for example, buys motherboards from Taiwan's Elitegroup and computer monitors

from Tatung and Teco Electric & Machinery Co. Similar OEM arrangements are reported for Toshiba, Hitachi and Fujitsu.

At the same time, Japanese computer manufacturers are less reluctant now to search out within the region and to qualify non-Japanese suppliers and contract manufacturers for an increasing number of their components, including now also computer memories, controllers and foundry services for ASICs. Since mid-1993, Japanese DRAM producers like NEC, Toshiba, Fujitsu, Mitsubishi and Oki Electric have all agreed to share new manufacturing processes or chip designs with much smaller chip producers in Taiwan and Singapore.[45] Most of these arrangements are second-sourcing agreements that enable the Japanese firm to cope with the current rapid growth of demand for DRAM devices without being forced to undertake huge fixed capital investments into new production facilities. By trading technology for factory space in East Asia, Japanese DRAM producers are able to sustain their broad product mix that distinguishes them for instance from their Korean rivals. Even more important, they can sustain their broad product mix at a reasonable cost and in a way that enables them to react flexibly to changing market requirements.

V The Proliferation of Competing Regional Production Networks

One final set of pressures on Japanese electronics firms to open up their regional production networks in East Asia results from the increasing globalization of competition. Across the whole spectrum of the electronics industry, the region is witnessing today the proliferation of competing international production networks which are beginning to change the rules of competition, the market structures and the prevailing patterns of technology diffusion. At the same time, these different networks are increasingly interacting and have merged into new hybrid forms of industrial organization with the result that Japanese electronics firms, irrespective of their market position, are forced to reconsider their traditional location and investment strategies.[46]

Two aspects need to be distinguished here: first, interactions with production networks that have been around for quite some time; and, second, the entry of new players, from within the region, with new priorities and distinct organizational patterns.

V.1 Established Production Networks in Semiconductors and Disk Drives

As for the first aspect, Japanese firms are not the only ones that have established regional production networks in East Asia, nor have they always been the first. In semiconductors for instance,

---

[45] For details, see Ernst [forthcoming].

[46] For the concept of "hybrid forms of organization", see Abo (ed.) [1993].

American firms began to invest in 100% owned offshore assembly plants already in the 1960s, while Japanese firms, with the exception of those chips that are necessary for consumer products, have started only recently to follow suit. What matters is that U.S. firms early on proceeded to open up these networks. Used to rely on market-driven, arms'-length supplier networks and faced with high costs of capital, they were forced since the late 1970s to shift from equity to non-equity forms of overseas investment, especially contract assembly and second-sourcing arrangements.[47] The result has been the development of strong domestic support industries, originally in Korea, Taiwan and Singapore, but later also in Malaysia[48] and the Philippines.

The next wave of American regional production networks was driven by the investments of disk drive producers that were forced to move offshore due to increasing price competition. The typical example is Seagate, which, in cooperation with the Japanese mini-ball bearing company Minebea, has established today a highly sophisticated regional production network centered around Singapore and Bangkok and which relies extensively on contract manufacturers within the region.

For both product groups, Japanese firms have been clear latecomers in establishing regional production networks. As a result, they are confronted today with two options: Either to rely again, at a considerable cost, on the wholesale transfer of their domestic production system, which would require, in addition, considerable time to become operational and profitable; or to participate as much as possible in the already existing regional production networks by linking up with the rich pool of contract assemblers, component producers and OEM suppliers that exist today within the region. Whichever way Japanese firms will decide to go, it is clear that they would have a hard time simply trying to replicate the old pattern of closed regional production networks.

V.2 Newly Emerging Asian Production Networks

This brings us to the second aspect, i.e., attempts by firms from Taiwan, Korea, Hong Kong and Singapore, and by some Overseas Chinese conglomerates based in Southeast Asia, to strengthen their position in the electronics industry by establishing their own regional production networks.[49] Some observers have claimed that these new networks, and in particular those established by overseas Chinese capital, may pose a substantial threat for American as well as Japanese firms "...whose

---

[47] Empirical research on this earlier period has shown that, rather than shifting from offshore to onshore investment, as many observers predicted at that time, U.S. electronics companies have simply shifted from intra-firm to inter-firm international production networks. See Ernst [1983].

