# Technological Capabilities and Samsung Electronics' International Production Network in Asia

Youngsoo Kim

Working Paper 106
November 1997



Youngsoo Kim is a Visiting Fellow at Australia Japan Research Centre of Research School of Pacific and Asian Studies at the Australian National University and a Director at Australia - Korea Research Association.

Support for this BRIE Working Paper is provided by the Alfred. P. Sloan foundation

The author would like to thank Dieter Ernst (University of California – Berkeley), Sung-Tack, Park (Korea Institute for Industrial Economics & Trade), Mark Hobday and Keith Pavitt (University of Sussex), S. J. Nicholas (University of Melbourne), Ken Ijjima and Dennis Tachiki (Sakura Institute of Research), Ian Vertinsky (University of British Columbia), C. A. Bartlett and D. J. Collis (Harvard Business School), John Cantwell (University of Reading) and Tetsuo Abo (University of Tokyo) for their helpful assistance and comments. Special thanks go to Peter Drysdale, Hal Hill and Mark Dodgson (the Australian National University) for their special guidance and support. I am also grateful to Tack-Myong Kim and Chang-Sik Yoon for their assistance. The author is indebted to Samsung Economic Research Institute and Samsung managers with whom I interviewed in China, Korea and Southeast Asia. The views expressed, and any remaining errors, are solely the responsibility of the author.

Korean electronics firms have been aggressively involved in learning and knowledge accumulation over the past two decades. Their consumer products, including color television sets (CTVs), video cassette recorders (VCRs), and microwave ovens, were able to remain competitive in the low-end segment of world markets until the late 1980s, generating the cash flow needed to support development of more advanced technologies. In recent years, however, Korean products are meeting increased competition, particularly from Japanese producers that have recovered their competitiveness by investing in low-cost offshore production.

Increased overseas production has been a major component of Korea's strategic response. Korean production networks in Asia now extend beyond the ASEAN region to China and India. The ratio of overseas production to total production has increased sharply in recent years, from 19 to 27% for CTVs and from 16 to 17% for VCRs during the period 1992-1994. However, those of their Japanese electronics counterparts increased even faster, from 67% to 86% for CTVs and from 36 to 71% for VCRs during the same period (see Table 1), keeping competition intense in the cost-driven struggle for low-end markets.

***Table 1***
***Overseas Production Ratio Of The Korean And Japanese Electronics Industries***

| | | **1991** | **1992** | **1993** | **1994** | **1995** |
|---|---|---|---|---|---|---|
| **CTV** | Korea | NA | 19 % | 20 % | 27 % | 28 % |
| | Japan | 63 % | 67 % | 72 % | 86 % *a* | NA |
| **VCR** | Korea | NA | 16 % | NA | 17 % | 20 % |
| | Japan | 29 % | 36 % | 48 % | 71 % *b* | NA |

Note: Overseas production ratio in the table is the ratio of the unit quantity produced overseas divided by the total unit quantity produced overseas and in the home country.

*a* The figure of Sharp's overseas production ratio.

*b* The figure of Sanyo's overseas production ratio.

Source: Electronics Industry Association of Japan (EIAJ), Tsuda and Shinada (1995), *Junja Shinmun* (28 Feb. 1994), Electronics Industry Association of Korea (23 Feb 1995), *Hankuk-Ilbo* (10 Apr 1995), *Jungang-ilbo* ( 24 Feb 1995).

Perhaps a better comparison would be with another newly industrialized Asian country. Outward foreign direct investment (FDI) by Korean electronics firms lagged behind their Taiwanese rivals. The cumulative FDI by the former amounted to $US 0.85 billion (EIAK, 1993), while for the latter it was $US 1.05 billion.[1]

In 1993, the three major Korean producers, Samsung, Goldstar and Daewoo, announced their intention to increase their overseas production ratio from an average of 20% in 1993 to 60% by 2000 (*Korea Economic Daily*, 21 July 1993). This paper will focus on the experience of Samsung, which has the highest overseas production ratio of the three.[2]

The paper is arranged chronologically, focusing both on the forces driving Samsung to develop offshore networks and on the struggle to adapt the nature of its networks to its capabilities. Particular attention will be placed on the networks connecting its offshore affiliates in East Asia.

The firms involved are all part of the Samsung Group, a highly diversified conglomerate. The core electronics producer is Samsung Electronics Co. (SEC) and its affiliated firms are Samsung Electron-Devices Co. (SED), Samsung Electro-Mechanics Co. (SEM) and Samsung Corning Co. (SC). The sources for this study are primarily internal Samsung publications, including monthly bulletins relating to international production, technological development, and organizational processes, as well as interviews that were conducted at Samsung in Seoul during November 1994. The organization of Samsung's international production networks in ASEAN were also reviewed during July 1995.

The first section examines the 1970's, following Samsung's entry into the electronics sector. The focus was on the development of mass production capability, and international linkages were used to acquire product designs and marketing outlets, allowing Samsung to concentrate its resources on the development of mass production capability. The second section looks at Samsung in the 1980s. The majority of the group's resources were channeled into the highly demanding production of advanced semiconductors. While the effort was eventually successful, it appears to have retarded the development of design and marketing capabilities for its mass-production goods, leaving the group dependent on foreign sources of product design and

[1] This is based on the figures published by the Investment Mission, Ministry of Economic Affairs, Republic of China in 1992. It is generally believed that the real figures are far bigger than the ones published because of unreported flows to mainland China.

