

HOW THE EMS (ELECTRONICS MANUFACTURING SERVICE) BUSINESS MODEL CAN HELP JAPANESE CORPORATIONS REVOLUTIONIZE THEIR FACTORIES?

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SUMMARY

1. EMS (Electronics Manufacturing Service) basically refers to the consigned production of electronic equipments. EMS is still not very common in Japan, which is known for its strong manufacturing sector, but this type of service continues to attract attention due to the tremendous success enjoyed by EMS providers in the United States.
2. With the EMS business model adopts “supply chain management (SCM)” to increase the speed of operations and reduce inventories, while standardizing facilities and enacting real-time information sharing between one’s corporation, customer (brand manufacturer) and suppliers. Furthermore, the earnings structure in this model is based on low-cost operations and increased bargaining power in the procurement of materials and components.
3. Corporations ideally want to develop long-term relationships with the suppliers of their main components, but at the same time they still want to be able to rigorously select suppliers and alter their supply routes. EMS is a business targeting products that are difficult to differentiate through the production process, but even this business model has limits.
4. When Japanese corporations consider offering consigned production services as a means of revolutionizing their factories, including those of overseas affiliates, there are two issues they must address; namely contextual skills and changing over to a service provider. First, it would be realistic to start receiving consigned services from other divisions within a group.

INTRODUCTION

1. FROM OUTSOURCING TO OPEN-SOURCING

In recent years there has been a qualitative change among corporations towards greater outsourcing of production, especially for computer-related product.

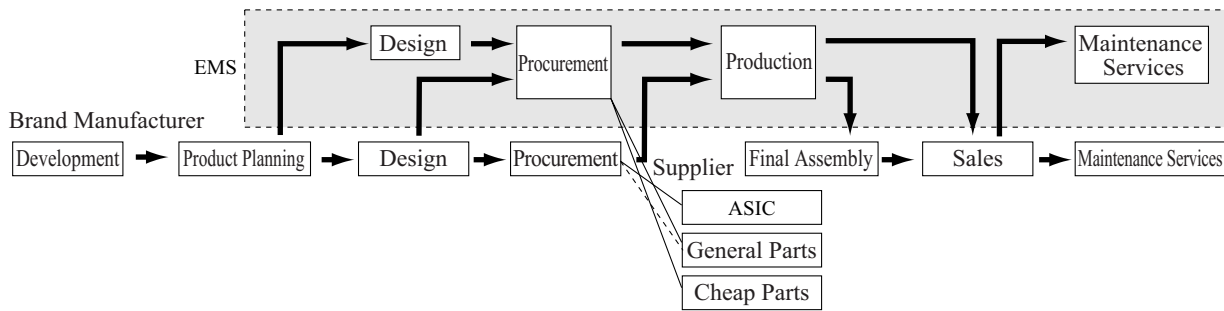
Outsourcing is seen as “a partial agreement to participate in carrying out a larger agreement.” In the case of manufacturing, the contractor consigns one of the following three duties to a sub-contractor (supplier): (1) part development and production, (2) complete product development and production, and (3) provide supplemental technologies, labor, facilities and skills for specific manufacturing and design process, as well as various other services (Nishiguchi, 1996).

Eastman Kodak is a well-known example of a major corporation that has effectively used outsourcing. In 1989 Kodak entrusted almost all of its system-related work, from development to operation and maintenance, to external parties. It also sold most of its hardware and software to IBM and DEC. Roughly 350 employees were also transferred to IBM as Kodak aggressively adopted outsourcing. The outsourcing contract was valued at \$500 million dollars with a period of 10 years. The result was that Kodak was able to slash its computer investment by 90% and reduce annual expenses by 10~20%. This success further heightened

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1 ‘Outsourcing’, “Nihon Keizai Shimbun” February 5, 1993, “Nihon Keizai Shimbun” September 6, 1991 Evening Paper, page 5

Figure 1 EMS Supply Chain Management (SCM) Model



Source: Produced by the author based on an interview with Solecron Japan.

interest in outsourcing in the U.S.¹

The market's taste for computer-related products varies greatly. The functions of these products have improved greatly, while their lifecycles are more likely to be shortened.

For example, the lifecycle for personal computers is said to be only three months and prices can fluctuate wildly. In such an environment the final assembly manufacturers (hereinafter referred to as the brand manufacturer) need speed to handle these short product lifecycles and maintain its competitiveness in the market. Specifically, corporations in the U.S. and Europe have been specializing on their core competencies (core capabilities to provide unique value), while outsourcing processing and assembly.

These processing and assembly services are often provided by Electronics Manufacturing Service providers, also known as EMS providers. EMS providers differ from conventional OEM (Original Equipment Manufacturing). Original Equipment Manufacturers are usually entrusted with just one specific aspect of the production process, and so generally procurement of materials and components is handled by the brand manufacturer. The EMS provider, on the other hand, is entrusted with everything from design, trial manufacturing and procurement to production and, in some cases, after sales services. The EMS provider is an independent corporation that does not have

its own brand and is not dependent on a single client, but has a wide range of customers².

The EMS provider uses the Internet to exchange order and technical information with its client, the brand manufacturer, and uses supply chain management³ to shorten the lead-time for everything from procurement of materials and components to production, and thus raise the quality and specialization of the service offered. At the same time, the EMS provider establishes production and distribution centers around the world to help lessen the client's inventory risks. Another unique characteristic of EMS providers is that they openly spread their risk by not relying on only a few select clients, and they try to make ordering smoother and optimize production (Deguchi, 1996).

Outsourcing is a means of for obtaining advanced technologies, low prices and lower risk. However, brand manufacturers and EMS providers are able to develop functional relationships through supply chain management. Global Internet society exchange information over the web and create a mechanism for sharing knowledge. Designs for capturing technicians and customers over the Internet are being improved and advanced at a rapid pace. This is all part of the qualitative shift towards the use of open-sourcing between corporations (Deguchi, 1996).

2 Hisami Mitarai [Study on Emerging Corporate Groups in the Electronics Industries of Singapore/Malaysia] (Nomura Research Institute "Nomura Asia and Global Report" January 2000) page 38, "3 Minutes Lesson: Keywords for Managers" ("Nikkei Information Strategy" August 24, 2000 issue) page 12

3 Method for sharing information along a chain from the supplier to the customer in which the exact amount of parts and products can be swiftly provided in an exact timing.

2. OUTSOURCED PRODUCTION BY JAPANESE AFFILIATES IN EUROPE AND THE U.S. DESPITE STRONG RESISTANCE IN JAPAN

This EMS business has been developing in Europe and the U.S. through functional relationships with brand manufacturers, and this has obviously caught the attention of Japanese corporations as well. Domestically, Japanese corporations have resisted the use of EMS on grounds of quality concerns and to protect jobs. However, some of their overseas affiliates have sold factories to EMS providers, and some have even begun consigning production to these factories that were previously in their possession. This consigned production has been for such products as personal computers, communications equipment, cellular phones, memory modules and car electronics.

Hitachi is one such example of a Japanese corporation consigning production. In 1998, Hitachi Semiconductor of America (HSA) entrusted the production of memory modules to Celestica after determining that this Canadian EMS provider had the technologies and production specialties needed for build-to-order production⁴.

Fujitsu is an example of a corporation that sold one of its factories to an EMS provider. In 1997 the D2D business division of Fujitsu's ICL (England) was sold to Celestica. This D2D business division handled production of personal computers and other on an OEM basis and had sales of \$560 million and 2,500 employees at the time of the purchase. The selling of this division was part of ICL's restructuring efforts aimed at focusing more on its main system development and network businesses⁵.

Mitsubishi Electric is an example of a Japanese corporation that sold one of its factories and then had its products produced at that factory on a consigned basis. In 1998 Mitsubishi Consumer Electronics America (MCEA) sold its wireless telephone produc-

tion facilities in Georgia to EMS provider Solecron (US). Solecron employed 350 former MCEA employees and entered into an agreement to provide MCEA with a full range of services from trial manufacturing, PCB assembly and final assembly of its cellular products for the North American market⁶.

In the same manner, NEC sold its North American communications equipment factory in Oregon in 2000 to the NatSteel Electronics, Singaporean EMS provider, and has since consigned production to this factory⁷. NEC also agreed to sell its NEC de Brazil communications equipment factory to Celestica and entered into a 5-year supply contract valued at roughly \$1.2 billion. NEC de Brazil is hoping to focus its resources on development, marketing and distribution⁸.

Domestically, it was learned in October of 2000 that Sony would sell its production affiliate Sony Nakaniida to Solecron (US), and consign to Solecron production of its car electronics. This decision was made after Sony confirmed that Solecron could provide the same level of quality while reducing production costs⁹.