[48] For a detailed analysis of the spin-off effects of Intel's semiconductor assembly plant in Penang on local suppliers, see Ernst 1994a.

[49] For a detailed analysis of these newly emerging regional production networks, see Ernst [forthcoming].

influence in the region could be eclipsed."[50] And a widely quoted management author goes as far as to claim a shift "from the dominance of Japan to a China-driven Asia."[51] These are highly exaggerated claims, especially if one talks about the electronics industry, in which three types of newly emerging networks can be discerned: (1) those established by Korean chaebol, mainly for low-end, price-sensitive appliances and consumer goods, which are basically a response to the earlier expansion of Japanese networks in Southeast Asia and which replicate the traditional Japanese model of a closed network;[52] (2) those established by Taiwanese producers of PCs and related peripheral equipment in Southeast Asia and China, which, again, until now have remained fairly closed;[53] and (3) those networks that involve Chinese-owned firms based in Hong Kong, Taiwan, Singapore and Southeast Asia that, in most cases, act as intermediaries for attempts by Japanese as well as American and European electronics companies to enter the "new frontier" markets of China and Vietnam.[54]

None of these networks so far poses a substantial threat to the existing regional production networks of Japanese electronics companies. The first two are at least equally closed as the existing Japanese networks-- local component sourcing is practically non-existent and capability transfer remains restricted to basic operational production capabilities. Both types of networks however are now facing pressures that are similar to the ones that we have discussed before for Japanese networks. The high cost of imported components often surpass the savings reaped from low local labor costs, with the result that both Korean and Taiwanese firms are now forced to reduce linkages with their domestic supply base. Rather than posing a threat, these networks could actually offer an opportunity for far-sighted strategies of Japanese firms to cooperate with and, possibly exploit some of these emerging networks for their own purposes.[55]

V.3 The Spread of Hybrid Forms of Regional Production Networks

What this implies becomes clearer when we look at the third type of new regional production networks. For instance, Japanese electronics companies have been expanding since 1992 their links with Taiwanese counter-parts to set up joint ventures in China and Southeast Asia. Examples such as

---

[50] Quoted from San Jose Mercury News, Special report on Ethnic Chinese Networks, June 26, 1994, p.1. Similar concerns about the "rise of overseas Chinese capital" are expressed in JETRO [1994], pages 5-9.

[51] John Naisbett, best-selling author of Megatrends, in an interview with the Far Eastern Economic Review, 7/14/94, p.12.

[52] For details, see Ernst [1994b], pages 16 and 17 and pages 119 and 120.

[53] For details, see Chen Tain-Ji and Wang Wen Thuen [1991]; Chung Chin [1994] and You-tien Hsing [1994b].

[54] BRIE data base on FDI and International Production Networks.

Sony, Sanyo and Sharp all have used their Taiwanese affiliates as bridgeheads into China. These hybrid regional production networks are meant to gradually combine "...Japanese technology and Taiwanese factory management and marketing expertise".[56] Similar link-ups are emerging with Hong Kong-based companies: a number of Japanese electronics firms that we interviewed in November 1993 indicated that they are using Hong Kong-based partners to establish joint ventures in China or that they are planning to do so. Apart from targeting China's domestic market, such link-ups may also concern products for sale back in Japan.

As Japanese firms increasingly interact with these types of Chinese networks, they will be forced to reconsider their traditional approach to the formation of regional production networks. The more Japanese firms become involved in such forms of cooperation, they are likely to discover a variety of advantages that could result from a gradual opening of their regional networks. Through such arrangements, they can pool scarce resources, like finance and qualified labor; and they can also reduce the tremendous risks involved in entering a highly unstable continental economy like China with its constantly changing rules and regulations and its institutional turmoil. At the same time, Japanese firms can use such tie-ups to build extensive local social networks that would help them not only in setting up future production plants but also to gain control of domestic distribution channels.[57]