[2] The value of its offshore production in 1994 was US$1,050 million, compared with US$550 million for Goldstar, and US$50 million for Daewoo (*Korea Economic Daily,* 29 Aug 1994).

distribution. The decade also saw the company's initial foray into international production to cope with trade pressure in its major markets, and explores how the group's internal organization was poorly adapted to the needs of overseas operation and to the task of organizational learning. The third section considers Samsung in the 90s. Samsung has been pursuing a variety of strategies, including internal organizational reform, rapid expansion of offshore production, and aggressive acquisition of technology.

Table 2 provides an overview of the profile of the group in each decade.

***Table 2***

***Samsung's Technological Capabilities And Features Of International Production***

| | 1970s | 1980s | 1990s |
|---|---|---|---|
| Key activities | Conglomerate diversification | Entry into DRAM market | Organizational reform, internationalization |
| Main sources of capabilities | J/V partners, Original Equipment Manufacturer (OEM) buyers and overseas training | OEM buyers, foreign licensing, reverse engineering | Acquisitions, strategic alliances, in-house R&D. |
| Level of technological capabilities | Capabilities in mass production (TVs) | Broader product range (VCR, MWO, DRAM, components), but very weak in ability to introduce a major change of product. | Continued weakness in product development |
| International production and scope of interaction | | US & EC for low-end markets (limited success). Centralized intra-firm interaction. | International production of low-end items in peripheral regions. Moving toward decentralized intra- and inter-firm interaction. |

The fourth section examines Samsung's Asian production networks in detail. Initial investments were for consumer goods for both export and local markets. The networks were promptly integrated backwards and linked to the networks of other producers in the region. A final section provides a brief summary of the findings about Samsung's production networks, along with an analysis of the directions the firm must go in if it is to remain competitive in a rapidly changing environment.

**Samsung in the 1970s—From Textiles to Televisions**

Samsung was first incorporated in 1938 by Lee Bung-Chull, and its main business line was trade. The trading function has continued to be important, first with imports, and later exports, starting in the mid-1970's. Samsung had become one of Korea's top ten firms by 1950.

In the mid-1950s Samsung entered two manufacturing sectors: sugars in 1953 and textiles in 1956 (SED 1990). Domestic demand was huge, and Samsung could start production using imported equipment from Japan and Germany. It was not until 1969 that the firm entered the electronics industry, with the incorporation of Samsung Electronics Co. (SEC).

Samsung's entry into the electronics industry had four important features which continued to characterize Samsung's electronics activities into the 1980's: an emphasis on mass production, reliance on foreign technology, a follow-the-leader strategy, and government support. First, its electronics business was significantly influenced by the two manufacturing activities of textiles and sugars. Both industries required a large scale of operation, and Samsung developed know-how through learning-by-doing for more than a decade before it entered the electronics industry. Secondly, its business started with imported foreign technology, having a close relationship with Japanese electronics firms. Having been educated in Japan, Lee Byung Chull was able to establish informal contacts. Originally Samsung had considered cooperation with American firms, but it finally chose Sanyo and NEC as joint venture partners because of the language difficulties inherent in learning about the American technology (SEC 1989). Thirdly, Samsung entered the Korean electronics industry as a market follower. Another Korean firm, Goldstar Electrical, had started assembling vacuum tube radios for a US firm in 1959 and had built up export capabilities for ten years before Samsung entered the industry. Finally, Samsung enjoyed government support for its expansion into electronics. In 1968, the Korean government introduced the Electronics Industry Promotion Law, marking the beginning of official support for the industry.[3]

Samsung's initial strategy was nothing more (or less) than the mimicking of its Japanese rivals. Its aim was to become a vertically integrated electronics firm: "...from materials to components to end-products, including consumer and industrial electronics" (SEC 1989).[4]

[3] It is also not surprising that Samsung entered the international DRAM market in 1983 the year when the government again promoted the semiconductors promotion policy.

[4] Samsung (SEC 1989) claims that to achieve this, it needed a large industrial complex in which to build several plants. It therefore bought a single block of land of about 1.5 million sq. m, which was larger than Sanyo's electronics complex in Japan in the late 1960s.

However, entry barriers were so strong that the government set a condition for Samsung that all products should be exported (SEC 1989).

Given its lack of previous experience in electronics, Samsung had no choice but to be simultaneously involved in learning a number of different technologies. To accomplish this, it turned to foreign sources of technology in management, production and marketing. It created several joint venture companies with foreign technology suppliers such as NEC, Sanyo, Corning Glass Works and other companies. It also reached numerous agreements to assemble electronics products for foreign original equipment manufacturer (OEM) buyers, who provided it with design and engineering support as well as with an international market. Investment in design and international marketing remained limited while Samsung concentrated on improving its production capability through such measures as the training of technicians in Japan.

A series of joint ventures allowed Samsung to rapidly achieve its goal of becoming a vertically integrated producer of television sets.

In December 1969, the recently-established SEC established one joint venture firm, Samsung-Sanyo, with Sanyo (40%) and Sumitomo Trading (10%), and in January 1970 another joint venture company, Samsung-NEC, with NEC (40%) and Sumitomo Trading (10%). According to the two joint venture agreements, Samsung alone had local market sales rights, while Sanyo and NEC had the export rights. However, it was not until the mid-1970s that Samsung was allowed to distribute its products within the domestic market and reap higher profits due to domestic market protection. Samsung thus had to rely on foreign linkages from the very beginning of its electronics endeavors.