CHAPTER 1 RAPIDLY GROWING EMS BUSINESS

1. RAPID GROWTH AS BRAND MANUFACTURERS ABANDON "FULL-SET" PHILOSOPHY

The EMS market has been expanding at a rapid pace and further growth is expected in the future. In fact, the market is expected to expand to around \$260 billion (28.1 trillion yen; 108 yen = \$1) by 2004¹⁰. This would put the annual rate of growth between 1998 and 2004 at 28%. In addition to the rapidly growing demand for computers, cellular telephones and other IT-related parts, corporations with an eye on providing more value to the shareholders have been

4 Selestica's Press Release

5 "Nikkei Sangyo Shimbun", January 9, 1997, page 9

6 Solecron's Press Release

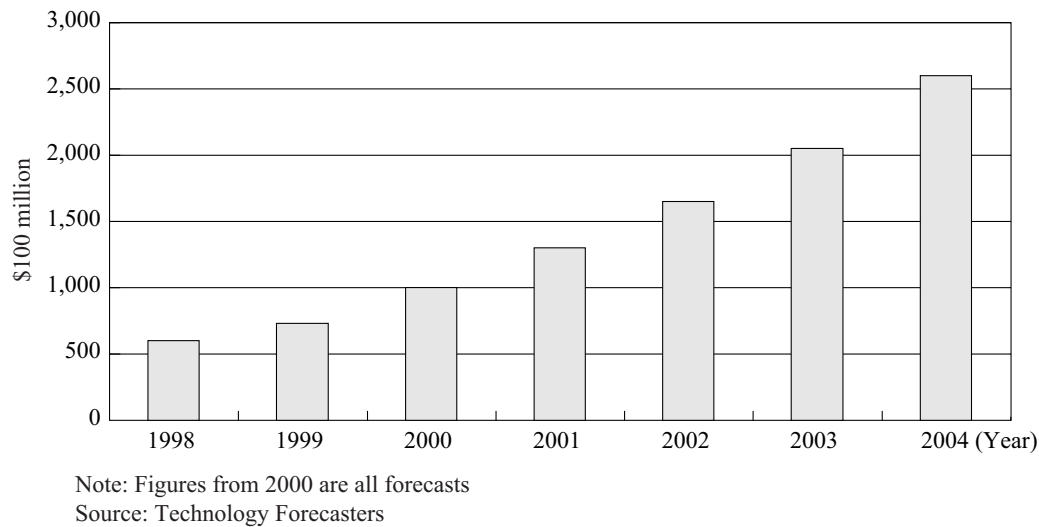
7 'New Story of Manufacturing in U.S.', "Asahi Shimbun", July 25, 2000, Morning Paper

8 Selestica's Press Release

9 "Nihon Keizai Shimbun", October 19, 2000, Morning Paper, page 1

10 Document from Technology Forecasters

Figure 2 Forecasted Growth for EMS Market



specializing on their core competencies (core ability to provide unique value) and have been actively switching to value chains. This is all expected to accelerate the use of outsourcing.

Many factors can be cited for the rapid growth of the EMS market. The following are a few factors for U.S. brand manufacturers mainly in the area of computer-related products.

- (1) Due to the progress of parts modulization, corporations are placing greater emphasis on procuring specialized parts as opposed to working to make a wide range of parts. Naturally, some of the value added during the processing and assembly stages is lost.
- (2) Device and software technologies are changing at a rapid pace and product lifecycles are becoming shorter. Therefore, TTM (Time To Market), TTC (Time To Customer) and other concepts regarding the time it takes to bring products to the markets and customers are very important. Inevitably, the inventories of products and procured parts have swelled.
- (3) Even more effective management of resources is demanded due to greater emphasis on shareholder value.

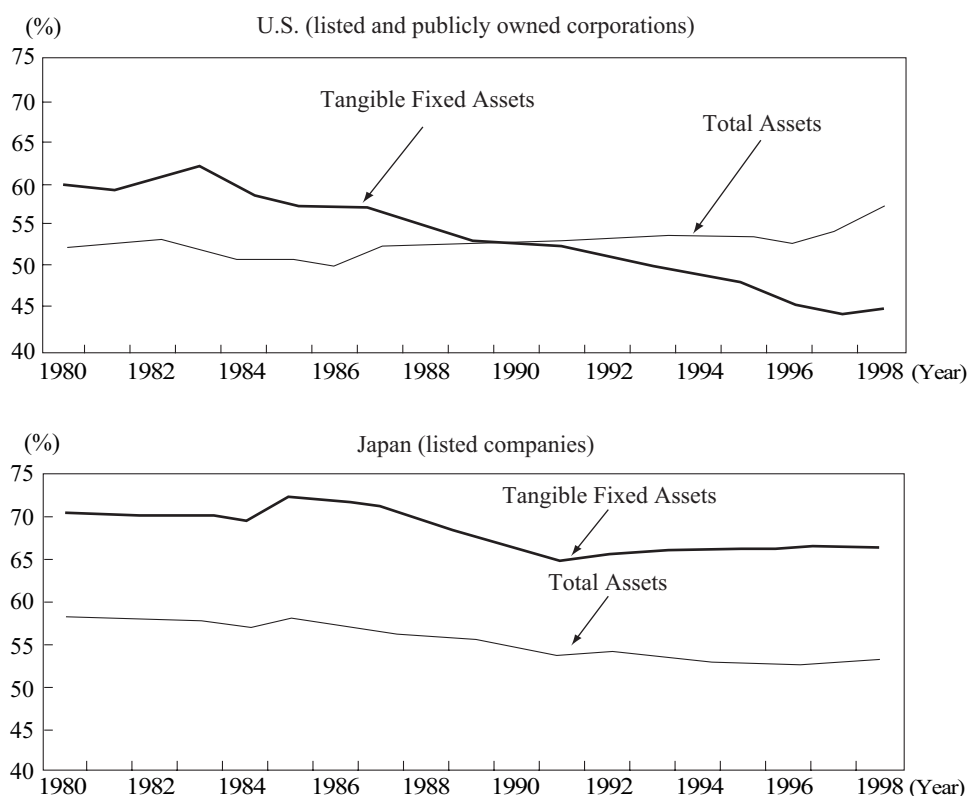
Against this changing business environment, the merits of the “full-set” philosophy that covers all value chains have been hotly debated. As a result, more corporations have decided on the outsourcing of manufacturing processes that can not be considered as a part of their core competencies. Other decisive factors in using EMS providers are “the EMS provider will not only purchase the factory, but may also employ the existing workers” and “information can be used by the supply chain management as a tool for increasing speed”. Thus, it can be analyzed that EMS quickly started up as a business. The rapidly changing business environment has led to the aggressive use of outsourcing and has supported the emergence of EMS businesses.

In the early 1990’s Cisco Systems began launching several R&D-type venture businesses like Bay Networks (currently Nortel Networks). Many of these corporations were “fabrication-less”¹¹. This means that the actual production of their products was outsourced¹². We cannot overlook the fact that EMS providers have served an important incubator role by providing production infrastructure for many of Silicon Valley’s high-tech venture corporations.

Data for America’s top 100 listed and publicly

¹¹ Fabrication-less corporations are those that do not own their own production facilities.

¹² Toshihiro Yamada, Toru Okamoto “Special Report: Learning from America’s High-tech Industrial Recovery” (“Weekly Toyo Keizai”) July 17, 1999, page 31

Figure 3 Ratio of Fixed Assets to Total Assets for Top 100 Companies in U.S. and Japan

Remarks: Prepared from Japan Economic Research Institute "Enterprise Financial Data",
Standard & Poor's "Compustat"

Source: Cabinet Office "FY2000 Economic Report" (July 2000)

Figure 4 Main EMS Providers (consolidated)

(Unit: million dollars)

Company Name	Country Name	Sales	Net Profit	Sales by Region (%)	Fiscal Year End
Solelectron	U.S.	14,138	497	U.S.: 69%, Europe: 20%, Asia: 11%	August 2000
SCI Systems	U.S.	8,343	197	U.S.: 50%, Overseas: 50%	June 2000
Celestica	Canada	5,297	67	Canada: 41%, U.S.: 26%, Europe: 20%, Asia: 13%	December 1999
Flextronics	Singapore	4,307	121	Asia: 16%, The Americas: 40%, Western Europe: 25%, Central Europe: 19%	March 2000
Jabil Circuit	U.S.	3,558	146	U.S.: 67%, Overseas: 33%	August 2000
Sanmina	U.S.	1,215	94	n.a.	October 1999

Source: Prepared by the author from Market Guide Inc. "The Benchmark for Quality Financial Information"

owned corporations show that while total assets have been increasing, the ratio of fixed assets has actually been decreasing. This would suggest that big corporations are separating themselves from the production process and are instead relying more and more on outsourcing.

2. EMS PROVIDERS BOASTING HIGH EARNINGS AND PROFIT GROWTH - FROM PCB ASSEMBLY TO FINAL PRODUCT ASSEMBLY

The top 6 EMS providers are Solelectron (U.S.), SCI Systems (U.S.), Celestica (Canada), Flextronics (Singapore), Jabil Circuit (U.S.) and Sanmina (U.S.). Solelectron, the largest of these corporations, posted

Figure 5 Average Annual Growth over Past 5 Years for Top EMS Providers (consolidated)

	Sollectron	SCI Systems	Celestica	Flextronics	Jabil Circuit	Sanmina	Average for 6 corporations
Sales	46.9%	25.6%	16.7%	71.3%	44.8%	60.2%	44.3%
EPS	31.8%	27.9%	19.7%	53.0%	67.5%	32.0%	32.1%

Note: EPS refers to earnings per share.