But probably some of the most important advantages are expected to result from the gradual blending of different business cultures and organizations, like the Chinese and the Japanese production networks. By linking up with Chinese networks, Japanese electronics firms could reap two important benefits:[58] "...their internationalization, based on a tradition as émigrés requiring them to build strategies to suit whatever environment in which they found themselves, as well as their more international education and management skills" and "...the ability of the Overseas Chinese group to make rapid decisions, unencumbered by the organized structures of Japanese firms, able to move in a "one-man" decision style, in contrast to Japanese companies' committees and consensus seeking." In its assessment of the perspectives for Japanese FDI in East Asia, Lloyds London comes to the following conclusion: "These Asian combinations will leave Japan with bigger competitive advantages than it has ever had before." (Lloyds List, 11/14/1991, p.5)

---

[55] For an analysis of some already existing tie-ups between Japanese and Korean semiconductor producers, see Ernst [1994a].

[56] Hsu, Michelle, "Japan Involves Taiwan in Its Asian Strategy", Business Taiwan, 6/14/1993, p.2.

[57] You-tien Hsing [1994a] provides an excellent analysis of how Taiwanese shoe manufacturers have been able to set up such local social networks in China and how they have benefited from them.

[58] The following quotes are taken from Abegglen [1994], p.201.

VI What are the Chances for a Shift to More Open Regional Production Networks?

We have seen that Japanese electronics firms are under increasing pressure to open up their East Asian production networks. But whether such opening-up will actually occur, and how fast and in which form it will be implemented, depends on a number of factors. External pressures matter, as they help to focus the attention of management on necessary change. But they will not automatically bring about change.

What are the chances that the East Asian production networks of Japanese electronics firms will become more open? We have seen in section IV.5 that a continuous upgrading of locational advantages of East Asian host countries constitutes one important enabling condition. Yet, despite these improvements, most Japanese electronics firms still tend to take a wait-and-see approach and appear undecided on how to proceed. Only a few of these firms have been willing to move ahead and to experiment with different approaches to an opening-up of their regional production networks. Instead, firms keep complaining and placing the burden of change primarily on the shoulders of governments, both in the East Asian host countries and in Japan.

Current debates in Malaysia are indicative of this approach.[59] Malaysia's investment climate has become increasingly conflictual, and Japanese firms and the Malaysian government find themselves embroiled quite frequently in conflicts of interest. A majority of Japanese electronics firms involved in Malaysia have clearly decided to stick as long as possible to their established organization of production and are currently developing defensive "rearguard strategies" that would enable them to counter the Malaysian government's request for a deepening and progressive localization of their production activities. By threatening to divert investment away from Malaysia to China and possibly also to Vietnam, they want to increase their leverage for gaining new concessions from the Malaysian government. The main reason that they feel confident to do so is that they perceive an intensifying competition among East Asian host countries for inward FDI by Japanese firms.[60]

---

[59] The following is based on press reports on the 17th annual conference of the Japan-Malaysia Joint Economic Associations in Kuala Lumpur, July 26 and 27,1994 , as reported in the Business Times [Malaysia], 7/27/94, p.1 and 7/28/94, pages 1 and 4.

[60] According to the chairman of JACTIM's Trade and investment Committee, "...there is no denying that competition in foreign capital induction and export between Malaysia on one hand and China, Vietnam and other ASEAN countries on the other will become increasingly acute in the future." (The Reuters Asia-Pacific Business Report, 8/11/94). This threat of a possible investment diversion to China has induced the Malaysian government as well as other ASEAN governments to accelerate trade liberalization through AFTA, primarily with the objective "...to create a market of 350 million people that can draw foreign investment and compete on a more level playing field with China. "(Far Eastern Economic Review, cover story on ASEAN, p.32).

What are the reasons for this reluctance? Are Japanese electronics firms under sufficient pressure to change the organization of their East Asian production activities? Are they really willing to embark on the risky path towards a paradigm shift? Or have they decided to stick as long as possible to the established pattern of international production activities that has served them so well in the past?

The answer to these questions obviously depends on how the benefits of opening-up compare with the costs and risks involved. If, for instance, potential benefits are long-term and difficult to prove, while the costs and risks involved are severe and sufficiently transparent, this could obviously induce Japanese firms to defend the status quo, plus (maybe) some minor adaptations.