In March 1973 Samsung-Sanyo Parts, from which Samsung Electro-Mechanical (SEM) originated, was set up. Its shareholders were Samsung-Sanyo, SEC and Sanyo. This company was to produce parts for televisions, including tuners, deflection yokes, transformers and condensers. In December 1973, Samsung formed another 50:50 joint venture company, with Corning Glass Works of the U.S. in order to produce glass bulbs for the production of cathode ray tubes (CRTs). Foreign linkages thus permitted Samsung to achieve a high level of vertical integration in the production of televisions in a remarkably short time. Furthermore, apart from the first three years of the venture with Corning, all ventures were under Samsung's management control (SC 1994).

Its joint venture partners provided significant training to Samsung's employees. An early example is NEC. The first intake of sixty-three Samsung-NEC employees was sent to NEC in Japan, from September 1969 to February 1970, in order to master the skills of assembling technologically simple products. In 1970, about twenty employees went to Japan for training with vacuum tubes and black & white CRTs, which Samsung-NEC was successfully assembling by the end of the year (SEC 1989). In accordance with a technical assistance agreement, NEC technical experts came to Korea annually to train eighty Samsung-NEC technicians (SED 1990). Starting in 1977 when NEC licensed Samsung-NEC to produce color picture tubes, several groups of Samsung-NEC technicians were once again sent to Japan for one to four months training. Foreign training has remained a feature of Samsung's partnerships in a variety of electronics fields, including Sanyo (radios and television sets), ITT (telecommunication switches), and Honeywell (semiconductors).

Although Sanyo divested its shares with Samsung, NEC and Corning Glass Works are still share-holders in Samsung Electron Devices (SED—a CRT producer) and Samsung Corning (SC), respectively.

SEC expanded and improved its assembling capability, producing nearly 10 million black and white TV sets by the end of the 1970s, by which time Samsung was exporting a considerable volume of television sets to the U.S., its only significant overseas market. On the strength of its mass-production capability and the Korean government's support for exports, SEC was able to seize a fairly high share of the US market (although far less than its Japanese counterparts), particularly in low-end products. SEC's exports were significantly concentrated on the US market[5] - USA (77%), Canada (7%), Europe (3%), South America (3%) and others (10%). The products exported were black and white TV sets (43%), color TV sets (44 %) and audio products (9.6%).

Most sales were through OEM channels. OEM buyers provided Samsung with product design, quality control and engineering support, leaving Samsung to increase its manufacturing capability through the intensive training of employees, particularly shop-level technicians.

[5] Due to this unbalanced distribution in the market, in 1984 SEC was forced to establish its CTV production plant in the US although its capability was not mature enough to operate it. Four years later, it dis-invested from the US, whose market is the most important for electronics products.

Apart from the NEC and Sanyo channels, Samsung tried to get access to other international distributors.[6] As growing connections with international direct marketing channels increased its bargaining power, Samsung was able to ease the restrictions initially imposed by its joint venture partners. When the agreement with Sanyo was renewed in 1972, the original export marketing restriction, which had been unfavorable to Samsung, was terminated.[7]

In addition to assembled products, Samsung also engaged in the direct sale of components to other firms. As SEC's quantity of production increased, its demand for core components produced by its affiliated part suppliers such as SED, SEM and SC increased accordingly.[8] However, SEC was not able to purchase all the components produced by the affiliates, who were obliged to find non-Samsung customers in Korea or Japan.[9]

Samsung expanded its OEM channels and capabilities by adding two new products — VCRs and microwave ovens. Samsung tried to get access to technology for the two products in the mid-1970s, but gaining foreign licensing was more difficult than for television sets. Therefore, Samsung had no choice but to get it through "reverse engineering" (SEC 1989: 248-250). In 1976, SEC formed a product development team which began to dismantle a Panasonic microwave oven. The project was successfully completed in 1978. In 1979, Samsung succeeded in developing its own VCR through reverse engineering. According to Jun and Han (1994: 317) Samsung still showed no improvement in creative development unless a similar sample or manual was available as the basis.

---

[6] SEC's first subsidiary, Tokyo Samsung Engineering Co., got access for SEC to Mitsubishi in 1971 and SEC obtained an order for 5,000 black and white TV sets for the US market under the brand name of 'Uncle Sam'. In 1973, SEC exported black and white TV sets to MGA of the US and electronic calculators not only to Casio, but also to Hermek in Europe and Hatzlack of the US. In 1974, SEC contracted with Beltrans, a European buyer, to export radios (SEC 1989: 171). In 1975, SEC's compact stereos were exported to AGS of Canada as were radios to Zenith on an OEM basis. The first export of CTVs was in April 1976 to Panama. In 1978 SEC established sales channels with Zenith of the US and exported amplifiers on an OEM basis (SEC 1989).

[7] The termination of the original contract must have been one of the main reasons that Sanyo divested from the joint-venture and withdrew its whole share from Samsung. This is in contrast to the relationship with NEC that still held about 10 percent of its share in SED, and Corning Glass Works that holds a considerable proportion of shares in SC.

[8] The localization ratio of components for black and white TV sets increased from 60% to 90% (SEC 1989:177). In July 1978 the linear IC was developed (SST 1987:177). In September 1978 the IC package assembly became available, because lead frames for the IC were produced. The initial semiconductor operation supplied only a small proportion of Samsung's internal demand, so a large quantity of ICs were still imported for several years (SST 1987:179).

[9] These early sales linkages enabled Samsung's foreign affiliates to interact with Japanese organizations in Southeast Asia right from the start of overseas production in the early 1990s.