Source: Prepared by the author from Market Guide Inc. "The Benchmark for Quality Financial Information"

Figure 6 Main Customers Accounting for 10% or More of Sales for Top EMS Providers

		1996	1997	1998	1999
Sollectron	HP	(11%)	(14%)	(14%)	(11%)
	Sun Microsystems			(11%)	
	Cisco Systems			(11%)	(12%)
	Nortel Networks		(10%)		
Celestica	IBM				
	HP				
	Sun Microsystems				
	Cisco Systems				

Source: Sollectron's Annual Report, Celestica's Annual Report

consolidated sales of \$14.1 billion¹³ (1.53 trillion yen; 108 yen/\$) and net profit of 500 million dollars (53.7 billion yen), and its business continues to grow.

The average rate of sales growth for these six corporations over the past five years was a whopping 44.3%. The rate of growth in per share earnings was a very high 32.1%, providing further evidence of the rapid growth achieved by these corporations. A breakdown of sales by region shows that America is the main market, but these corporations are also aggressively developing business in Europe and Asia. Many of these corporations have bases in ten or more countries.

EMS providers target consigned production mainly of IT-related products such as desktop and notebook computers, network equipment, communications equipment and mobile equipment. In recent years Sollectron and SCI Systems have bought factories from Ericsson and Nokia to aggressively establish cellular phone production bases. (Sollectron is believed to currently be responsible for 10% of the

world's cellular phone production¹⁴.) Even though EMS providers have mainly handled PCB assembly, the ratio of final product assembly has been increasing in recent years. In the case of Sollectron the ratio of finished products to PCB was 5 : 95 in 1995, but 21 : 79 in 1999.¹⁵ Operations have also been expanded to upstream services such as trial manufacturing and product development, and downstream services such as distribution and maintenances.

The main customers for Sollectron are Hewlett-Packard (HP) and Cisco Systems, each of which account for more than 10% of its overall sales. The main customers for Celestica are Sun Micro Systems and Cisco Systems. Sun Micro Systems, Cisco Systems and HP are shared customers of these two leading EMS providers. A unique feature of EMS providers is that they try not to rely on just a few select customers, but are open to receiving work from many different corporations. The brand manufactures, likewise, choose to use several different EMS providers.

¹³ Compared to a Japanese electronics corporation, Sollectron has a business scale a little smaller than Sharp, which has consolidated sales of around 1.85 trillion yen.

¹⁴ Based on an interview by the author with President Yasui, Sollectron Japan (November 22, 2000)

¹⁵ Sollectron's Annual Report

Figure 7 Average Profit Margins over Past 5 Years for Top EMS Providers (consolidated)

(Unit: %)

	Solectron	SCI Systems	Celestica	Flextronics	Jabil Circuit	Sanmina	Average for 6 corporations
Sales	100	100	100	100	100	100	100
Gross Profit	10.0	3.7	6.5	8.3	11.0	21.5	10.2
Operating Profit	5.7	3.6	2.1	2.5	6.7	13.2	5.6
Net Profit	3.8	2.1	0.6	1.3	4.3	8.4	3.4

Source: Prepared by the author from Market Guide Inc. "The Benchmark for Quality Financial Information"

Figure 8 Average Operational Efficiency over past 5 Years for Top EMS Providers (consolidated)

(Unit:8%)

	Solectron	SCI Systems	Celestica	Flextronics	Jabil Circuit	Sanmina	Average for 6 corporations
ROA	8.6	7.1	0.9	2.1	11.6	14.8	7.5
ROI	12.2	11.6	1.1	4.1	19.3	18.6	11.2
ROE	17.4	18.5	2.0	6.9	25.3	30.3	16.7

Note: ROA = net income/average assets, ROI = net income/(average long-term debt and other long-term liabilities, stocks and assets), ROE = net income/average common stockholders' equity

Source: Prepared by the author from Market Guide Inc. "The Benchmark for Quality Financial Information"

CHAPTER 2

FINANCIAL CHARACTERISTICS OF EMS PROVIDERS

The following is simply a general overview of the financial conditions for the top six EMS providers. However, special mention has been made to areas where there is a significant variance between the corporations.

1. PROCUREMENT OF MATERIALS AND COMPONENTS AS A SOURCE OF PROFITS

Looking at profit rates based on sales, each corporation had gross profit rates of 10% or higher. Half of all corporations have rates under 10%. The difference between gross profit rates and operating profit rates are on average 4.6% for these six corporations. In other words, gross profit rates are around 10%, but sales expenses and general operating expenses have been suppressed to a very low 4.6%. By comparison, the brand manufacturer Dell Computer, which has successfully reduced inventories by using supply

chain management, had a gross profit rate of 21.4% and an operating profit rate of 9.4%. This means that sales and general operating expenses were around 12%. In the case of Sony, which sold a production affiliate to an EMS provider, the gross profit rate was 26%, while the operating profit rate was 5.6%. This means that sales and general operating expenses were 20.4%. The difference was large sales expenses (figures are the averages for the past five years according to market Guide Inc.).

Looking at the sales breakdown, in the case of Solectron, which uses a value chain, 80% of sales were attributed to procurement of materials and components¹⁶. The remaining 20% was attributed to processing and assembly. This is one reason why the sales expense and general operating expense ratios are so low. SCI Systems in 1999 procured more than 20.5 billion materials and components from some 17,500 different suppliers¹⁷. Taking this all into consideration, it would seem that the source of profits for EMS providers comes more from its large volume purchases of all-purpose parts, as opposed to its mounting and

¹⁶ Based on an interview by the author with President Yasui, Solectron Japan (November 22, 2000)

¹⁷ SCI Systems' Annual Report

Figure 9 Cash Flow of Main EMS Providers (consolidated)

(Unit: million dollars)

	Solectron	SCI Systems	Celestica	Flextronics	Jabil Circuit	Sanmina
Cash flow from business activities	38.0	68.0	94.4	67.4	107.3	115.1
Cash flow from investment activities	819.4 (425.8)	615.8 (280.2)	277.3 (211.8)	572.2 (250.5)	174.3 (150.1)	418.1 (65.3)
Cash flow from financial activities	1,877.2	629.0	711.4	1,069.6	157.4	351.1
Changes in cash on hand	1,100.4	49.3	339.8	424.1	90.4	48.2
Free cash flow	387.8	348.2	306.2	317.9	42.8	49.8

Note: Free cash flow refers to the amount after capital investment and dividend payments have been subtracted from the "cash flow from business activities".

The figures inside the parentheses () for investment activities refers to capital investment.

The figures for Solectron, Celestica and Jabil Circuit are for 1999. All other figures are for 2000.

Source: Prepared by the author from Market Guide Inc. "The Benchmark for Quality Financial Information"

Figure 10 Efficiency of Main EMS Providers (consolidated)

(Unit: times)

	Solectron	SCI Systems	Celestica	Flextronics	Jabil Circuit	Sanmina	Average for 6 corporations
Per Capita Sales (\$)	508	263	476	159	543	414	394
Per Capita Net Profit (\$)	18	6	8	-	22	19	15
Accounts Receivable Turnover	8.79	11.22	8.82	9.65	9.27	9.04	9.47
Inventory Turnover	5.88	7.51	7.12	7.82	9.10	8.32	7.63
Fixed Assets Turnover	16.31	16.09	18.27	8.56	7.89	6.09	12.20
Average Asset Turnover	1.94	2.90	2.28	2.03	2.55	1.64	2.22

Note: Accounts receivable turnover is sales / average accounts receivable, inventory turnover is cost of goods sold / average inventory, fixed assets turnover is sales / average fixed assets, and average assets turnover is sales / average assets.

The figures for Solectron, Celestica and Jabil Circuit are for 1999. All other figures are for 2000.

Source: Prepared by the author from Market Guide Inc. "The Benchmark for Quality Financial Information"

assembly businesses. The cost for procurement of materials and components is not determined solely on volume, rather information skills, logistics, and early participation in the design stage are all used to reduce these costs (Handfield et al, 1999).

2. HIGH EFFICIENCY INDICATED BY 12.2 FIXED ASSET TURNOVER

These EMS providers have maintained very high levels of operational efficiency with average ROE and ROI coming to 10% or more. However, many of these providers had minus free cash flows. These corporations place precedence on investment, putting money back into purchases and capital investment. Therefore, it takes time before returns in cash can be seen.

These six corporations had an average accounts receivable turnover rate of 9.5, an average inventory turnover rate of 7.6, and an average fixed income turnover rate of 12.2. Furthermore, average asset turnover rates of 2 or greater have also been achieved. By comparison, Dell Computer has an average asset turnover of 2.5, while the figure is 1.0 for Sony (according to Market Guide Inc.).