One could argue that, in essence, Japanese electronics firms face a basic dilemma: If they continue to rely on closed and highly centralized regional production networks, they may create increasingly non-competitive domestic and overseas production systems. If, on the other hand, Japanese firms proceed too quickly to open up these networks, the resultant transfer of technology and capabilities may increase the competitiveness of new competitors-- not only for low-end, labor-intensive products, but increasingly for mid-level and some higher-end products. It may also lead to "hollowing-out" effects on the Japanese economy and may thus erode the competitiveness of the domestic Japanese production system.

This dilemma could become quite serious, if the following scenario would materialize: Suppose Japanese electronics firms seriously begin to open up their regional production networks. And suppose that this would significantly reduce exports "...of highly sophisticated high value-added specific intermediate goods, parts and components, and capital goods from Japan." (Yoshitomi [1994], p.28) As Yoshitomi correctly points out, the rapid growth of these exports so far has contained possible "hollowing-out" effects for the Japanese economy. If these exports would rapidly decline, this would add a third displacement effect to the two earlier displacement effects identified by Yoshitomi [1994], i.e., the displacement of exports from Japan by sales from East Asian affiliates of Japanese firms; and the displacement of domestic production in Japan by increasing "reverse imports' from Japanese transplants located in the region. Obviously such a third type of displacement effect would considerably increase the challenge of restructuring the Japanese economy. It would also raise substantial implementation constraints to a progressive opening-up of Japanese East Asian production networks.

How likely is the above scenario? Obviously, we need empirical research to establish whether this is a realistic scenario. As far as I am concerned, I would not take too serious the above "worst case" scenario, at least within a timeframe of five to ten years. While East Asian economies have made

substantial progress in the formation of their technological and organizational capabilities and in the development of domestic support industries, there are only a few areas where East Asian firms could realistically expect to substitute Japanese imports of core components and sophisticated production equipment.[61] In addition, almost all of these countries are now faced with quite substantial structural adjustment requirements in their established growth models.[62]

My overall assessment of the chances for a shift to more open regional production networks can thus be summarized as follows: Despite substantial implementation constraints, there is no doubt that the East Asian production networks of Japanese electronics firms will gradually become more open and will involve more local and regional firms. At the same time, these linkages will come in an increasing variety of forms, with the focus shifting from equity to non-equity forms of investment. This may substantially broaden the scope for capability transfer and for the localization of production, but also of marketing, procurement and R&D. Very little can stop this opening-up, but this will be a painfully slow and difficult process, fraught with a variety of potential conflicts.

It would thus be quite unrealistic to expect that such opening-up will occur naturally, simply as a reflection of market forces. For quite some time, the Japanese government and intermediate institutions like industry associations and bilateral chambers of commerce will have to play a critical role. This is also true for the main Japanese trading companies which are beginning to provide important support and coordination services, by establishing for instance bilateral "industry dialogues" (as discussed before for Malaysia), and by identifying possible local partners for Japanese companies and by acting as a match-maker. As demonstrated before, Japanese electronics firms are likely to rely as much as possible on defensive rearguard strategies. It would thus be quite unrealistic to expect that they will become primary agents of change.

As a result, host country governments may need to play a much more active role. But they also need to change the focus of their policies. Traditionally, this focus has been on the low level of direct technology transfer by foreign companies and on how these companies can be induced to expand these flows. This focus may have been misplaced, as learning and technology accumulation by local firms is of at least equal if not greater importance than the conscious transfer activities of foreign firms (Ernst, Mytelka and Ganiatsos [1994]). Host country policies thus should focus much more on the formation of domestic capabilities and the development of support industries. Finally, attempts to liberalize trade and investment flows, both globally and within the region, can play an

---

[61] Two examples are DRAMs, in which Korean chaebol have been able to increase their share of the East Asian market to the detriment of Japanese firms (Ernst [1994b]; and computer subassemblies and peripheral equipment from Taiwan (You-tien Hsing [1994b].

[62] For evidence, see Ernst [1994a], [1994b] and Ernst and O'Connor [1992] and [1989].

important role in facilitating the opening-up of Japanese regional production networks -- provided they take into account the needs of East Asian host countries.