Samsung further diversified its business line into the telecommunications sector through a 1977 joint venture with GTE of the U.S.[10]

But even as its product engineering and assembly capabilities improved, the Samsung group's development of market knowledge was stymied by its internal organization, further stunting the creation of original product designs. Samsung Corporation, the group affiliate involved in general overseas trading, distributed the electronics products manufactured by SEC through international branch offices (Cho 1983). According to an interview, SEC's expansion into foreign marketing had been blocked by Samsung Corporation, whose priority was the increase of export performance in order to meet the export-led industrialization policy. It was not until 1978 that SEC was actively engaged in overseas marketing through its own sales affiliate established in the U.S.

Yet, intra-firm interaction between the US-based sales affiliate and Korea-based production site was not effective. The affiliate belonged to the department handling export marketing, not to the production department. Once again, SEC was not able to recombine knowledge of the U.S. market with that accumulated in Korea. In short, there was no organizational support for links between production and international marketing.

One cause may be the profit-center system that was introduced in 1975 to stem the losses incurred for the first five years of operation[11](SEC 1989). Each affiliate operated independently in its own interests, and the same was true for each business division. Autonomy was limited by the central control of the Chairman's Secretariat.

The profit-center system led to at least two negative effects. First, the strategic direction of each affiliate put much more importance on the short-term[12] than the mid- and long- term. The system was reinforced by an employee evaluation system which focused on short-term performance which remained in place up to the early 1990s (Samsung 1993). Secondly, the

[10] In December 1977, Samsung-GTE was incorporated. SEC had a 51% share and GTE a 49% share of the company. Samsung-GTE produced and marketed electronic private automatic branch exchanges (EPABX), which had been developed by the Korea Institute of Science and Technology (KIST). Furthermore, Samsung decided to acquire the Korea Telecommunications Company (KTC), a state-run telecommunications corporation established in 1977 to produce electronic switching exchanges (ESS) for the local Korean market in collaboration with BTM of Belgium, a subsidiary of ITT (SST 1987).

[11] These were turbulent years. SEC had five different CEOs between 1969-1975 (SEC 1989).

[12] See Yu Seongjae (1989) and Koh Dong-Jin (1992) who have identified Samsung's short-term strategic view.

system generated unproductive competition rather than cooperation between affiliated organizations within the group, and between organizations within a firm.

Despite the organizational difficulties it experienced, Samsung made considerable progress during its first decade in the electronics business. But the next decade would see Samsung's electronics operation reach new levels of sophistication.

**Samsung in the 1980s—Technological upgrading**

The 1980's saw Samsung expanding and diversifying. Table 3 shows how the company's revenues were expanded first by the addition of microwave ovens, then VCRs, and later by successive generations of memory chips. We will begin the review of this critical period in the firm's history with integrated circuits, which have become its primary focus, before returning to the history of its product divisions which are, in fact, the source of Samsung's international production networks in Asia.

***Table 3***

***Samsung Electronics Corporation***

***Major export products in the 1980s (US$million)***

| | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 |
|---|---|---|---|---|---|---|---|
| CTVs | 88.2 | 151.7 | 196.7 | 141.9 | 221.6 | 353.8 | 408.9 |
| VCRs | - | - | 2.6 | 134.5 | 297.4 | 401.7 | 581.7 |
| MWOs | 59.8 | 95.2 | 149.5 | 127.4 | 238.8 | 308.4 | 367.1 |
| REFs | 12.5 | 10.8 | 16.0 | 24.0 | 34.4 | 53.6 | 89.8 |
| W/Ms | 0.7 | 1.0 | 1.4 | 2.5 | 5.6 | 13.4 | 18.1 |
| A/Cs | 0.2 | 2.3 | 2.5 | 1.6 | 1.9 | 12.4 | 14.6 |
| EPBXs | - | - | - | - | 0.4 | 0.5 | 1.6 |
| Keyphones | - | 0.8 | 0.2 | 5.2 | 13.2 | 62.0 | 48.4 |
| FAXs | - | - | - | - | - | - | 2.2 |
| Computers | - | - | 0.02 | 0.8 | 7.9 | 22.5 | 69.5 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Watch chips | 8.1 | 7.7 | 12.8 | 13.1 | 27.5 | 21.1 | 21.9 |
| Linear ICs | 4.6 | 5.9 | 10.9 | 15.8 | 22.0 | 37.3 | 45.6 |
| Transistors | 1.2 | 1.2 | 7.6 | 13.7 | 17.8 | 38.8 | 50.0 |
| 64K DRAM | - | - | 5.5 | 12.4 | 33.2 | 21.7 | 76.9 |
| 256K DRAMs | - | - | - | 27.0 | 50.3 | 134.2 | 253.4 |
| 1 M DRAMs | - | - | - | - | - | 6.0 | 221.3 |

Note: MWOs = microwave ovens; REFs = refrigerators; W/Ms = washing machines; A/Cs = air conditioners; EPBXs = electronics private branch exchanges; FAXs = facsimile machines

Source: SEC (1989:1032, 1036, 1053, 1057,1067)

***Integrated Circuits***

Samsung's vertical integration strategy was extended quite early to embrace semiconductor technology, which was to be SEC's key focus in the 1980's. In 1974, Samsung acquired Korea Semiconductor Co. (KSC), a joint venture between Korea Engineering & Manufacturing Co. and Integrated Circuit International, a U.S. firm which manufactured simple integrated circuits ("chips") for electronic watches. This time, Samsung acted well ahead of its rival, Goldstar, which entered the market by acquiring Daehan Semiconductors in 1979.