Looking at fixed assets, it can be seen that Solectron regularly purchases factories, but direct capital investments are rare. Typically an investment bank or other financial institution will first be purchased, and then leases will be arranged through these institutions¹⁸. Reducing assets in this manner while improving capacity utilization through increasing and

18 Toshihiro Yamada, Toru Okamoto "Special Report: Learning from America's High-tech Industrial Recovery" [Weekly Toyo Keizai] July 17, 1999, page 31

smoothing orders is thought to be the main reason behind these high turnover rates for fixed assets. (Lease accounting in the U.S. classifies leases as finance leases and operating leases. With operating leases, the lease fees are handled as expenses by the borrower. With finance leases these fees are handled by the borrower as fixed assets or purchase obligations.)¹⁹

The business structure is one in which assets, including inventories, are kept as small as possible to bring about a faster turnaround. Management, for the most part, is conducted in a very efficient manner.

CHAPTER 3 BETTER COMPETITIVENESS THROUGH SUPPLY CHAIN MANAGEMENT

The major EMS providers can propose and make full use of advanced multi-layer board mounting techniques. Based on this foundation, the EMS provider can focus on products that are difficult to differentiate through the production process, and can make use of supply chain management (SCM) while standardizing equipment and sharing real-time information between itself, the customers and the suppliers. SCM uses this information sharing to increase overall speed and reduce inventories. Currently only the production of desktop computers has advanced to the pure BTO (build-to-order) stage where there are no inventories²⁰.

1. CONDITIONS FOR FORMING A BUSINESS: SHORT LIFECYCLES AND MASS PRODUCTION OF PRODUCT DIFFICULT TO DIFFERENTIATE IN THE PRODUCTION STAGE

EMS providers are mainly entrusted with the production of personal computers, network equipment

and cellular phones. In the case of personal computer production, for example, product planning involves combinations with peripherals such as motherboards, LCDs that already have de facto standards, and so horizontal specialization is developed. In order to properly meet the TTM (Time to Market) and TTC (Time to Customer) requirements under short lifecycles, parts with de facto standards must be quickly procured, assembled and delivered.

In other words, EMS providers do not provide production for every type of electronic equipment. Rather, they must be able to handle products such as personal computers that have rapidly changing technologies, short lifecycles and must be made cheaper, as well as products that are difficult to differentiate through the production process²¹. In other words, modulization is a necessary condition, and heavy weighting is given to software, which has added value, and variable costs for the additional supply of developed products is low despite the high development costs (Kokuryo, 1999). These are the conditions for starting a business. For American brand manufacturers, which are major users of EMS providers, the rate of returns from their services businesses tend to be larger than the rate of returns for their products businesses (see Figure 11).

2. STANDARDIZATION OF FACILITIES, PROCUREMENT AND PARTS DISTRIBUTION

Solectron is a good example of an EMS provider that has actively standardized its facilities. Solectron basically introduced the same equipment and assembly methods for everything from part mounting to inspection equipment at its 11 mass production trial bases (NPI centers) and its 57 mass production factories around the world.

The location for the production of the consigned

19 "Lease Accounting" (September 1996), Chuo Keizaisha "Practical Affairs of English Financial Statements" supervised by Asahi Incorporated Accounting Firm

20 Based on an interview by the author with President Yasui, Solectron Japan (November 22, 2000)

21 Fumio Koyano "Conditions for Starting an EMS Business" (Ohm "Electronics" February 2000) pages 2~3.

Figure 11 Product Division and Service Business Earning Rates for Leading American Brand Manufacturers

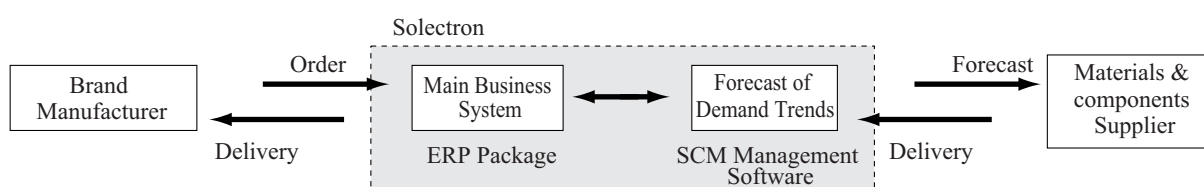
(Unit: %)

			1997	1998	1999
IBM	Gross Profit Rate	Product	35.9	31.6	26.9
		Service	26.6	26.9	27.6
	Operating Profit Rate	Product	12.4	7.9	4.9
		Service	11.5	13.0	14.1
HP	Gross Profit Rate	Product	29.8	28.2	29.5
		Service	36.9	37.4	31.8

Note: Figures for IBM's products and services are based on hardware and global service figures from their segment information.

Source: Prepared by the author from Annual Report of each company

Figure 12 Supply Chain Management (SCM) Configuration



Source: Based on the "Nikkei Information Strategy" (August 1998) page 17 diagram with additions by the author.

products is determined based on the target region for sales of the product or the nearest factory to the target region²². A global basic parts procurement team is organized to facilitate smooth procurement of materials and components. The members of this team are those responsible for procuring and managing materials and components used by the factories in the various regions. Furthermore, codes in agreement with standard manufacturing codes are attached to the materials and components, and customer parts codes are shared. Standardization is also important in the distribution of these parts. When a condenser for a specific purpose is needed at the start of production, an all-purpose FPGA (Field Programmable Gate Array) is used to change the gate array on the board and set the desired application. There has been a switch to customize ASIC (Application Specific Integrated Circuits) based on the notion that the FPGA function

is stable and can be used for a long period of time (Handfield, et al., 1999). ASIC allows for cheaper mass-production as compared with FPGA. This is one example of how all-purpose parts are used in the initial stage of production.

Jabil Circuit offers a good example of real-time information sharing. When Cisco Systems entrusted Jabil Circuit with the production of routers and switches, it provided Jabil Circuit with the exact order it had received from its customer. After receiving this order, Jabil Circuit used its supply chain management to conduct procurement of materials and components and production, and then delivered the product directly to the original customer, bypassing Cisco Systems²³. In this manner a mechanism is constructed to eliminate the asymmetry of information (differences in the amount of information held by the business partners) between business partners.

22 Shoichi Terayama, Ryohei Yamazaki "Trends and Beyond Trends" ("Nikkei Business", October 30, 2000) pages 8 ~ 9

23 Toshihiro Yamada "Special Edition: Seek Winners of the Internet Revolution", ("Weekly Toyo Keizai", May 6, 2000) pages 68 ~ 69

3. ACTUAL SUPPLY CHAIN MANAGEMENT APPLICATIONS

The managerial foundation for EMS providers is based on the supply chain management that incorporates the brand manufacturers and the suppliers of materials and components. Part inventories are controlled and business efficiency is raised by timely and efficient production and purchasing plans. These plans take into consideration demand forecasts based on customer needs and make active use of Internet technologies. EMS providers can begin production within 24 hours of receiving the customer's order.

The following is an actual example of how this supply chain management was applied by Solectron.

First of all, the following standards were established in the supply chain management. These standards had a huge influence on the selection of suppliers (Handfield et al, 1999).

- (1) Very flexible
- (2) Ability to handle sudden increase in orders
- (3) Main parts supplier can handle 30% increase in the order
- (4) Can forecast demand
- (5) Can alter production processes to match product specifications
- (6) Shipping within two weeks
- (7) Can reduce by half the period needed from trial manufacturing to actual production. Can contain in its production plan the brand manufacturer making the order, production contents, schedules, prices and other details in advance. Can obtain an unofficial notice of the production amount two to three months before the order is to be placed.

Along with orders from the brand manufacturer, design data are also received over the Internet. This provides evidence of the rapid changes in demand that have huge impacts on the nature of the orders each month. Production plans are reorganized to meet these changing orders, but ERP (Enterprise Resource Planning) is also introduced as a basic business system for managing the related profits. Along with the

real-time management of the progress of orders, production, inventories and earnings conditions, the major brand manufacturers are also provided with a browser covering the production and delivery of the ordered products.

In order to maintain suitable inventory levels, supply chain management software is used to forecast weekly demand trends based on data regarding past orders. These results are reflected in the production plan proposals, the various production line schedules and parts purchasing plans. By carefully managing the purchasing schedule and understanding the parts delivery schedule, an accurate delivery schedule can be provided to the brand manufacturer.

Among the more than 7,000 suppliers of materials and components used, forecasts for the next six months are provided to a little more than 100 of the main suppliers and updates are provided on a weekly basis. In the case of printed circuit boards and other all-purpose parts, deliveries are made within one week after the order is placed in order to maintain adequate inventory levels²⁴.

SCI Systems introduced a Supplier Managed Inventory (SMI) program, which is a program used to supplement its suppliers to better handle the large fluctuations in customer orders. With the program the parts suppliers manage hub- warehouses near the SCI System's factories. Hub-warehouses are part of a mechanism for delivering materials and components to the factory on a "just-in-time" basis²⁵.

4. SUPPLY CHAIN MANAGEMENT EFFECTS

The calculation of the cash conversion cycle time for the six leading EMS providers is shown in Figure 13. The cash conversion cycle time is calculated by adding the number of days for receivable accounts and the number of days for inventory turnover and then subtracting the number of days for paying accounts payable. This serves as an indicator of how quickly products are converted into cash.