Bibliography

Abe, T. [1992], "Overseas R&D Activities of Japanese Companies" (in Japanese), The Journal of Science Policy and Research Management, Vol.7, No.2.

Abegglen, J.C. [1994], Sea Change. Pacific Asia as the New World Industrial Center. (New York: The Free Press).

Abo, T. (ed.) [1993], Hybrid Factory. The Japanese Production System in the United States. (New York; Oxford: Oxford University Press).

Axelsson, B. et al. (eds.), [1992], Industrial Networks. A New View of Reality. (London; New York: Routledge).

Bell, M. and K. Pavitt [1993], "Technological Accumulation and Industrial Growth: Contrasts Between Developed and Developing Countries", Industrial and Corporate Change, Vol. 2, No.2.

Biemans, W.G. [1992], Managing Innovation Within Networks, (London; New York: Routledge).

Blomström, M. [1992], "Host Country Benefits of Foreign Investment", in: D. McFetridge (ed.), Foreign Investment, Technology and Economic Growth, (Calgary: The University of Calgary Press).

Borrus, M. [forthcoming], "Building an Alternative Supply Base in East Asia: Regional Production Networks of U.S. Electronics Firms", (Berkeley, Calif.: Berkeley Roundtable on the International Economy, University of California at Berkeley).

Branscomb, L.M. and F. Kodama [1993], Japanese Innovation Strategy. Technical Support for Business Visions, (Harvard, Mass.: CSIA Occasional Paper No. 10, Center for Science and International Affairs, Harvard University).

Cantwell, J. [1989], Technological Innovation and Multinational Corporations, (London: Basil Blackwell).

Castells, M. [forthcoming], "The Culture, Institutions and Organizations of the Information Economy: The Network Enterprise", in A Cross-Cultural Theory of Information Society. (Oxford: Blackwell).

Central Bank for Commercial and Industrial Cooperatives [1993], Survey of the Effects of the Yen Appreciation on Small- and Medium-Sized Enterprises, (in Japanese), (Tokyo).

Chen Tain-Ji and Wang Wen Thuen [1991], Globalization of Taiwan's Electronics Industry, (Taipei: Chung Hua Institution of Economic Research).

Chesnais, F. [1992], "National Systems of Innovation, Foreign Direct Investment and the Operations of Multinational Enterprises", Lundvall, B.A., et al. (eds.), National Systems of Innovation, (London: Publishers).

Chesnais, F. [1994], "World Oligopoly, Rivalry Between "Global" Firms and Global Corporate Competitiveness", in: J. Molero (ed), Technological Innovation, Multinational Corporations and International Competitiveness, (Reading, UK: Harwood Academic Publishers).

Chung Chin [1994], " The Changing Pattern of Division of Labor across the Straits: Macro Overview and Sectoral Analysis of the Electronics Industry". (Taipei: Chung Hua Institution of Economic Research).

Dicken, P. [1992, 2nd edition], Global Shift. The Internationalization of Economic Activity. (New York; London: The Guilford Press).

Dunning, J.H. [1993], Multinational Enterprises and the Global Economy. (Addison-Wesley).

Ernst, D. and D. O'Connor [1989], Technology and Global Competition. The Challenge for Newly Industrialising Economies. (Paris: OECD Development Centre Studies).

Ernst, D. and D. O'Connor [1992], Competing in the Electronics Industry. The Experience of Newly Industrialising Economies. (Paris: OECD Development Centre Studies).

Ernst, D. and G. Linden [1994], "The BRIE Data Base on FDI and International Production Networks: A Brief Description", (Berkeley, Calif.: Berkeley Roundtable on the International Economy, University of California at Berkeley).

Ernst, D. and G. Linden [forthcoming], "East Asian Production Networks and Capability Transfer: A Comparison of U.S., Japanese, Taiwanese and Korean Electronics Firms", (Berkeley, Calif.: Berkeley Roundtable on the International Economy, University of California at Berkeley).

Ernst, D. and P. Guerrieri [forthcoming], "International Production Networks and Changing Trade Patterns in East Asia: the Case of the Electronics Industry", (Berkeley, Calif.: Berkeley Roundtable on the International Economy, University of California at Berkeley).

