5

Electronic Industry in Asia: Changing Supply Chain and the Effects

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1. INTRODUCTION[1]

In this chapter, we focus on the electronic industry, an industry that is intensively introducing IT into business operations. Companies in the sector face intensive global competition, continual price erosion, shortening product lifecycles and the uncertainty of fluctuations in demand on the markets. Their customers demand a just-in-time delivery. But they need to decrease inventories of the entire supply chain.

To do this, these companies need to share more timely information on actual supply, demand, and inventory with their partners on the Web. They should replace step-by-step interactions in the supply chain with parallel simultaneous interactions between trading partners across the entire supply chain. To realize these operations, multinational companies are introducing computer-aided management systems such as Supply Chain Management (SCM), Electronic Commerce (EC) and outsourcing.

In the case of US companies, they gather materials, parts and products from all over the world, especially from Asia in IT related items' case. US companies often outsource the manufacturing process and concentrate their resources on R&D and sales activities. A good example can be seen in Mexico where parts are imported and assembled for

export to the US market. The formation of NAFTA and progress in IT has complemented this process toward establishment of the international division of labor.

Companies in Asia are trying to construct or respond to these structures. This is also true of Japanese companies. Facing recession in the 1990s, they were forced to improve their productivity, cultivate new markets and change their structures of division of labor to be able to absorb the merits of IT and meet their customers' demands.

2. SCM, EC AND OUTSOURCING IN ASIA

2.1. SCM in Asia

2.1.1. SCM by Dell Computer in Asia

Firstly, the case of Dell Computer. This case will help to explain the international division of labor in Asia and Japan that emerged in the 1990s.[2]

Dell Computer is famous for its direct model and build-to-order (BTO) system. Dell can accept orders directly from customers, customize the products according to customers' orders and deliver them quickly without finished goods' inventories.

Products ordered from Japan are manufactured, customized and, with software installed at the Asia Pacific Customer Center (APCC) in Malaysia, transported to Japan by air. Dell is allied with FedEx and other transportation companies. Computers arriving in Japan are transported to a Dell Logistic Center (DLC), where peripherals procured in Japan are merged into computers if necessary, and delivered to customers (see Figure 5.1).

Figure 5.1: Production and Distribution Flow of Dell Computer
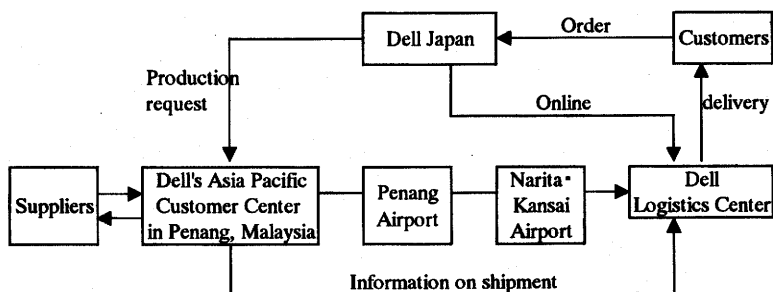
Source: *Nikkan Kogyo Shimbun*, July 25, 2000.

As a result of the opening of Kansai DLC near to Kansai International Airport in Western Japan in 2000, eventually 90 percent of customers will be able to receive ordered products within two days after shipping from Malaysia. It was 67 percent before starting its operation.

The shortening of lead-time for delivery was realized by sharing information with the company's offices and partners. In Malaysia, APCC and suppliers of parts and peripherals share information on production and delivery plans. So they can decide on how many products they should produce and when they should deliver to Dell's sites. Each ordered product is identified by a code and controlled on the computerized system from preparation of its production to shipment. Customers can monitor the state of their products in real time. In Kansai DLC, Vendor Managed Inventory (VMI) was introduced. In this system, peripherals are delivered to the warehouse in Dell's site, but these inventories are counted as vendors' until PCs with these peripherals are shipped. Dell's inventories become close to approximately zero.

In China, Dell introduced the direct model to nine main cities including Beijing and Shanghai in 1998. It also introduced direct sales on the Internet and that was the first electronic commerce (e-commerce or EC) in Mainland China. In Xiamen, Dell has established the China Customer Center (CCC) to emulate the manufacturing and professional functions found at APCC.

2.1.2. SCM by Japanese Firms

Japanese firms have been trying to introduce Enterprise Resource Planning (ERP) and other computer aided management systems. Recession in Japan forced firms to restructure their business, while, at the same time, requirements from worldwide customers to reduce delivery time are behind this.

To know the situations of Japanese firms, it will be helpful to see a survey of the number of articles concerning IT in newspapers, magazines, the Web, etc., compiled by the Electronic Commerce Promotion Council of Japan (ECOM). According to the survey, the number of Business-to-Business (BtoB or B2B) EC is rapidly increasing. This was 33 in fiscal 1997, 175 in 1998, 295 in 1999 and 126 from April to July 2000.

By classifying the collected cases by about 50 keywords such as Electronic Data Interchange (EDI), we can confirm that keywords related

with EC like EDI, SCM, Internet and Web explosively increased in 1998 and are mainstream now. In 2000, the number of cases of e-Marketplace is rapidly increasing (see Figure 5.2).

2.2. EDI and EC in Asia

2.2.1. EC in Asia

In the process of making the supply chain more efficient, it is expected that BtoB EC will dramatically increase in the world.