The firm hoped that internalization of core components technology would reduce its heavy dependence on Japanese suppliers (SEC 1989). SEC suffered from the outside purchase of core components because its production quantity of CTVs and VCRs were limited by component availability. In the late 1970s, Kim Kwang-Ho (currently CEO of the Electronics division), who had worked for the TV production department, was transferred to the semiconductor sector. It seems that his primary mission was to develop core ICs such as the "chroma IC" that were then imported from Japan. The mission was accomplished in November 1981, followed by another important development—the motor drive IC—in 1982.

To successfully achieve its objective, Samsung once again tried to learn foreign technology through a broad range of formal and informal contacts. The acquired technology was internalized through learning-by-doing, backed by a large pool of resources. The decade-long effort to develop semiconductor capabilities may well have limited learning and knowledge accumulation in other areas.

In 1983 Samsung expanded beyond production for its internal needs and entered the merchant market for dynamic random access memories (DRAMs), which require the most advanced manufacturing technologies and huge capital outlays. As for its initial entry into electronics, government support was a factor, with a semiconductor promotion law enacted in 1983. To the extent that the company was known to be naturally very cautious on entering new business ventures (Jun and Han 1994), the entry decision would not have been made without nearly a decade of successful chip manufacturing experience.

Samsung was able to shorten its learning process by a variety of interactions with foreign technology sources.

In June 1983, Samsung licensed a DRAM design from Micron Technology,[13] a medium-sized American producer. Samsung claims that it was the only source of DRAM design after contact with various firms including Texas Instruments, Advanced MOS, Motorola, NEC, Toshiba, etc. For the process development of 64 K DRAM, Samsung was fortunate to get access to Sharp which was the only source of process technology such as 16K SRAM and 256K ROM technology. In November 1983, a 64 K DRAM chip was developed at Samsung, and in mid-1984 mass production started.

Samsung placed great importance on informal learning and training in addition to the purchase of foreign technology. This provided Samsung with an opportunity to overcome problems whenever critical situations occurred. For instance, Samsung succeeded in managing more than 300 manufacturing steps, excepting only eight key process steps, and overcame this obstacle by adding "three experts who had participated in the project of 64K DRAM in the US and been trained at Micron Technology" (SST 1987: 203). Japanese technology advisers who had maintained a relationship with the ex-Chairman, Lee Byung Chull, consulted to the firm about the semiconductor technology and market trends. Similarly, the current Chairman Lee Kun Hee's informal networks with technology sources were significantly beneficial during the development of the 4M DRAM.

But inter-personal networks were insufficient to develop capabilities in a demanding field where Korea was so far from the center of activity, necessitating the globalization of Samsung's technology development.

[13] There were two strategic reasons for Micron Technology: it desperately needed cash, and intended to established a low-cost second-source, enabling Micron to keep its own investment as a minimum. (Ernst 1994b:79).

Soon after its entry in the DRAM market, Samsung set up a research institute - Samsung Semiconductor Inc. (SSI) - in Silicon Valley**.** SSI's first objective was to develop 64K and 256K DRAMs. The office began producing silicon wafers in 1985 with 300 engineers and was expanded in 1987 to study IC applications in computers, office and telecommunications equipment. That same year, SEC opened its Tokyo Design Centre for ICs.

SSI became an important platform for collecting information about up-to-date technology and markets as well as a training post for Korean engineers. Samsung was also able to recruit several Korean DRAM experts educated in the US who would play an important role in helping Samsung to develop and commercialize DRAMs.

The company adopted a dual strategy for development of the 256K DRAM generation, following extensive "reverse engineering" of Micron's design (Ernst 1994b: 81). Two teams, one in Silicon Valley and the other in Korea, simultaneously started the same work. In October 1984, the Korea-based team developed a 256K DRAM sample. In early 1985 the Silicon Valley team developed one, and this was the sample adopted for mass production (Ernst 1994b).[14]

The DRAM case provides one of the most important examples of Samsung's practice of creating new capability by quickly combining new knowledge and information from foreign sources with its accumulated current skill base. As it developed subsequent generations—1 M DRAM (July 1986), 4M DRAM (Feb. 1988), 16M DRAM (Sep. 1990)—Samsung mastered the necessary capabilities bringing it ever closer to the frontier of innovation. In the early 1990's it became the world's largest producer of DRAMs, and was one of the first companies to ship engineering samples of the 64M generation in 1995.

Foreign linkages have continued to be important. Samsung's development of the 64M and 256M generations was undertaken in close cooperation with NEC.

Samsung's progress in internalizing DRAM know-how improved its ability to develop integrated circuits for its consumer electronics, industrial, and telecommunications products. By the late 1980's, SST was able to produce sixty-one kinds of telecommunications ICs, for use in phone sets, computers, private automatic branch exchanges (PABXs), and facsimile machines. Similarly, SEC could produce a total of thirty-seven kinds of ICs for use in its VCRs (*SMM* Jan

[14] Samsung had considerable trouble in producing the 256K chip. It was not until April 1986 through trial and error that it managed to start mass production.

1987). As a result, it was freed from dependency on Japanese suppliers for these core components.