The average cash conversion cycle time for American corporations that have introduced supply

24 "Dramatic Effects from Providing Information Directly to Customers" ("Nikkei Information Strategy", August 1998), pages 16~17.

25 SCI Systems' Annual Report

Figure 13 Cash Conversion Cycle Time (consolidated)

	Solectron	SCI Systems	Celestica	Flextronics	Jabil Circuit	Sanmina
No. of Days for Receivable Accounts	41.5	32.5	41.4	37.8	39.4	40.4
No. of Days for Inventory Turnover	62.1	48.6	51.3	46.7	40.1	43.9
No. of Days for Paying Accounts Payable	46.8	41.3	35.9	49.2	44.0	36.7
Cash Conversion Cycle Time	56.8	39.8	56.7	35.3	35.5	47.6

Source: Prepared by the author from Annual Report of each company

chain management is just under 80 days (just under 30 days at the highest levels)²⁶. The cycle time for EMS providers is between 35 to 56 days. Without question, this means that they have achieved a very high level of performance compared to other businesses.

CHAPTER 4

BUYING FACTORIES AND ACCUMULATING STRATEGIC ASSETS

1. PURCHASES TO ESTABLISH NETWORK EXTERNALITIES

EMS providers have been purchasing factories from brand manufactures based on the notion of horizontal specialization. There are many cases in which the EMS provider will also enter into multi-year contracts to produce the products the brand manufacturer used to produce on their own at the factory they sold to the EMS provider. The scale of the EMS providers is also growing at a rapid pace. In fact, in October 2000 Solectron, the world's largest EMS provider, announced that it had purchased 43% of the existing shares in NatSteel Electronics (Singapore), the world's sixth largest EMS provider²⁷.

It is well known that IT businesses in the U.S. have been undergoing a structural change from their perpendicular "full-set" philosophy to a more "horizontal development" approach. This change has been accelerated due to the advantages being gained by

those who have already made these changes. It has been said that this is due to the functioning of network externalities for the products of the IT businesses (Kokuryo, 1999). Network externalities means that the utility values increase when there is use by a larger number of people. Therefore, greater importance is being placed on horizontal business development.

Continuous purchases by EMS providers are seen as having a large impact on network externality. Furthermore, when the factory of a major brand manufacturer is purchased, the EMS provider can effectively convince the market that it can guarantee the same level of quality as the brand manufacturer.

2. FLEXIBLE PRODUCTION FACILITIES TO HANDLE LARGE ORDER FLUCTUATIONS

A unique characteristic of the EMS providers is that they do not use the purchased production faculties in the same manner as the previous owners. Instead they reorganize the production lines to accommodate greater standardization. Scale merits are also produced by adjusting the production methods so that the same product can be produced anywhere.

The products entrusted to the EMS providers not only have wildly fluctuating demand, but also have short lifecycles and provide low gross profit rates when produced using conventional methods. There are even some products that can only be produced for a few weeks. Therefore, the production lines use a movable wheel and carriage method.

At the Solectron factory in Milpitas production is temporarily stopped when the number of printers

²⁶ "Results of a Study by U.S. Research Firm PRTM on Businesses Using Supply Chain Management (1997)" (Nikkei Business "50 Methods for Innovating Business 2000 version"), page 132

²⁷ Solectron's Press Release

produced exceeds 30,000. Then the entire production line is transferred to the plant in Guadalajara Mexico where cheaper labor can be used. In this manner a full-production system can be introduced without any changes to the plans. The Milpitas factory has trial mass-production functions and joint operations with designers from the brand manufacturer are conducted here.

Some production facilities at the Milpitas factory are also lent to a plastic parts supplier seen as a strategic partner so that this supplier can produce printer covers. The main reason for this arrangement is to cut down on the expenses associated with shipping these printer covers. Workers are also trained to handle a variety of line operations. This helps to prevent the workers from become bored with repetitive operations and further improves worker flexibility (Handfield et al, 1999).

The factories purchased by the EMS providers are rarely held as their own property, but more commonly a leasing arrangement is made. The case mentioned earlier where Solecron entered into a leasing arrangement through a purchased investment bank is quite common. Jabil Circuit is in control of 25 factories around the world, but only nine are held as its own property²⁸.

Standardization of production lines and the adoption of leasing systems are two of the main reasons why EMS providers enjoy very high returns on their fixed assets.

3. STRATEGIC ASSETS ARE ACCUMULATED BY HIGH EMPLOYEE RETENTION RATE AFTER PURCHASES

Strategic assets made up of core technologies and related assets can be both tangible and intangible assets and provide competitive advantages. EMS providers are able to increase strategic assets such as design and production technology expertise through its many purchases of factories and businesses. In

many cases the vast majority of the factory employees are retained with their existing salaries and benefits in place. For example, in the more than 20 major purchases made by Solecron more than 85% of the former employees are still employed.

The number of employees at the factories purchased by the Solecron group actually increased two-fold on average. In fact, the number of employees at one factory in France purchased from IBM actually increased almost 10-fold from 260 employees to just under 3,000 current employees²⁹.

These employees are familiar with the technologies of major high-tech firms, have the superior values of the large corporations and make it easier for the EMS providers to obtain information on suppliers of materials and components, and obtain equipment for making advanced products. In other words, these employees help the developing EMS providers to quickly accumulate strategic assets.

In recent years American brand manufacturers of computers have been placing greater emphasis on software over hardware. As more investment is made in research and development, the trend towards downsizing and simplifying production facilities has grown stronger. Along with this strategy change, factories have lost some importance and the morale of factory workers has fallen. In some cases, options such as selling the factory or using outsourcing have been selected.

The basic policy of Solecron has been to offer the employees of the purchased corporation the same opportunities as its existing employees in order to foster mutual trust. All employees are offered stock options. Profit sharing and merit-based pay systems have also been adopted. The corporation also uses a system whereby each factory is free to determine the basic wages for individual employees³⁰. Solecron has also established mechanisms by which it can grasp important financial yardsticks for each line at its 57 factories worldwide. These financial yardsticks in-

28 Toshihiro Yamada "Special Report: Seek Winners of the Internet Revolution]" ("Weekly Toyo Keizai" May 6, 2000) pages 68~69

29 "Path to No. 1 - The Solecron Story] (Ohm "Electronics", February 2000), page 11

30 Shoichi Terayama, Ryohei Yamazaki "Trends and Beyond Trends" ("Nikkei Business" October 30, 2000) page 8

Figure 14 Recent Purchases by Leading EMS Providers (including other than factories)

	Solectron	SCI Systems	Celestica
1998	<ul style="list-style-type: none"> - NCR: Atlanta factory, Columbia factory (US), Dublin factory (Ireland) - IBM: North Carolina electric card factory (US) - Mitsubishi Electric: Georgia cellular phone factory (US) 	<ul style="list-style-type: none"> - Nokia: Telephone factory (Finland) - Nokia: Terminal factory (Sweden) - Ericsson: Mexico City factory, Spain factory 	<ul style="list-style-type: none"> - Madge Networks: Ireland factory - Lucent Technologies: Mexico factory - HP: Massachusetts systems factory (US) - Analytic (US design and testing company) - Silicon Graphics: PCB factory - Accu-Tronics (EMS provider in US) - IMS merger (EMS provider covering Asia)
1999	<ul style="list-style-type: none"> - Sequel (personal computer support) - Smart Modular Technologies (memory module design and production) - New Logics (IBM Maintenance company in Canada) - Glenayre (Illinois pager facility (US)) 	<ul style="list-style-type: none"> - HP: Kunshan factory in China - Nortel Networks: Ontario factory, Quebec factory (Canada) - TAG (US maker of electronic sealing materials) - ECI Telecom: PCB factory (Israel) 	<ul style="list-style-type: none"> - Gossen-Metrawatt (Czech) - HP: Massachusetts PCB factory (US)
2000	<ul style="list-style-type: none"> - Ericsson: communications base factories (France, Sweden) - Americom Wireless Service (US) - Bluegum Group (EMS provider in Australia) - IBM: Brazil PCB factory - Nortel Networks: factories in France, Northern Ireland and Turkey - Nortel Network's CAD facilities - Sony Nakaniida (Japan), Sony Industries (Taiwan) - Stock in NatSteel (EMS provider in Singapore) 	<ul style="list-style-type: none"> - Stock in Uniwill (notebook PC maker in Taiwan) - Nokia Engineering Group - EOG (US design, EMS provider) - Telrad Networks: factory in Israel - CMS (US maker of electronic sealing materials) 	<ul style="list-style-type: none"> - IBM: Minnesota electric card factory (US) - IBM: PCB factory (Italy) - Bull Electronics (US affiliate of Bull group) - NEC: communications equipment factory (Brazil)

Note: Related Japanese companies are indicated by bold-faced type.

Source: Prepared by the author from Press Release (as of November 2000) of each company

clude cash flows, return on assets and return on equity³¹.

This idea of providing all workers with equal opportunities helps to stimulate the employee moral that had fallen with the previous corporation, and is a reason for the high level of employee retention after the EMS provider purchases the company.