In 1999, according to the Garter group forecasts, the worldwide BtoB EC market was US$145 billion, and the North America region accounted for 63 percent of the market with revenue reaching US$91 billion. The Asia-Pacific market was US$9.2 billion and 6.3 percent. Japan was the third largest market in the world, which was US$11.1 billion and 7.7 percent (see Table 5.1).

Table 5.1: Forecasts of Business-to-Business e-Commerce

Unit: US$ billion

|	World	Japan	Asia/ Pacific	North America	Latin America	Europe
1999	145	11	9	91	1	32
(share)	100.0%	7.7%	6.3%	62.8%	0.7%	21.9%
2004	7,290	861	992	2,840	124	2,340
(share)	100.0%	11.8%	13.6%	39.0%	1.7%	32.1%
Annual Growth (%)	118.9%	138.7%	155.0%	99.0%	162.2%	136.2%

Note: Japan will be surpassed by the Asia/Pacific region by 2002.
Source: Garter Group (Released on February 16, 2000).

In 2004, worldwide BtoB e-commerce is projected to surpass US$ 7.29 trillion. The North America region will remain the largest market in the world, but decrease its overall share to 39 percent of the market with revenue of more than US$2.84 trillion. The Asia-Pacific market will grow faster than the world market. The market size will be US$992 billion with 155.0 percent growth annually and account for 13.6 percent of the total. The Asia-Pacific region will surpass Japan by 2002.

The growth of EC seems to be initially BtoB that substitutes existing

Figure 5.2: Classification by Keyword
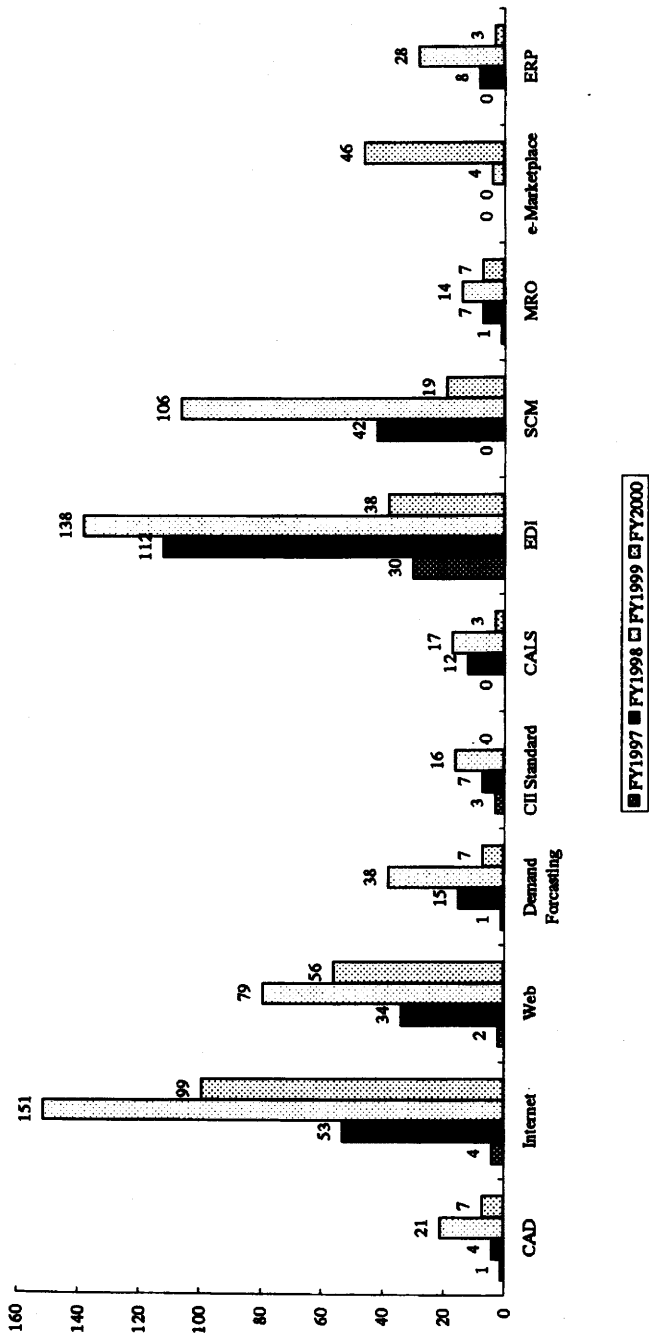
Note: The cases of FY2000 were collected from April to July 31, 2000.

Source: ECOM (2000).

paper-based transactions. Many companies in Asia have already entered into the BtoB business. In Singapore, Singapore Network Services Pte Ltd (SNS), SESAMi.com, BeXcom, ECnet and so on are offering various BtoB services. They are offering marketplaces where participating firms make deals and related-services. Their service offerings lie not only in transaction-related services such as document processing but also in services from transactions such as logistics and accounting. We will study cases in Singapore below.

2.2.2. EDI/SCM and Procurement of Parts by Japanese Firms in Asia

In Asia, some Japanese firms are promoting the introduction of IT to their procurement processes. A survey, conducted by the Japan External Trade Organization (JETRO) in 2000, of Japanese firms mainly belonging to the electronics and automobile sectors in Singapore, Malaysia, Thailand, the Philippines and Indonesia (ASEAN5), showed that the ratio of companies that have already introduced BtoB EC was 17.3 percent and those that are planning to was 11.3 percent (JETRO [2000]). About 30 percent of companies have already introduced or are planning to introduce the system (see Table 5.2).