Ernst, D. [1983], The Global Race in Microelectronics, with a foreword by David Noble (MIT), (New York; Frankfurt: Campus).

Ernst, D. [1994a], "Network Transactions, Market Structure and Technology Diffusion: Implications for South-South Cooperation", in: L. Mytelka (ed.), South-South Cooperation in a Global Perspective, (Paris: Development Centre Documents, OECD).

Ernst, D. [1994 b], What are the Limits to the Korean Model? The Korean Electronics Industry Under Pressure. (Berkeley, Calif.: Berkeley Roundtable on the International Economy, University of California at Berkeley).

Ernst, D. [forthcoming], "Competing Asian Production Networks in the Electronics Industry: How Do They Interact?", (Berkeley, Calif.: Working Paper # , Berkeley Roundtable on the International Economy, University of California at Berkeley).

Ernst, D., L. Mytelka and T. Ganiatsos [1994], "Technological Capabilities: A Conceptual Framework", in: D. Ernst, T. Ganiatsos and L. Mytelka (eds.), Technological Capabilities and Export Success: Lessons from East Asia, (Cambridge; New York: Cambridge University Press).

Forsgren, M. et al. (eds.) [1992], Managing Networks in International Business, (Philadelphia, etc.: Bordon and Breach).

Freeman, C. [1987], Technology Policy and Economic Performance. Lessons from Japan. (London: Pinter Publishers).

Graham, E. and N. T. Anzai [1994], " Is Japanese Direct Investment Creating an Asian Economic Bloc?", (Washington, D.C.: Institute for International Economics).

Graham, E. and P. Krugman [1992], Foreign Direct investment in the United States, (Washington, D.C.: Institute for International Economics).

Granstrand, O. et al. [1993],"Internationalization of R&D -- A Survey of Some Recent Research", Research Policy, Vol. 22

Guerrieri, P. [1994], Trade Integration and Changing Specialization Patterns in the East Asian Electronics Industry, report prepared for the BRIE/CIS project *FDI and Technology Diffusion* (Berkeley, Calif.: Berkeley Roundtable on the International Economy, University of California at Berkeley).

Hitachi Research Institute [1994], Corporate Culture through Globalization. A Report Prepared for the National Institute of Research Advancement, (Tokyo).

Howells, J. and M. Wood [1993], The Globalization of Production and Technology, (London: Pinter Publishers).

Hsing You-tien [1994a], The Work of Networks in Taiwan's Export Fashion Shoe Industry, Vanvouver: Centre for Human Settlements, University of British Columbia).

Hsing You-tien [1994 b], Technological Capability Formation in Taiwan's Electronics Industry: Achievements and Challenges, (Vancouver: Centre for Human Settlements, University of British Columbia).

Hu, Yao-Su [1992], "Global or Stateless Corporations Are National Firms with International Operations", California Management Review.