The mastery of integrated circuit technology meant not only the internalization of supply but also the development of new capabilities to be deployed in new and existing products. In 1988 SEC developed 2-micron bi-polar process, which combined with other breakthroughs leading to its development of VCR motor control ICs, which improved the quality of the picture and sound of its VCRs (*SMM* Mar 1989). Samsung developed voice synthesis ICs in 1989 for use in robots, automobiles, microwave ovens, refrigerators, washing machines and electronic toys.

However, the success in DRAM came at a price. The combination of long-term investment commitments and cyclical demand from downstream users meant that DRASM prices were unreliable. A sustained price drop in the mid-80's lead to huge losses, reducing the cash flow to other group affiliates.[15]

***The OEM Trap***

Because of the drain on resources inflicted by the integrated circuit operation during much of the 1980's, other divisions and affiliates had few strategic options except that of exploiting the company's previously-developed strength in production. Except for short-term investments generating immediate cash, most other investments were strictly controlled by the Chairman's Secretariat. Relatively little effort was spent on product development or strategic marketing, and Samsung's emphasis remained on the mass production of relatively low-end products. Another important characteristic of the group's operation in the 1980's was the internal production of core components. SED became one of the world's largest producers of CRTs. The strategy was extended to newer products such as VCRs and microwave ovens, for which Samsung produced most of its own magnetrons.

The development of product design capabilities was undermined by the company's major commitment to integrated circuits. Of course, SEC had a minor change capability that required

[15] In October 1984 the 64K DRAM was exported to the US and Europe. Samsung, however, seriously suffered from the huge loss because its price fell drastically from 3 US$ in 1984 to 20 cent in 1985. This continued until the end of the 1980s. Many Samsung affiliates suffered a tight cash flow because millions of dollars of group money was poured into its semiconductor business (Business Korea, Mar. 1992: 66).

an ability for doing 'reverse engineering', but was very weak in major change capability.[16] As a result, it continued to use foreign sources of technology even for its main export products,[17] which were seen mainly as a means of generating cash to support the IC project.

Nevertheless, Samsung slowly built an institutional infrastructure to increase its internal technological capability. Three directions were pursued. First, the company expanded Korea-based R&D centres involved in the assimilation and adaptation of acquired foreign technology and acknowledged that the original objective was to set up an integrated R&D organization. The Samsung Advanced Institute of Technology (SAIT) was created to inter-link several affiliates, but, at least initially, it was unable to transcend the demand for projects which were commercially exploitable in the short-term (Koh, 1992). Second, Samsung established foreign-based R&D centres which could provide it with new technologies, up-to-date information, and training for Korean R&D personnel. These were used mainly for integrated circuits and, starting in the late 1980s, for computer-related technologies.[18] The third form of effort was continued collaboration between SEC and its affiliated components suppliers.

The ability to use R&D to build new capabilities was constrained by accounting perspectives. Research projects were held to extremely short-term objectives, preventing the development of know-how beyond what was needed for simple adaptation to mass production requirements. Table 4 shows a typical example of how the company evaluated the impact of R&D on sales and profits, placing a strong emphasis on immediate sales growth.

[16] See Bloom (1992), Ernst (1994b) and Hobday (1995) for details of the Korean electronics' weakness on design and product development.

[17] Examples are: hi-fi VCRs over three years (1987), for which Toshiba sent SEC technical advisers (SEC 1989); two of the licensing agreements with Sanyo were: for microwave oven technology, over five years (December 1984), for which Sanyo sent technical experts to train SEC's employees (SEC 1989); In May 1985, SEC made a five year licensing agreement with Matsushita for magnetron production technology, for which Matsushita dispatched technical experts to SEC and SEC sent its technical personnel to Matsushita-Japan for training (SEC 1989: 371); in August 1983 Sony licensed Samsung to produce VHS-VCRs over five years.

[18] In 1988 SEC acquired the Micro Five Corporation of the US to complement technological capability in the computer sector, and set up Samsung Software America (SSA) in Boston. The objective was to acquire advanced software technologies but also to establish a US marketing base for computer exports. In October 1989 SEC established Samsung Information Systems America Inc. (SISA) in San Jose, California, to support export activities and gather further technology for information and telecommunications products (Koh 1992).

***Table 4***
***Samsung Electronics Corporation***
***Measures of R&D Expenditure And Its Effect (1980-1983) (million Won)***

| | 1980 | 1981 | 1982 | 1983 |
|---|---|---|---|---|
| R&D expenditure (A) | 768 | 1,323 | \2,092 | 2,417 |
| Attributed sales increase | 2,099 | 36,137 | 22,028 | 133,406 |
| Profit (B) | 277 | 691 | 2,116 | 28,976 |
| Net Profit (A-B) | - 491 | - 632 | 24 | 26,559 |
| Net profit (Accumulated) | - 491 | - 1,123 | 1,099 | 25,460 |

Source: SEC (1989: 284)

Another victim of Samsung's concentration on integrated circuits may have been its international marketing capabilities, which remained weak. Samsung started distribution of its own-brand products, making minor changes from models it had built from designs provided by the US and Japanese customers, but success was limited. SEC gradually established a network of foreign sales affiliates. It would typically set up a foreign branch office, and then the office turned into a sales subsidiary when it had accumulated a certain degree of foreign market knowledge. However, the hierarchically integrated organization structure restricted the interaction of its own foreign sales channels with Korea-based production sites, limiting feedback from customers to factories. Accordingly, OEM channels remained dominant in the company's sales (Table 5).