The ratio of 'doing EC' was high in Singapore (35.7 percent) and Malaysia (30.6 percent). The sum of the ratio of 'doing' and 'planning' was highest in Singapore (64.3 percent) followed by Malaysia (43.5 percent) and the Philippines (31.0 percent).

In the industrial sectors, the ratio of 'doing EC' was extremely high in the assembly of electric and electronic products (33.8 percent). the ratio of 'planning' was high in the electronic sector and the assembly of automobiles. The sum of 'doing' and 'planning' in electronics was also extremely high.

Asked about the types of BtoB EC, introduced 50 firms responded and 60 percent of them had introduced EDI while SCM remained at 20 percent (see Table 5.3).

We can expect from these facts that some Japanese firms in ASEAN5 have already introduced BtoB EC, mainly EDI, and companies that have introduced SCM are limited. In the case of Asia Matsushita Electric in Singapore (AMS). AMS is now connecting its internal network with networks of suppliers through EDI vendors like SNS. SNS will be mentioned in the following section. Matsushita set up an organization, Asia Matsushita EDI, which is organized through 20 production bases to sup-

Table 5.2:   Introduction of BtoB EC for Parts, Materials and Products in ASEAN5

(Unit : %)

	Number of Respondents	Already Introduced	Not Yet	Planning
Total	335	17.3	71.3	11.3
Singapore	28	35.7	35.7	28.6
Malaysia	85	30.6	56.5	12.9
Thailand	129	8.5	86.0	5.4
Philippines	29	17.2	69.0	13.8
Indonesia	64	9.4	78.1	12.5
General Machinery	11	0.0	90.9	9.1
Assembly of Electric & Electronic products	77	33.8	49.4	16.9
Electric & Electronic Parts	106	19.8	67.9	12.3
Assembly of Automobiles	14	0.0	85.7	14.3
Automobile Parts	80	8.8	86.3	5.0
Precision Instruments	5	20.0	80.0	0.0
Others	42	7.1	81.0	11.9

Note: the number of respondents were used for calculation of share as denominator.
Source: JETRO (2000).

Table 5.3:   Contents of BtoB EC in ASEAN5

(Unit : %)

	Number of Respondents	Upload of Electronic Catalog	Upload of procurement Plan	EDI Within Industry	Developped SCM
Total	50	14.0	10.0	60.0	20.0
Singapore	10	40.0	10.0	50.0	0.0
Malaysia	23	8.7	13.0	73.9	21.7
Thailand	8	12.5	0.0	62.5	25.0
Philippines	4	0.0	25.0	0.0	50.0
Indonesia	5	0.0	0.0	60.0	20.0
General Machinery	0	0.0	0.0	0.0	0.0
Assembly of Electric & Electronic products	22	13.6	4.5	63.6	27.3
Electric & Electronic Parts	18	11.1	16.7	72.2	11.1
Assembly of Automobiles	0	0.0	0.0	0.0	0.0
Automobile Parts	6	0.0	16.7	33.3	33.3
Precision Instruments	1	100.0	0.0	0.0	0.0
Others	3	33.3	0.0	33.3	0.0

Note: the number of respondents were used for calculation of share as denominator.
Source: JETRO (2000).

port their introduction of EDI for procurement of parts and materials.

2.3. Outsourcing of Manufacturing

2.3.1. Roles of Contract Manufacturers

Seen in the cases of Dell and AMS, EDI/SCM are doing the outsourcing to make stages of the supply chain, such as procurement and distribution, more efficient. In manufacturing process, PC makers like HP sold their factories to contract manufactures (CMs) and are intensively using CMs or Electronics Manufacturing Service (EMS). Introduction of IT made it possible to share information with external enterprises as if they are integrated into one company.

CMs contract production of proprietary products, distribution, design, after sales services to users of the products with their customers. Customers of EMS enjoy the benefit of reduced production costs and avoid the risk of owning production facilities, develop worldwide networks rapidly and concentrate their resources into development, sales and other activities such as R&D that make more efficient use of their assets.

More specifically, the lifecycles of IT products like PC are very short, and the difference in sales between a hot seller and others is very large. But it is difficult to predict the speed and the difference accurately. Technologies are also progressing very rapidly. More value added is acquired from R&D activity. Resources necessary for R&D and production facilities are large.

CMs will be able to reduce costs and the risks of investment in facilities by contracting with many firms. This enables CMs to reduce burdens of fixed costs by enjoying economies of scale, to recoup initial investment in the facilities in a shorter period and to increase purchasing power to procure parts.

CMs are now expanding their service offerings to cover a wider range of the supply chain from design to distribution. Some of them are changing their roles into Original Design Manufactures (ODMs). ODMs are contract manufactures with product design capabilities. ODMs can reduce development time for new product models by creating 'ready-to-go' products for their customers. ODMs with technologies to be integrated into advanced products can produce new products soon after their customers recognize the need for new products.

2.3.2. *Activities by Contract Manufacturers in Asia*[3]

According to the Manufactures' Services Limited (www.msl.com), the market size of the worldwide EMS industry seems to be US$73 billion in 1999, US$88 billion in 2000 and US$106 billion in 2001 and growing at a two-digit growth rate annually (see Table 5.4).

Table 5.4: EMS Industry Forecasts

(Unit: US$ billion)

	Worldwide Electronic Market	EMS Market Share	Percentage
1998	633	60	9.5%
1999	672	73	10.9%
2000	711	88	12.4%
2001	759	106	14.0%
2002	813	126	15.5%
2003	873	149	17.1%

Source: Website of Manufacturers' Services Limited
(Originally, Technology Forecasters, 2000).