Ikemoto, Yukio [1991], "Coexistence of Import-Substitution and Export Promotion in an Industry: The Case of the Thai Home Electric Industry", (in Japanese), in: Ajia Keizai (Asian Economies), November.
Japan Institute for Overseas Investment [1993], Foreign Direct Investment in East Asia: Trends and Outlook, 2 volumes, (Tokyo).
JETRO [1994b], Survey of Overseas Business of Japanese Corporations (in Japanese), (Tokyo).
JETRO [1994], JETRO White Paper on Foreign Direct Investment, (Tokyo).
Kinoshita,T. [1994a], "Japan's Foreign Direct Investment in East and South-East Asia: The Current Situation and Prospects for the Future", Research Institute for International Investment and Development, (Tokyo: Sakura Institute of Research).
Kinoshita, T. [1994b], "A Note on Long-Term Flows of Financial Resources in the Asian and Pacific Region", Research Institute for International Investment and Development, (Tokyo: The Export-Import Bank of Japan).
Krugman, P. and Graham, E., [1992], "The Surge in FDI in the late 1980s -- Conceptual Issues", paper presented at the National Bureau of Economic Research Conference *Foreign Direct Investment Today*, Cambridge, Mass., May.
McCulloch, R. [1992], "New Perspectives on Foreign Direct Investment", paper presented at the National Bureau of Economic Research Conference *Foreign Direct Investment Today*, Cambridge, Mass., May
MITI [1993], Prospects and Challenges for the Upgrading of Industries in the ASEAN Region, (Tokyo: Southeast Asia-Pacific Division, International Trade Policy Bureau, MITI).
Miyashita, K. and D.W. Russell [1994], Keiretsu. Inside the Hidden Japanese Conglomerates, (New York; etc.: McGraw-Hill).
Moran, T. (ed.) [1993], Governments and Transnational Corporations, (London; New York: Routledge).
Mukoyama, Hidehiko [1993], "Development of Supporting Industries in ASEAN: A Case Study of Thailand.", RIM. Pacific Business and Industries, Vol.IV, No.22, (Tokyo: Sakura Institute of Research).
Mukoyama, Hidehiko [1994], "Active Investment by Japanese Parts and Materials Process Industries in Asia: Exploring the Backgrounds of their Moves in Thailand and China", RIM. Pacific Business and Industries, Vol.II, No.24, (Tokyo: Sakura Institute of Research).
Nishiguchi, T., [1994], Strategic Industrial Sourcing. The Japanese Advantage, (New York; Oxford: Oxford University Press).
OECD [1992], Technology and the Economy. The Key Relationships, (Paris).
Pearce, R.D., The Internationalization of Research and Development by Multinational Enterprises, (London: MacMillan).
Porter, M.E., The Competitive Advantages of Nations, (London: MacMillan).
Safarian, E. [1990], "The Investment Decisions of Multinational Enterprises", North American Review of Economics & Finance, Vol.1 (2).
Sangyo Kenkyujo [1989], Survey on Personnel Development and Technology Transfer to Asian Countries (in Japanese), (Tokyo).
Shiraki, M. [1993], "A Comparative Study of Human Resources Development in Asian Settings: Problems and Strategies of Japanese Companies", in Report on APO Top Management Forum: Human-Centred Management, (Tokyo: Asia Productivity Organization).
Sunada, T. et al. [1993], "Japanese Direct Investment in East Asia -- Changing Division of Labor and Technology Transfer in the Household Electric Appliance Industry", MITI/RI Discussion Paper No. 93-DF-14, March, (Tokyo).
Takeuchi, Junko [1993], "Foreign Direct Investment in ASEAN by Small- and Medium-Sized Japanese Companies and its Effects on Local Supporting Industries", in RIM. Pacific Business and Industries, Vol.IV, No.22, (Tokyo: Sakura Institute of Research).

Tejima, Shigeki, et al. [1994], "The Recent Trends of Japanese Foreign Direct Investment and Prospects in the 1990s based on the Japan EXIM Bank's Survey Implemented in FY 1993", EXIM Review, Research Institute for International Investment and Development, (Tokyo: Sakura Institute of Research).

United Nations [1993], World Investment Report 1993. Transnational Corporations and Integrated International Production, (New York).

Vernon, R. [1971], Sovereignty at Bay, (New York: Basic Books).

Vernon, R. [1979], Storm Over the Multinationals, Cambridge, Mass.: Harvard University Press).

Von Hippel, E. [1988], The Sources of Innovation, (New York; Oxford: Oxford University Press).

Whitley, R. [1992], Business Systems in East Asia: Firms, Markets and Societies, (London: Sage Publications).

Yakushiji, T. [1993], "Beyond Competitiveness: The Changing Environment for Intra-/Inter-Firm High Technology Cooperations in Japan", in P. Gourevitch and P. Guerrieri (eds.), New Challenges to International Cooperation: Adjustment of Firms, Policies and Organizations to Global Competition, (San Diego, Calif.: International Relations and Pacific Studies, University of California Press).

Yamazawa, I. (ed.) [1993], Effects of Japanese Overseas Production on Japan's Machinery Trade. Report Prepared for the Japanese Machinery Export Association (in Japanese), (Tokyo).

Yoshitomi, M. [1994], "Building New United States -- Pacific Asia Economic Relationship for the Post-Uruguay Round Era", paper presented at the fifth United States-Korea Symposium, *Economic Cooperation and Challenges in the Pacific*, Korea Economic Institute of America, Berkeley, Calif., September.