***Table 5***
***Samsung Electronics Corporation Exports***
***(US$million***

| | 1984 | 1985 | 1986 | 1987 | 1988 |
|---|---|---|---|---|---|
| OEM export (A) | 443 | 483 | 813 | 1,130 | 1,205 |
| Total export (B) | 669 | 743 | 1,146 | 1,727 | 1,840 |
| OEM ratio (A/B) | 66.2% | 65% | 70.9% | 65.4% | 65.5% |

Source: SEC (1989: 1037)

Samsung maintained close relationships with OEM buyers such as JC Penny, Sears Roebuck, GTE, Toshiba, IBM, Hewlett-Packard, RCA, and Crown Corporation. However, its clients were generally not providing Samsung with leading-edge product design, and Samsung did little to upgrade its internal capabilities in this area, confining itself to low-end market segments.

In the early 1980s, the U.S. market was by far the most important for Samsung, but by the end of the decade it had greatly increased the geographic diversity of its distribution channels, particularly in Europe and Southeast Asia (see Table 6).

***Table 6***
***Samsung Electronics Corporation Exports By Region (%)***

| | 1982 | 1984 | 1986 | 1988 |
|---|---|---|---|---|
| North America | 62.1 | 75.6 | 62.4 | 35.5 |
| Europe | 7.1 | 6.5 | 19.1 | 26.0 |
| South America | 9.3 | 6.0 | 7.3 | 8.0 |
| Southeast Asia | 8.2 | 6.9 | 6.2 | 20.0 |
| Oceania | 2.2 | 1.6 | 1.6 | 1.5 |
| Middle East/ Africa | 11.1 | 3.4 | 3.4 | 8.6 |

Source: SEC (1989: 1036)

In the early 1980s, CTVs imported from Japan, Korea and Taiwan became a controversial trade issue in the US and Europe (Bellance 1987), and Korean firms faced anti-dumping duties on their CTV exports.[19] SEC had no alternatives but to protect existing export markets mostly in the US and EC.

[19] The dumping rate was preliminarily charged on three leading electronics firms: 3.87% (Goldstar), 3.05% (Samsung) and 1.77% (Daewoo). Their export growth in three consecutive years from 1983 to 1985 remained without significant change.

In order to protect its access to the U.S. market (Jun, 1987), SEC set up an affiliate producing CTVs in the United States in 1984 (two years after its domestic rival, Goldstar, had made a similar move[20]), transferring production capability accumulated at home.

The experience proved unsuccessful and the firm started to divest from the United States in 1989 and shift to Mexico as part of a low-cost strategy. There were two main reasons for the retreat: the U.S. production organization failed both to develop high-end products for the American market and to link with local components suppliers, continuing to rely on components from its Korean factories.

In general, the U.S. affiliate failed to upgrade overall capabilities in strategic marketing. There was no effective interaction between the marketing and production departments. This case is totally different from that of its Japanese rivals who had superior technological capabilities; they succeeded in providing high-end products and linked well with local component suppliers.[21] In short, SEC's failure was due to the fact that SEC was forced by trade issues to set up an international production platform in the US without the prior accumulation of capabilities in product design and development.

**Samsung in the 1990s: Challenge and Response**

The 1990's have presented Samsung with a number of challenges requiring adaptive strategies. The key strategic shift is from 'quantitative' to 'qualitative growth'. This has been manifested in a series of organizational reforms and in new approaches to technology management. Another major thrust of recent years has been an increasingly aggressive globalization of production.

***Declining competitive advantage leads to organizational restructuring***

In recent years, Samsung has had to cope with a very changed environment from the world it faced twenty years earlier as it entered the electronics business. On the one hand, its investments in semiconductors paid off handsomely. But on the other hand, its traditional cash-generating product lines—in which it has sunk considerable investments—began to face serious

[20] In 1982 Samsung had implemented a pilot project in Portugal where it established its first overseas production joint venture in cooperation with Portuguese and British partners, in order to gain international production experience (SEC 1989).
[21] See Kinugasa (1982) for the case of the Matsushita's international production strategy in the US.

challenges in both foreign and domestic markets. In 1993 Samsung Chairman Lee Kun-Hee described the electronics business as suffering from cancer.

One aspect of this decline is a series of changes that have occurred in the markets Samsung serves. First, Samsung's major export markets for consumer electronics in the US and Europe have become saturated. The reduced growth in demand has severely increased price competition, and has increased the importance of smaller markets with specialized demand—turning Samsung's marketing weakness into a major problem (Ernst and O'Connor 1992). Second, Korea's domestic electronics market, which had long been protected from foreign competition, has been liberalized as Korea prepares to join the ranks of industrialized nations, eroding an important source of profits.

Liberalization of imports by the Korean government has led global players to enter the Korean domestic market, which had long been protected from foreign electronics products. In 1989, import quotas on consumer electronics goods were removed. From July 1991, foreign retail distribution outlets were allowed to possess up to ten stores with less than 1,000 sq. ft. in size (Jun 1992)- far bigger than the 100-130 sq. ft. that local Korean outlets usually occupied (*SEMM* Apr 1991). By 1993 there was a plan to cut the average tariff rate to below 10% for all imported electronics goods (Bloom 1992).

Samsung conducted an internal analysis of Taiwan's market liberalization (*SEMM* Apr 1991). It found that Taiwanese producers lost huge market shares when faced with competition from Japanese brand products. The market share of Japanese goods between 1986 and 1990 rose from 18.5% to 77.5% for CTVs; from 43.3% to 86% VCRs; from 35.5% to 62.2% for refrigerators; from 48.7% to 72.1% for washing machines); and from 21.6% to 40.7% for air-conditioners.