Solectron was awarded the Malcolm Baldrige National Quality Award (quality control award established during the Reagan administration) in 1991 and again in 1997. However, Solectron has continued to

set winning of this award again as a target for the corporation. To this end it has created an environment fostering solidarity between existing employees and employees from the purchased corporation and has incorporated quality improvement mechanisms based on customer satisfaction indexes (CSI) that make weekly assessments possible³². Other factors that cannot be overlooked include the employees' shared awareness of customer satisfaction and quality, as well as the creation of an environment where teamwork can be easily put to use.

31 *ibid.* Page 8

32 Satoru Kawashima, Shoichi Terayama, Ryohei Yamazaki, Arata Satoh "Factories' Declaration of Independence" ("Nikkei Business" October 16, 2000) pages 32~33

CHAPTER 5

PERSPECTIVES OF INTER-CORPORATE RELATIONSHIPS

1. BUILDING LONG-TERM PARTNERSHIPS WITH SELECTED SUPPLIERS

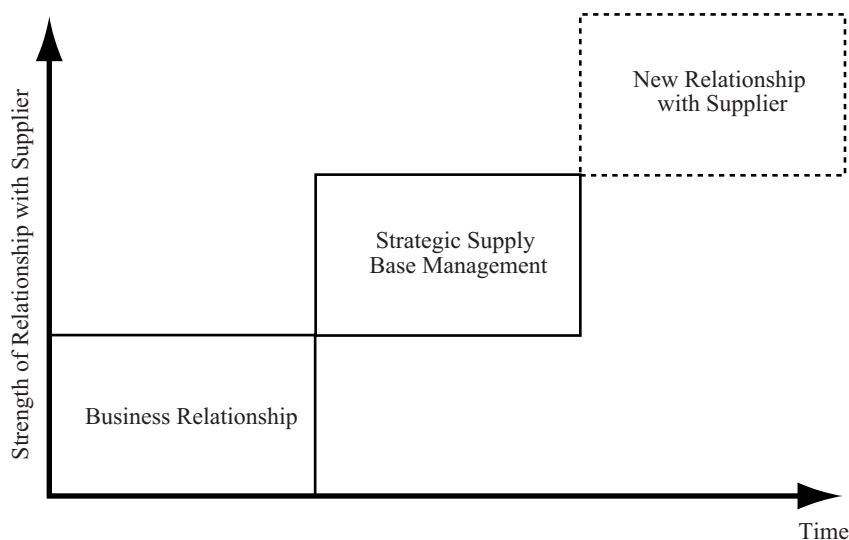
Many EMS providers establish long-term partnerships with their customers and suppliers. Solectron has had business relationships of 10 or more years with IBM, Hewlett-Packard, Sun Microsystems, Apple Computer and others (Handfield et al, 1999). The initial customer-supplier relationship in the 1980s was mainly a relationship based only on the transaction characteristics. In the 1990s customers began developing strategic supply base management by focusing on supply base optimization, measuring supply capabilities, developing relationships with main suppliers, and improving quality and delivery capabilities. In the future these relationships will likely be maintain, while developing new relationships with suppliers focusing on the performance of the overall supply chain, going beyond the simple ties between customer and supplier (Handfield et al, 1999).

Solectron is not the only corporation that is aiming to develop intimate and long-term relationships with its suppliers. In fact Dell Computers, which is not an EMS provider, has introduced supply chain management to reduce its more than 100 suppliers down to around 25 corporations (account for more than 90% of procurement in terms of value)*33. Hewlett-Packard, 3M, Xerox and other corporations have reduced the number of direct parts suppliers from several thousands to several hundred, and many are still trying to reduce this number to double-digits (Kato, 2000).

Traditionally these American corporations have used bidding systems and market transactions to determine contracts and trading partners and avoid trading risks between businesses. So why are these same corporations now so drastically changing their supply strategies?

One reason for this change in strategy has been greater modulation targeting shorter lead times. Another reason is the intermediate transactions within a network targeting cost reductions.

Figure 15 Customer and Supplier Relationships



Source: Based on page 194 of "Introduction to Supply Chain Management" by Robert B. Handfield and Ernest L. Nichols, May 1999, with additions by the author.

33 "Special Edition: Japanese and American Businesses Chasing Quality" ("Nikkei Business" March 2, 1998) pages 26~30, "Lecture: Business Model" ("Nikkei Electronics" January 4, 1999) pages 179~186

2. MODULIZATION TARGETING SHORTER LEAD TIMES

Modules are made by assembling parts. However, if the functional contacts between modules are standardized and made compatible, the modules themselves can function as the product when connected. Some 40 years ago IBM introduced the first design modulization for its System 360 computer. As a result IBM no longer had to design each product part one by one. Product lead-times were said to be reduced by designing module units in concurrent (Sako, 2000). Another effect is the reduction in the amount of communication needed between the organizations responsible for each module (Kokuryo, 1999).

In this manner EMS providers have promoted the modulization of computer-related products that they are asked to produce. However, this standardization has not led to external orders for individual parts, but has made it easier to use outsourcing that combines the design and production of the entire module. This modulization that focuses only on the suppliers that can shorten lead times has led to the emergence of this new business known as EMS.

3. NETWORK-TYPE INTERMEDIATE TRANSACTIONS TARGETING COST REDUCTIONS

There is much contextual³⁴ information in the business transactions between Japanese corporations and so trading risks are lessened through personal exchanges as opposed to contractual relationships. In order to hold down transaction costs, the number of trading partners is reduced and continuous, stable relationships are built with proven corporations and founded on the so-called “keiretsu” (business affiliate) trading system. These so-called “intermediate transactions” are a cross between market transactions and transactions within an organization.

However, in America bidding systems are generally used and market transactions are based on contractual relationships. In order to reduce some of the resulting transaction costs, some corporations have

used merger and acquisitions as a means of bringing the transactions within their organization. However, mergers and acquisitions increase the size of the business (business size increases from S0 to S1 as shown in Figure 16), thus raising organizational costs. This effectively cancels out any reduction in the transaction costs (Takao Ito, 1999).

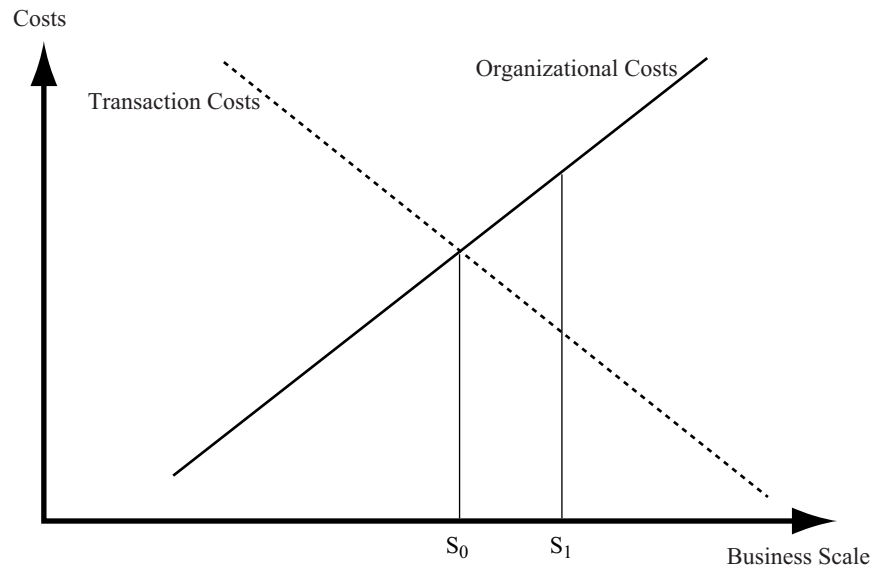
The Japanese-style “keiretsu” transaction system is the better choice provided that the amount of contextual information, which is associated with higher costs, can be successfully kept under control.

From the point of view of cost planning, part suppliers for the “design-in” aspect of product development do not generally participate in the bidding process used by American and European countries, which is not the case in Japan. However, from the 1990’s American and European businesses began studying the mechanisms adopted by their Japanese counterparts. The result was that they were able to greatly reduce parts costs by letting the parts suppliers participate in the initial stages of development. This had a large impact in shifting cost plans more toward the intermediate transaction style (Okano, Shimizu, 1997).

Taking into consideration the issues of increasing organizational costs and supplier commitments, American corporations have adopted a network-type intermediate organization making aggressive use of information technologies and roughly corresponding to the Japanese “keiretsu” style of trading (Takao Ito, 1997). In other words, attention is now being given to this movement towards intermediate transactions, which are seen as being somewhere between market transactions and transactions within an organization.

EMS providers have been attracted to the strong points of the Japanese-style “keiretsu” transactions as a means around the fact that reductions in transaction costs are cancelled out by increasing organizational costs due to their aggressive use of mergers and acquisitions. Supply chain management has been raised as one business model for coping with the cost demerits of contextual information.

34 Common interpretation though accumulated communication.

Figure 16 Relationship between Business Scale and Transaction Costs, Organizational Costs

Source: Takao Ito "Network Organization and Information" (May 1999) page 126

4. STRICT SELECTION OF SUPPLIERS, PROGRESS IN REORGANIZING SUPPLIERS

Supply chain management is used to strictly select and reorganize suppliers in order to focus on just a few direct suppliers of key components.