From the viewpoint of region, North America accounts for 47 percent of worldwide EMS industry revenues, Europe 24 percent, Japan 18 percent, other Asia 8 percent and the rest 3 percent. The share of Asian countries in world electronic product production is comparatively small, and here the forecast share for the US is about 32 percent, Europe 24 percent, Japan 19 percent and Asia-Pacific 20 percent in 2000 (REED ELECTRONICS RESEARCH [2000]).

There seems to be growing room for the EMS market in Asia. Several Asian companies are also included among world majors. NatSteel Electronics, which will be acquired by Solectron, JIT Holdings which was acquired by Flextronics International. And Universal Scientific Industrial Co., Ltd. from Taiwan. These were included among the top 50 CMs.[4]

Major CMs have already been operating in Asia. SCI Systems is in Singapore, Thailand, Malaysia and China. Solectron has operations in Japan, Malaysia, Singapore, Taiwan and China. With its acquisition of NatSteel, Solectron will also increase transactions in Asia, including Malaysia, Indonesia and China. Celestica operates manufacturing and design facilities around the world including Thailand, Malaysia, Hong

Kong and China. Flextronics International, headquartered in Singapore, has manufacturing centers in Malaysia and China and a design center in Taiwan. The companies mentioned above are the top 6 CMs in the world.

2.3.3. Changing Japan and Japanese Firms

Historically Japanese firms have had their own manufacturing section in their organizations to produce at least their key products. But some Japanese firms have already begun outsourcing production to CMs. Mitsubishi Consumer Electronics America transferred its wireless telephone assets to Solectron and contracted the manufacturing (*Nikkei Business*, October 16, 2000). Japanese firms are now changing. In Japan, the market for EMS is growing.

EMS industry in Japan can be classified broadly into three types. First is a company separated from major companies.[5] In the case of Sony,[6] Sony is redesigning Engineering, Manufacturing and Consumer Services (EMCS) systems. This reforms the existing production system that can be differentiated along product categories and Sony group companies. In 2001, Sony will integrate domestic manufacturing facilities for the final assembly of electronic products into a new EMCS Platform Company, tentatively named Sony EMCS AV/IT.[7] On the other hand, Sony agreed with Solectron on cooperation in electronic manufacturing. Sony will transfer two manufacturing facilities in Japan and Taiwan, and will contract the EMS from these facilities to respond to fluctuations in demand and product cycles sensitively.

The second type is a foreign company like Solectron mentioned above. In 1999, Solectron opened a New Product Introduction (NPI) center in Japan, becoming the first US-based EMS Company to establish a manufacturing presence in Japan. In October 2000, Celestica announced the official opening of an office in Japan.

The last type is an independent company. For example, Kyoden[8] aims to become a Total Solution Provider (TSP) in electronics and offers services such as design of print-circuit board (PCB) and box, ODM, prototyping, procurement of parts, mass production, logistics and maintenance. This company is growing very rapidly.[9] Kyoden is building a new factory named EMS factory in Japan to meet growing demand for EMS and the emerging new market of digital consumer electric appliances.

Large Japanese firms will on the one hand spin off their own manufacturing facilities and expose them to competition with outside manu-

facturers, while on the other hand using EMS to strengthen their manu-
facturing facilities and concentrate their resources on R&D, services and
devices. Some of them have an advantage in key devices that seem to
occupy the most part of the production cost of IT products and will bring
more value added.

3. SINGAPORE: EC HUB AND CROSSROAD OF WESTERN AND JAPANESE MANUFACTURING SYSTEMS

We saw SCM, applications of IT like EDI and EC and EMS. EDI, EC
and EMS can be seen as supporting services for constructing SCM.

In this section, we will see the development process of indigenous
CMs and make case studies of EDI/EC vendors in Singapore. These
cases will be helpful to examine the prospect of IT effects on the elec-
tronic sector in Asia and to know the roles of services for SCM.

3.1. Electronics Industry and CMs in Singapore

Singapore is one of the production centers for electronic products in the
world. More than 7 percent of world electronic data processing equip-
ment, including computer equipment, was produced in Singapore in
1998 (REED ELECTRONICS RESEARCH [2000]).

In the development process of the electronic industry in Singapore,
foreign direct investment (FDI), especially from the US and Japan,
played an important role. Rapid growth of investment in computer relat-
ed products began from the mid-1980s.[10] US firms overwhelmingly dom-
inated here. This was followed by Japanese companies' investments in
computer and related peripherals manufacturing from the mid-1990s.

As the electronic manufacturing industry grew, the investments in and
growth of electronics supporting industries, particularly printed circuit
boards (PCB) and their assembly (PCBA), were stimulated. Japanese key
components manufactures, US CMs and Singapore indigenous compa-
nies conducted these new investments. US firms promoted outsourcing
to local electronic supporting industries. This promoted acquisition of
know-how, expansion of service offerings and business organization by
local firms. Outsourcing has extended to logistics and warehousing,
design services and so on. As a result, a number of local firms succeeded
in supplying to Japanese firms in Singapore (Wong [1998]).

Today, indigenous CMs, for example NatSteel Electronics, Venture Manufacturing, JIT Holdings, Omni Electronics, CEI and PCI, and the Philippines-based Ionics, are listed on the Singapore Stock Exchange. Some of these firms have grown to become world top 50 CMs as mentioned above.