Brand manufactures monitor in a very business-like manner the production management of the EMS providers, and then select and replace the EMS providers they use. Electronics For Imaging, an American fabrication-less business developing signal processing servers for color and digital images, operates a barcode tracking system with its EMS providers to allow for remote monitoring of at exactly which factory and at which line parts are being assembled. Furthermore, a virtual engine that uses a workstation for product tests was supplied to an EMS provider to improve the efficiency of quality inspections. This data on the production management of the EMS providers are used to select providers from the point of view of stable quality and "just-in-time" product provision³⁵.

From the point of view of the EMS provider, Sollectron, for example, introduced the use of customer satisfaction indexes in 1985. Every week conferences are held to go over score sheets returned by the customers covering various areas such as quality, speed of delivery and response to inquiries. Those in charge of areas that receive a score of 90 or lower must determine the cause of the problem and take corrective measures and other quality improvement measures in order to raise the score by the following week. Cross-functional teams are also organized for each major customer. These teams are given authority over specifications, production planning and part procurement. At the same time a system is established assigning responsibility for each customer in terms of earnings³⁶.

The EMS provider works with the suppliers to realize short delivery times and low costs. In a horizontal specialization structure suppliers can be easily selected based on price and delivery. The emergence of EMS providers is due to the parts modulization

35 "Second Section America on a Fast Ride" 'Nikkei Sangyo Shimbun' February 2, 2000, page 24

36 "Path to No. 1 - The Sollectron Story" (Ohm "Electronics" February 2000) pages 10~11; "Special Feature: Factories' Declaration of Independence" ("Nikkei Business" October 16, 2000), page 33; Japan Printed Circuit Association ("Report on Business Strategy Vision for the Electronics Circuit Industry" January 2000) pages 52~53.

and standardization mentioned earlier, but it is also due to the uses of many suppliers to low cost, quick delivery times and tolerable quality³⁷.

In the case of Solectron, for example, the main standards for suppliers are (1) reliability, (2) lead time in filling orders, (3) average time between problems (quality), (4) allotment of all-purpose parts, (5) reduced inventory risks, and (6) cost reduction (Handfield et al, 1999)

From the point of view of the supplier, procurement by electronic commerce is accelerated, product modulization is progressing and transaction price have become more severe. Therefore, if the supplier, for example, proposes a module product that has a connector mechanism with an LCD open/shut mechanism, the value of the part is likely to increase³⁸. Also, large quantities of information about the market are promptly provided to the suppliers. These suppliers are expected to quickly interpret and analyze this information, and then incorporate the information into their own production and inventory plans³⁹. As a result, suppliers that best demonstrate these capabilities receive more business.

The arrangement of businesses in the supply chain management of American EMS providers is now being looked at very closely. Compared to the business relationships within the Japanese keiretsu system, which people both in and out of Japan have described as being stiff, this is seen as a more open and economically rational relationship.

5. IS SUPPLY CHAIN MANAGEMENT A WIN-WIN STRUCTURE?

Supply chain management has been described as a win-win relationship⁴⁰ in which the participating businesses and divisions share their intentions and work in a partnership, pulling their talents together to

achieve the overall best result. However, in reality the overall control of the chain is applied regardless of the size of the participating business, and this is seen as a profitable structure as the earnings capabilities of one's corporation are improved⁴¹. This control is seen as the organization maintaining its own autonomous power, while trying to expand the power of other organizations when possible (Yamakura, 1993). This is in agreement with the resource dependence perspective framework of the conventional management organization relationships that are based on this premise.

Dell Computer can again be cited as an example of a successful application of supply chain management.

Dell Computer has realized very high returns due to its competitive strengths in the areas of personal computer quality, delivery and price. Microsoft is the much larger corporation, but Dell Computer is better able to control its entire chain. The high profitability of EMS providers is due to their realization that procurement of materials and components is the most profitable area along the entire chain. In other words, with supply chain management any participating corporation has the chance to be a leader for the entire change regardless of its business size and ties with other corporations.

When supply chain management is seen as a link between the user and the supplier, it takes on a composition in which "BTO (build to order) strategies, which do not have the inventory risks associated with Dell Computer and other brand manufacturers, are strengthened and the EMS providers make use of the suppliers with the superior capabilities in handling such orders"⁴². Product modulization and standardization are premises for brand manufacturers like Dell Computer, as well as for the EMS providers.

37 Japan Printed Circuit Association ("Report on Business Strategy Vision for the Electronics Circuit Industry" January 2000) page 131

38 *ibid.* Page 74

39 "Special Feature: Streamlining Domestic Factories - Using the Internet and Outsourcing Production" (Fuji Research Institute 'fai' May 2000) page 6

40 A win-win relationship means that there are merits for both parties involved.

41 Yoshiki Matsushima "The Essence of EMS is Starting Factories" (Fuji Research Institute 'fai' May 2000) page 16

42 Japan Printed Circuit Association ("Report on Business Strategy Vision for the Electronic Circuit Industry" January 2000) page 129~130, "Nikkei Information Strategy" (August 1998) pages 18~19

Therefore, even if emphasis is placed on the speed and costs of the suppliers participating in the chain, the questions of technical prowess and individuality are not really seen as problems. This has meant that suppliers that are more technically oriented in such areas as developing unique products have had trouble gaining power within the organization and in enacting expansion policies. There are also doubts as to whether or not relationships based on mutual trust can be fully developed as they are in the Japanese keiretsu system. It has been said that the structure of these relationships supports exchanges between businesses that can freely enter and leave the structure, but some see it as an organization with fixed roles. Hanada (1996) said, "The individual corporations actively provide their core competences (corporations' core capabilities in providing value), and the mechanism for producing added values through the tie-ups with other corporations is not fully realized. The core competences become locked up within the structure, and nothing more than mutually complementing relationships are developed." However, most of these problems are associated with the limits of the EMS model in starting up businesses targeting products that are hard to differentiate in the production process.

In order to reach a Win-Win situation, a framework has to be found where core competences are openly shared to develop new core competences (Hanada, 1996). The ideal model is one in which the superior technologies and individuality of the participating corporations are actively incorporated, the entire business is aware of participating in the shared specifications, technologies and testing and coordinates a supply mechanism. However, the EMS business is likely to adopt business models with individual concepts.

CHAPTER 6

IMPLICATIONS FOR JAPANESE BUSINESSES

1. INROADS INTO JAPAN BY EMS PROVIDERS AND REFORMATION OF FACTORIES OF JAPANESE CORPORATIONS

Over the past few years, Japan has also seen active mergers and acquisitions and divestitures. As greater demands are placed on industries to raise their value, more and more factory operations are being combined, separated, sold off or outsourced as these corporations look to reorganize their business portfolios. However, some factories have been trying to become independent, breaking free from its ties to the parent company and group. In other words, there have been advances in the liquidation of production elements.

Foreign EMS providers are now starting to seriously try to develop the Japanese market. The world's largest EMS provider, Solecron (US), purchased Sony Nakaniida as its first production base in Japan. The world's third largest EMS provider, Celestica (Canada) established a Japanese affiliate "Celestica Japan", which began operations from November 2000⁴³.

Japanese businesses have also started to outsource more of its production. In other words, they are starting to reform their factories.

In 2001 Sony began to aggressively distance itself from its production divisions by moving some operations to a new company called EMCS (engineering, manufacturing, customer service). EMCS single-handedly undertakes all manufacturing processes from product and parts design and production to distribution and after sales service, and in this manner provides service to the parent company and group. At the same time EMCS is also eyeing the possibility of providing services to companies outside of the Sony group⁴⁴. NEC has also announced that its five domestic production affiliates plan to provide production

43 "Nihon Keizai Shimbun" November 9, 2000, Morning Paper, page 13

44 "Nihon Keizai Shimbun" October 19, 2000, Morning Paper, page 11

services to other companies in the same industry. In fact, NEC Nagano has established a sales division and has already started providing services for the production of monitors and projectors. With more Japanese corporations shifting production overseas, there has been an excess of employees and facilities at domestic factories resulting in stagnant production. To counter this situation, many factories are trying to become independent. Factories are being reformed with consideration to employing workers and supporting the local economies⁴⁵. From fiscal 2001 Matsushita Electric Industry began using domestic factories and has begun accepting production orders from group companies and other electronics manufacturers. This has helped to put the brakes on the hollowing out of Japan's production capabilities, while helping to foster new businesses⁴⁶.

Fujitsu is also considering turning some of its overseas factories into EMS providers. The company is currently building a cellular phone PCB factory in Vietnam on the premise it will serve as a EMS⁴⁷.

2. OUTSOURCING PROBLEMS

The following problems are being examined from the points of view of outsourcing and the reformation of factories.

Outsourcing is seen as a strategic consideration for business resources. "Instead of total perpendicular internal unification, the use of superior external services can make the business economically larger, more flexible and provide more specialized techniques. In terms of business strategy, only the essential elements need specialization. All other elements should be handled externally to the greatest extent possible" (Kobayashi, 1999, Quinn, et al., 1991). In other words, the focus for production has shifted from "how can we make things" to "how can we entrust production to capable suppliers" (Kobayashi, 1999, Venkatesan, 1992). Peter F. Drucker also stressed that "business resources other than the company's core competences should be externalized."