From this historical development process and current situation, it seems that the electronics industry in Singapore has evolved in an environment of competition and cooperation with the production networks of US and Japanese electronics firms.

3.2. EC in Singapore

Following the success in the development of the electronic industry, the Singapore government has promoted the national IT master plan "IT2000" to make Singapore an 'intelligent island'. "The Infocomm21 Strategic Plan,[11]" a new master plan on ICT (Information and Communication Technology) followed IT2000 to position Singapore as an EC hub.

To view the situation of EC in Singapore that was the background of Infocomm21, we refer to a Business-to-Business e-Commerce survey that was conducted by the then National Computer Board (NCB), now reorganized into IDA (NCB [1999]).

The survey investigated more than 1,000 companies from 8 industrial sectors.[12] 73.3 percent of companies had corporate Internet access and 33.4 percent owned corporate websites. About 9 percent of all companies in the selected industries were using Internet based BtoB EC. Some 28 percent expressed an interest in doing so within the next six months.

The usage of BtoB was highest among electronics product manufacturers, followed by freight forwarding companies. Among electronics product manufacturers 14.9 percent were already trading on the Internet and 28.9 percent were interested in BtoB. In the case of freight forwarding companies, the former was 9.2 percent and the latter 26.0 percent.

3.3. Case Studies of EDI and EC

3.3.1. SNS and TradeNet

SNS[13] was incorporated in 1988 and financed by governmental organizations such as the Trade Development Board (TDB) to operate the trade related EDI "TradeNet" service.

Today SNS is offering services other than TradeNet. One of the services is EDIMAN that is a service for manufactures and links between buyers and suppliers to facilitate procurement activities throughout the process from order to delivery by EDI. Six hundred companies, 50 percent of which are Japanese, including Hitachi, Aiwa and Sony, as well as Motorola, Compaq, HP, Phillips and so on, use this service (CICC [2000]).

Some systems or modules, parts of which have already been in operation, will be integrated into TradeNet Plus in 2001. TradeNet Plus covers all aspects of the trading cycle from supply chain management to financial/insurance transactions, government regulatory interfaces and logistics management transactions.

SNS is spreading its activities worldwide and has already set up joint ventures or affiliates in Canada, China, India, Malaysia, Mauritius, the Philippines, Taiwan and South Africa to transfer know-how and technologies (CICC [2000]).

3.3.2. ECnet Ltd.[14]

ECnet was founded in 1995 and named as Advanced Manufacturing Online (AMO) in Singapore but is now headquartered in the US. It began to make its e-supply chain management services or ECnet available in 1998. To augment offering services, it allied with Oracle, Sun Microsystems, DHL, FedEx, HP and so on.

The services were created exclusively for high-tech sectors such as components and semiconductors, contract manufacturing, computer and peripherals, communications and networks, and consumer electronics. The services cover supply chain management processes including order management and inventory management.

Some 65 multinational companies are deployed mainly as buyers and more than 1300 companies were operating as supplier on ECnet in August 2000. Customers include AMD, Epson, Siemens, Phillips, Sharp, Hitachi, Motorola, Seagate, JIT and so on.

The company is offering services in the US, Mexico, Japan, Singapore, Malaysia, Thailand, Korea, Hong Kong and China, and is planning to spread its activities to Ireland and the Netherlands. In Malaysia, 80 factories including JVC, three Matsushita and five Sony plants were linked to the ECnet system in 1999 (APIA [1999]). In China, ECnet allied with Capinfo Company Limited, one of the Internet and EC enterprises

backed by the government.

Many multinationals in high-tech sectors operating in Asia have already been exchanging documents electronically through EDI-VAN systems. But many Asian firms face a difficulty in participating in them because of the need for expensive investment in proprietary software.

ECnet services make participation easier and cheaper. They can be offered by connecting existing EDI or ERP/MRP systems. Users are also capable of any-to-any translation between such various standards as EDIFACT and XML, to automatically share data between systems. This is realized through a standardized Internet browser. This enables the system to deploy rapidly and to eliminate the time-consuming and error-prone manual processes.

ECnet is also offering ECnet Exchange that is an Internet-based marketplace for electronic components. Registered buyers can participate in the marketplace. But sellers are limited to registered manufacturers of finished products, OEMs, component manufacturers, authorized distributors and trading companies in order to guarantee the source and quality of the components. ECnet Exchange ensures financial transaction security by offering an escrow service and also a logistic service. ECnet began to offer this service from February 2000 and more than 600 companies have already registered.

3.3.3. *NatSteel Electronics and ECnet*[15]

NatSteel Electronics Ltd, founded in Singapore, was one of the world's top 10 contract manufacturers. But in 2000 it was announced that Solectron would acquire a 33 percent stake of the company. NatSteel Ltd., the parent company of NatSteel Electronics, decided to sell because of weak PC sales of its major customer, Apple Computer. In 1999, the group turnover was S$3,230 million. Revenues by customers are distributed among Apple (49 percent), HP (18 percent that was more than 60 percent in 1995), IBM (14 percent), Compaq (9 percent) and others (10 percent).

NatSteel addressed the introduction of EC from 1999. NatSteel linked its existing ERP system to ECnet. The company started the EC implementation process from the development of a system for its 200 suppliers. At the beginning, three kinds of messages were used: Purchase Order (PO) and Delivery Forecast for the order process, Advance Shipping Notification for the logistic process, and Invoice, Credit/Debit Notice

and Payment Advice for accounts payable trade. Some 100,000 per annum of these kinds of documents were exchanged to electronic data.

Before introducing ECnet, documents, for example POs, were sent from NatSteel's procurement section to suppliers by mail, telephone and fax. NatSteel's logistic section arranged transportation forwarders by telephone and so on. After the introduction of ECnet, selected messages were sent or accepted through ECnet electronically.

As a result of the introduction of ECnet, the percentage of suppliers connected with NatSteel online increased from 9 percent in the EDI-VAN environment to 32 percent in 3 month. Order lead-time was reduced by 2-3 days. The company also succeeded in cost reduction of paperwork on PO by 50 percent and on accounts payable trade by 35 percent.

4. CHINA: GLOBAL PRODUCTION BASE BUILT INTO NETWORKS

4.1. Growing China

The network of production and transaction of electronics products is spreading globally. Asia seems to be the world manufacturing center of ICT goods. Today, China is attracting investments from all over the world including other Asian countries. Especially, Taiwan is encouraging relocation of manufacturing to the Mainland. China has grown to be the world production center of ICT and electronic products. *The Nihon Keizai Shimbun* (July 15, 2000) reported that China is catching up to Japan in the production of new products like DVD players and mobile phones.

Moreover, China's world share of unit production of IT related products is growing rapidly. The world share of desktop PC manufacturing is already second to Taiwan and expected to rise from 8.7 percent in 1999 to 9.6 percent in 2000 (see Table 5.5). Another survey by the Institute for Information Industry (III) in Taiwan said that production value of PC related products in Mainland China will surpass that in Taiwan in 2000 (*Nihon Keizai Shimbun*, November 24, 2000).

China will rank third in the world share of mobile phone manufacturing, following Korea and Japan. The share will increase from 7.6 percent in 1999 to 8.7 percent in 2000. Furthermore, China's share of AV products is higher than IT products. The share of Color TVs produced at about 25 percent and VTRs at more than 20 percent, hold the top posi-

**Table 5.5: World Share of Production in
Asia and China**

(unit: %)

	Asia	China
Color TV	57.2	24.0
DVD Player	92.9	19.2
Mobile Phone	42.4	8.7
Desktop PC	43.0	9.6
HDD	97.1	7.5
VTR	76.0	21.2
Air Conditioner	78.4	40.5

Note: Unit base, Estimates in 2000.
Source: *Nihon Keizai Shimbun*, July 15, 2000.

tion. And DVD production is on the rise from 19 percent. China is becoming one of the world's manufacturing centers of DVDs following Japan (46 percent) and Malaysia (22 percent) in 2000.

In addition to its growing large domestic market, cheap labor cost, and liberalization of the economy for its entry to the WTO, accumulation of industry, especially around Guangdong and Shanghai, seem to act to invite further FDI.

4.2. Extending Global Supply Chain Network to China

4.2.1. Expanding Networks of CMs to China

As mentioned above, major CMs are also operating in China. In addition to the shift of PC manufacturing from Taiwan to China by Taiwanese firms that is analyzed by Ohki in this volume, multinational CMs have acquired facilities or are making alliances with existing companies in China.

Jabil Circuit Inc., ventured into China for the first time with the acquisition of Hong Kong based GET manufacturing. Sanmina Corp. acquired Chinese contract electronics manufacturer Ocean Manufacturing Ltd. that has a factory in Shenzhen, administrative offices in Hong Kong and a branch procurement office in Taiwan.

In the case of Flextronics, acquisition and merger agreements announced in 2000 will expand its service offerings in Asia including China. The acquisition of the Dii Group will improve its PCB business in China. The merger agreement with Li Xin Industries will expand plastic

operation in Northern China. The merger with JT Holdings will provide Flextronics with manufacturing operations through JIT's new operations in Tianjin and Shanghai.

4.2.2. Cyber Network Embracing China

In addition to the manufacturing of electronic products, the potential for the e-commerce market in Mainland China is appreciated. To start with, China is one of the most rapidly growing and largest markets of the Internet in Asia. The number of computer hosts is exploding. It was 6.5 million in July 2000 up from 542,000 in July 1998. The number of Internet users was 16.9 million in July 2000 up from 1,175,000 in July 1998 (CNNIC [2000]).

Today, Chinese and foreign EC companies are doing business actively aiming at the hopeful market. The Chinese government is also participating in the business cooperating with private and even foreign companies. ECnet allied with Capinfo being backed by the Chinese governmental organizations as mentioned above.

Hong Kong is playing the role as 'portal' for companies to enter EC business in Mainland China. Hong Kong can offer such services as finance, telecommunication infrastructure, and logistics. Native Chinese companies in Hong Kong can also offer a know-how or network to enter Mainland markets. Some EC companies operating in China are headquartered in Hong Kong.

One company is Alibaba.com founded in Mainland China. Its international headquarter is in Hong Kong, with offices in Beijing, Shanghai, Hangzhou, London and Silicon Valley and a joint venture in Soul, Korea. It offers BtoB marketplace focusing on small- and medium-sized enterprises (SMEs) to over 400,000 registered members from over 200 countries, with over 170,000 members in China in 2000.

If we look at the transportation system, Tradelink[16] is one of the largest EC service providers in Hong Kong. The company incorporated in 1989 is a joint venture with the Hong Kong Special Administrative Region (HKSAR) and the private sector to offer EDI service. It is handling tens of millions of transactions annually, submitted by 53,000 companies.