American corporations embraced this philosophy from the 1990's and began aggressive outsourcing. Clearly outsourcing had become the big trend. However, Japanese corporations, except for some of their overseas affiliates, have resisted using EMS providers for everything from procurement of materials and components to production. This has been due to their awareness of the limits of outsourcing in the processing and assembly stages, and some of the other relevant problems.

One limit to outsourcing is that over the long-term expertise does not remain within the organization and the effectiveness in managing that area is lost. Accordingly, from the point of view of creating the organization, there is the problem of how to generate new values and in what form the outsourced information will take for the corporation itself (Hanada, 1996). Effort is needed in sharing external resources with EMS providers and in collaboration to create added value.

3. PROBLEMS REFORMING FACTORIES

One problem with reforming factories is that profit levels for processing and assembly in the brand manufacturer's value chain decreases, and personnel, facilities and other fixed expenses involved with production are increased. Therefore, there has been the effort to take on production from corporations outside of the group in order to maintain operating ratios and improve productivity. However, how this is achieved is probably different from the methods used by the American-style EMS provider business. This is because the EMS provider profit structure mentioned earlier [sales expenses and general operating expenses rate: average of 4.6% for top 6 EMS providers] is an extremely low-cost operation that cannot be imagined by Japanese industries. Moreover, in the value chain 80% of sales are from procurement of materials and components, while only 20% of sales are from processing and assembly. In other words, this type of earnings structure is a huge change for

45 "Asahi Shimbun" October 13, 2000, Morning Paper, page 13

46 "Nihon Keizai Shimbun" October 30, 1000, Morning Paper, page 11

47 Toshihiro Yamada, Toru Okamoto "Special Report: Learning from America's High-tech Industrial Recovery" [Weekly Toyo Keizai] July 17, 1999, page 35

factories built on the concept of production.

Despite the different aims, much can still be learned from the EMS business model. One important point is to establish functional relationships between the party making the order and the party filling the order. Roughly the same problems are seen when using outsourcing. The factories of Japanese corporations must consider two points when creating a functional relationship from the point of view of an open sub-contractor⁴⁸. The first consideration is contextual skills, which require a great deal of transactional costs. Another problem to consider is the switch to a service-type industry.

(1) Contextual Skill Problem

First of all, skill must be classified as either functional skill or contextual skill. "Functional skill is fitting for executing a certain assignment and gaining a certain aim, and it is an ability employed for that purpose based on a personal principle. Contextual skill means relatively limited space of action. That is, this skill can be coexistently combined and recombined with minimum valid diversity⁴⁹ of functional skill which belongs to self and non-self in the context of action. It cannot possibly exist without functional skill." (Nishiguchi, 1996).

The structural relationships between Japanese assembling firms and parts manufacturers support the deep development of contextual skills through their direct contact. There is mutual commitment within the organization, resulting in high performance (Nishiguchi, 1996). However, some of these merits can become demerits considering the rapid changes in technologies, shorter product lifecycles and heightened market competition. When the ordering corporation is deemed as not having core competences, outsourcing can be carried out. In order to reduce risks sub-contractors prefer to an open relationship with

the contractors. Standardization supports economic streamlining and supply chain management helps to reduce inventories. When the party placing the order relies on contextual skill-type outsourcing, it pressures the subcontractor in terms of transaction expense and speed. This existence of skilled competence has made it difficult for foreign EMS providers to develop the Japanese market (Solelectron first opened a Japanese office in 1992, but did not obtain its first domestic production base until eight years later in October of 2000).

(2) Problem of Switch toward a Service Industry

EMS providers boast of being "a service that meets the various needs of various customers in various businesses"⁵⁰. There are customers that want to rush a new product to the market, and there are corporations looking to reduce costs. Solelectron has a plant that produces only printed circuit boards. This plant produces around 1,200 different boards each day, and for roughly two-thirds of these boards the designs and production amounts change within a 24-hour period. There are even customers that will suddenly request production of a completely different product, and so EMS providers must be ready to meet any such order⁵¹. EMS providers do more than just procurement of materials and components, and production. They have expanded their range of services to include design, maintenance and other services to better meet customer needs. Service has been generally defined as labor outside of the physical production processes (according to the Kojien dictionary). However, when the factories of a Japanese corporation assumes the role of a subcontractor, it must do more than simply provide assembly technologies at the production site. It must also offer a wide range of services from design and parts development to maintenance. This is affectionately called the "smile curve"⁵² that is a policy for raising the level of added value.

48 An open subcontractor is one that does not limit itself to a particular client. In a narrower sense, this also means one that does not limit itself to a particular in-house company or division.

49 Ashby is indicating the law of minimum valid diversity in which the system is not suited to the environment unless it has diversity exceeding the diversity held by the environment.

*50 Based on an interview by the author with President Yasui, Solelectron Japan (November 22, 2000)

*51 "Nihon Keizai Shimbun" March 30, 1998, Morning Paper, page 11

*52 The "smile curve" refers to the point in the producer's value chain where the added value of the mid-stream processing and assembly procedures curves downward.

On the other hand, the service industry of the EMS provider is based on the premise of having no brand. There are of course doubts that the factories of large corporations that have prided themselves on their own brands will now be able to provide a brand-less subcontracting service and be able to flexibly meet the demands of clients with vastly different corporate cultures. In order to make this switch to a service industry based on customer satisfaction indexes and a system responsible for each customer, a fair deal of change will be needed for the organization's culture and attitudes.

The EMS provider initially starts out handling only consigned processing (receives equipment and parts from the customer). In the second stage the EMS provider expands its customer base and acquires its own facilities. In the next step it finally has the turnkey capabilities to purchase materials and components on its own⁵³. Among Japanese corporations, suppliers and parts companies that have independent businesses similar to this turnkey may possibly become system suppliers⁵⁴ developing complex parts or multi-agents for several corporations. This is probably similar to the EMS business.

Generally speaking, the factories of large Japanese corporations, including those overseas, tend to rely heavily on a particular corporation or division within the group. If these factories can move away from this dependent relationship and can accept production orders from another companies and divisions within the group, they should then be able to begin accumulating expertise as a service business.

CONCLUSION

We are now in an age in which the business management environment is rapidly changing. Inevitably, corporations will need to change from the conventional strategy of keeping personnel, physical, monetary and information resources focused within one

organization, while trying to pursue scale of profit. This is especially true for the manufacturers of IT-related equipment. With the fast pace of technical innovations and shorter product lifecycles, corporations must now carefully consider the merits and demerits of keeping production facilities within the organizations.

Along with the greater modulization of electronic components, EMS providers have been able to exercise strong bargaining power in procuring components, while remaining sensitive to lead times for customers and markets. In this manner the EMS providers are able to help the brand manufactures to improve speed and reduce inventories.

The spread of the Internet has produced a digital society and increased demands for greater speed and flexibility. EMS providers, based on horizontal specialization, aim to be a network-based service industry that builds mutual relationships between businesses in a virtual structure. Business value is based on improving free cash flow.

If the factories of Japanese corporations, including overseas affiliates, want to reform to become production subcontractors, they will need to overcome the problems mentioned earlier (contextual skills and switching a service industry). However, some of these corporations have started receiving orders from other companies and divisions within their own group. How will these factories maintain a competitive edge over American EMS providers that have been promoting standardization (for example, cost advantages, time advantages and individual advantages in areas such as diversification, miniaturization, device development, and variable production skills)? Problems still exist in terms of incorporating the technical skills and individuality of the suppliers – standardization – and in terms of cost and speed demerits – contextual skills –. It will be important to see if a Japanese business model can be created in the domain located somewhere between this standardization and contextual skills.

53 Based on an interview by the author with President Yasui, Solelectron Japan (November 22, 2000)

54 Supplier capable of accepting an order for entire sub-system.

TERMINOLOGY

- ASIC: Abbreviation for Application Specific Integrated Circuit.
- BTO: Abbreviation for Build to Order. Production and sales in accordance with the order from the customer.
- CTO: Abbreviation for Configure to Order. Specifications based on the customer's order.
- EMS: Abbreviation for Electronics Manufacturing Service. Consigned manufacturing service of electronic equipment.
- ERP: Abbreviation for Enterprise Resource Planning. Methods and concepts with the aim of optimizing resources throughout the organization.
- FPGA: Abbreviation for Field Programmable Gate Array. IC in which the user can write its own program.
- LCD: Abbreviation for Liquid Crystal Display.
- OEM: Abbreviation for Original Equipment Manufacturing. Complete products and components are provided under the customer's brand name.
- PCB: Abbreviation for Printed Circuit Board. Boards mounted with electronic component.
- SCM: Abbreviation for Supply Chain Management. Management method in which related corporation and division information is shared in real-time to improve speed and efficiency for the entire chain.
- TTC: Abbreviation for Time to Customer. Time needed to deliver the product to the customer
- TTM: Abbreviation for Time to Market. Time needed to deliver the product to the market.

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