Tradelink participated in the regional EC alliance in Asia with Singapore and Taiwan government-backed EC facilitators: SNS and Trade-Van Information services Co. of Taiwan. The total membership of

three networks at the time of the agreement was exceeding 90,000 organizations: Tradelink, 51,000; SNS, 25,000; and Trade-Van, 14,000. These three companies are aiming to spread this alliance to the region as a whole and have already decided to invite KTNET of Korea and InfoShare Information Technology Development Company Limited of China to join the alliance.

Such networks will closely connect Mainland China and the Asian region with the global trade network and system of international division of labor.

5. EFFECTS OF INFORMATION TECHNOLOGY ON ASEAN

In this section, ASEAN does not include Singapore except if indicated.

5.1. Losing Competitive Advantage

In ASEAN's development process, member countries invited in factories that had been transplanted from more developed and higher labor cost countries to less developed and cheaper labor cost countries. In parallel with this process, the manufactured products transferred to higher value added ones. This happened throughout the region and this developing pattern was likened to flying geese.

However, viewing the current situation in some ASEAN countries, it is noticeable that they are losing their comparative advantage in labor cost (see Table 5.6). Labor cost in China is cheaper than in ASEAN, especially Thailand and Malaysia. Industries in these new growing middle-income countries in ASEAN need to shift from low margin value added products to higher value added products. More automation and skilled labor will be needed to promote this shift. However, here again a problem arises, as capital and skilled labor are scarcer in these countries than in more advanced countries like Singapore.

5.2. Changing Developing Patterns

In addition with this situation of the competitiveness advantage, the flying geese theoretical developing pattern also seems to be affected by the following two factors.

Table 5.6: Assessment of Investment Conditions in Selected Asian Economies

	China	Korea	Malaysia	Singapore	Taiwan	Thailand	Indonesia	Philippines	Vietnam
Supply of Labor	A	C	C	D	D	B	A	A	A
Quality of Labor	C	B	C	B	A	C	D	B	D
Cost of Labor	A	C	C	D	D	B	A	A	A
Infrastructure	C	C	B	A	B	C	C	C	D
Domestic Market	A	C	C	D	B	B	C	C	D
Local Supplier	C	C	B	B	A	B	D	D	D
Incentives	B	B	A	A	C	A	C	B	C
Competitiveness Ranking 1998 (WEF)	28	19	17	1	6	21	31	33	39
Competitiveness Ranking 1998 (IMD)	24	35	20	2	16	39	40	32	n.a.

Note: WEF (World Economic Forum), IMD (Institute of Management Development).
Source: OECD, 2000.

5.2.1. Current Characteristics of Business Location

Indeed, if we look at the recent trend in the location of factories/offices, we find that factories/offices for cutting edge products are in information-oriented localities. And that these localities are at the center of regions with networks of R&D centers and universities clustered like a Silicon Valley, and are near or in large markets. Companies need to acquire information on changeable demands, deliver products to the markets as soon as possible with fewer inventories and at lower costs, and make use of acquired information in sales and R&D efficiently.

But there is a shortfall in telecommunication infrastructure and highly skilled engineers in ASEAN countries. Market size of individual countries is not large compared with China (see Table 5.6). The accumulation of industry, especially key components and materials, is not enough.

Indeed, it can be argued that it will be disadvantageous in attracting FDI. FDI transfers the necessary technology and know-how for developing countries to transform themselves into higher value added knowledge-based economies.

5.2.2. Prevailing Outsourcing

The outsourcing of IT and manufacturing, which has already spread in Asia, enables users to make it easier to construct more efficient and flexible supply chains globally. Conversely, users of these services can build SCM by using outsourcing even if they don't have enough resources to do so. This will also have effects on ASEAN.

The changing methods of Japanese firms are behind this scenario. Japanese firms were one of the major players that transferred their manufacturing operations to ASEAN. These transfers were partly affected by existing business in ASEAN. But then Japanese firms began to promote outsourcing as mentioned above. In parallel with this process, firms will integrate, abolish, scrap-and-build and change roles of existing operations or relocate operations.

These movements are offering business opportunities to multinational CMs. They are spreading their activities in Asia. Multinationals including Japanese firms are promoting partnerships with CMs further. These will have effects on the relationships between Japanese and Asian local firms.

Outsourcing of production will release multinationals from existing

operations. IT that diminishes national and companies' boundaries will reinforce this movement. These make it easier for multinationals to transfer business to more competitive countries than ASEAN. Furthermore, the fact that supplies of key components and materials in ASEAN mainly depend on imports will work in their favor. Spreading EC will also support outsourcing to build global SCM.

5.3. ASEAN Indigenous Companies Need to Change

Although ASEAN is losing competitiveness and their readiness for IT is behind multinational CMs, probably even China, local companies in ASEAN have been mainly engaged in relatively labor-intensive processes. In the case of HDD industry in Thailand, a production base for labor-intensive HDD, foreign companies dominate supply of HDD parts. Indigenous suppliers are not interested in this segment. The BOI of Thailand analyzed the reasons as follows (Panichapat and Kanasawat, [1999]):

1)   HDD is a very volatile industry.
2)   HDD firms are mainly American with little attention to long-term relationships. Thai suppliers are accustomed to the Japanese system with long-term relationships and felt more comfortable to stay with Japanese firms in the automobile and electrical appliance industries.
3)   Large Thai conglomerates with technological strength found HDD parts less attractive than petrochemical, automotive, electronics, electrical appliances, and so on.
4)   Thai SMEs did not have enough technical and financial strength to supply HDD parts.

These characteristics are not limited to the HDD industry. Some of these were also factors that force multinationals, including Japanese firms, to introduce SCM or outsourcing. In the course of introducing SCM and EC, they are screening suppliers depending on the ability to meet their needs. Cooperation between multinationals including EMS and EDI vendors is deepening.

Faced with the above, indigenous firms need to increase production scale, or shift their products from labor-intensive products to higher value added ones like electronic parts. Simultaneously they need to promote the introduction of IT and IT-based services to increase productivity, improve services offering to customers and seize new business opportunities. In the current situation of scarcity in human and capital resource,

IT will enable them to make flexible use of outsourcing and concentrate their restricted resources on businesses with competitive advantage.

6. CONCLUSION AND PERSPECTIVE

With progress of SCM based on IT and outsourcing, companies can choose their operating places more flexibly depending on competitive advantage of each company and country. An example of this is that some Japanese firms began to spin off their manufacturing facilities.

On one hand ASEAN is losing competitiveness, on the other China is emerging as production center and large market of IT-related products. There is a possibility that China will follow the developmental process and the division of labor seen in Singapore.

In addition, ASEAN firms' readiness for IT, production scale and purchasing power of parts seem to be inferior to multinational CMs. CMs can contract or form a partnership to retain SCM services and use EC to optimize their procurement, production and delivery processes.

Facing these situations, indigenous firms in ASEAN will be forced to increase scale of production, shift their products to higher value added products and introduce IT and IT based services to improve productivity, services and seize new business opportunities. IT also makes it possible to expand market reach and reveal niche markets that are large globally. This will give business opportunities to developing countries.

Although there exists obstacles to the prevailing of IT in Asia: cost, security issues, IT infrastructure and so on, technology and diffusion of IT itself will help it jump over the hurdles. As seen in the cases of NatSteel, transfer to Web-based EDI promoted registering to the system. Accumulations of actual experiences on the Web will help firms in developing countries to introduce IT. In this case, advanced firms in the region, which are accustomed to the business practices of the region, will play important roles. They can transfer their IT related know-how to countries in Asia.

Seeing characteristics of IT that include economy of scale and scope, IT will push developing countries into globalization. Actually multinationals promote globalization and closer connections within and between Asia and the rest of the world. Liberalization of investment and trade on a bilateral and multilateral basis complement these trends.

However it must be remembered that the introduction of IT and globalization sometimes forces countries to restructure their industrial organi-

zations, which in turn raises unemployment. Some companies will integrate, abolish, scrap-and-build and change the roles of existing operations or relocate operations corresponding to the changing business environment.

Such occurrences can create opposition against deregulation and globalization that will reduce the benefits of IT. It will be strategically more important for global cooperation or negotiation on trade and investment liberalization to combine the liberalization process and cooperation in IT in order to support a social safety network.

Notes

[1]   Cases of companies in this paper mainly depended on information from each company's website and newspapers, such as Nihon Keizai Shimbun, Nikkei Sangyo Shimbun and Nikkan Kogyo Shimbun.

[2]   Ohki's paper in this volume detailed the international division of labor in PC manufacturing.

[3]   See Kagami and Kuchiki [2000] for information on CMs in Mexico.

[4]   See top 50 contract manufacturers for 1999 at Manufacturing Market Insider's website (http://www.mfgmkt.com/top_50.html).

[5]   Except the examples mentioned in this paper, Matsushita announced the FY2001-2003 business plan that include the spin-off of manufacturing facilities. The aims are: (1) Identification of revenue and expenditure of manufacturing department, (2) Shifting to large-scale and high-efficiency factories through the integration of small factories, (3) Creation of a professional body with high-efficiency manufacturing like EMS, proprietary devices and modules, and ultimate assembly technologies.

[6]   In addition to Sony's press release on July 26, 2000, see *Nikkei Business*, October 16, 2000.

[7]   The new company will be responsible for the domestic engineering and manufacturing processes of all electronics products. That includes mass production design and prototyping, materials procurement, production planning, manufacturing technology and mass production. Inventory control, logistics and customer services will also be included with the aim of creating speedy, flexible and high quality manufacturing.

[8]   The case of Kyoden depended on information from the company's website, *Nikkei Business* (October 16, 2000) and newspapers.

[9]   Consolidated sales of Kyoden have more than tripled from ¥17.6 billion in March 1997 to ¥66.5 billion in March 2000. This was a result of the growth of the EMS market and this company's aggressive M&A strategy. Kyoden made Sotec, a PC maker, affiliate in 1998.

[10] On the history of the growth of the electronic industry in Singapore, see Wong [1998].

[11] About the Infocomm21 Strategic Plan, see IDA [2000].

[12] 8 industrial sectors: manufacturing of electronics products, chemicals and chemical products, manufacturing of aircraft and spacecraft, logistics services, freight forwarding, storage and warehousing, courier other than postal and publishing.

[13] See SNS's website, R. Schware and P. Kimberley [1995] and J. M. Burn and M. G. Martinsons [1997].

[14] The case mainly depended on information from its website and materials obtained from ECnet Japan.

[15] The case of NatSteel and ECnet depended on information from NatSteel's website, T. Teo etc. [2000] and materials obtained from ECnet Japan.

[16] In addition to Tradelink's website, see J. M. Burn and M. G. Martinsons [1997].

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