In 1991, imported electronics goods accounted for 5% of the Korean market, but that figure was expected to increase to 15% (*SEMM* Apr 1991). This was a threat to Korean electronics firms, considering that Samsung, Goldstar and Daewoo were fighting to increase their market share by 1 or 2 % per year. During the early 90's, virtually every major producer has developed and begun to implement plans for penetrating the Korean market.

Meanwhile, international economic forces had further eroded Samsung's competitiveness. Generalized system of preferences (GSP) privileges were withdrawn from Korean electronics goods by the U.S. and the E.C. in 1988 (EIAK 1989: 255). At the same time, the Won had

appreciated about 20% against the dollar, making exports from Korea less attractive in their major markets.

Such demand-side developments are particularly troublesome to a firm like Samsung which followed a "market-pull" approach rather than the "technology-push" strategy of product innovators like Japan's Sony (Yu Seongjae, 1989). Samsung's low-end products were increasingly squeezed out of the market by more sophisticated goods which were nonetheless price-competitive. Furthermore, the speed of technological obsolescence has accelerated, with shorter product cycles making it more difficult for a mass-production-oriented firm like SEC to amortize its production set-ups.

A shift of resources from OEM to own-brand production made matters worse because, unbacked by adequate product development capabilities, it was doomed to failure. In the 1990's, the share of Samsung's sales attributable to own-brand merchandise has actually risen to about 60%, but this is due in large part to an absolute decrease in OEM business.

Samsung's leadership responded with two sets of initiatives. One change is increased internationalization, which will be considered in a separate section. The other initiatives involved organizational reform designed to overcome the lack of coordination and cooperation between different organizations within and across group member firms (Samsung, 1993; Jun and Han, 1994). Particular attention has been paid to the essential realm of technology management.

Starting in the early 1990s, SEC undertook a gradual organizational integration to increase coordination between production, marketing and research both within and across product lines. In 1991, Samsung set up a strategic management section in SEC, which was in charge of planning, internationalization and strategic technology management (*SEMM,* Aug 1991). In December 1992, SEC's multiple product sectors were fully integrated under a single CEO, Kim Kwang Ho, previously head of semiconductor operations (*SMM* Dec 1992)[22]. In January 1993, SEC restructured further by merging the audio and video business divisions (*SEMM* Jan 1993). In mid-1993 Samsung started to initiate more radical reform than it had done

[22] The head of the consumer electronics sector was transferred to SEM, while the head of the telecommunications sector was transferred to the Samsung Advanced Institute of Technology.

before.[23] In October 1994, Kim Kwang Ho was appointed as head of all electronics affiliates, including SEC, SED, SEM and SC.

One of the key reasons for this consolidation was to improve the dissemination of knowledge throughout the group. An integrated technology management division was established in 1993 (*SEMM*, Jan 1993).

During the 1990s, internal improvement in DRAM technology has generated technological spill-over effects, so a number of core components were being developed and produced due to the advanced production capability.[24] Samsung says that the semiconductor sector created technological synergy for use among all of its related businesses. For instance, the development of DRAM process technology caused the level of Samsung's overall precision process technology to improve significantly (SST 1987).

Yet, till the early 1990s, SEC had done little to upgrade its capabilities in product design and development. This lapse became particularly dangerous as competition increased in its non-component product markets. Furthermore, product design capability was an important complement to the internationalization of production; as low-value-added goods were increasingly produced offshore, new and better products were needed to avoid the hollowing out of production in Korea.

As competitive conditions changed in the electronics market, foreign licensing of important technologies and designs became more difficult. Samsung, flush from the achievement of profitability in its semiconductor business, began to acquire new capabilities through the outright acquisition of, or direct investment in, foreign firms.[25]

Table 7 shows that the acquisitions and strategic investments dating from the time when Samsung's boldest organizational reforms were being implemented covered a broad range of technology such as telecommunications, computers and semiconductors.

---

[23] The reform was initiated by Lee Kun Hee, who was called the Samsung group's chief visionary officer, and by Kim Kwang Ho who set the strategic goals. (*Business Times*, 19 Feb 1994). The three main strategic goals were quality-first management, globalisation and multifaceted integration.

[24] Ernst and O'Connor (1992) state that DRAMs are the best technology driver among alternative IC types. For other spillover examples, see SST (1987).

[25] Samsung continued to engage in strategic alliances, particularly in the IC field, where it could now exchange its advanced production capabilities for complementary technology.

***Table 7***
***Samsung Electronics Corporation***
***Two Years of Investments (Apr.'93 to Feb.'95)***

| Name of firm | Date | Scope and content |
|---|---|---|
| Array Microsystems (US) | Apr. 1993 | SEC acquired 20% of Array and established cooperative arrangement in digital process chip technology used in multimedia products. |
| Harris Microwave Semiconductor (US) | May 1993 | HMS specializes in gallium arsenide chips and is one of the world's leading makers of optical semiconductors. |
| LUX (Japan) | May 1994 | Acquisition (51%) of Japanese hi-fi audio maker:<br>- LUX: development and sales<br>- SEC: manufacturing and sales |
| Control Automation Inc. (US) | Jun. 1994 | Acquisition (51%) of the CAD/CAM software technology company. |
| ENTEL (Chile) | Sep. 1994 | Investment (15.1%) in the largest operator of telecommunications systems. |
| Integrated Telecom Technology (US) | Dec. 1994 | Acquisition (100%) of ITT that specialized in ATM technology. |
| Integral Peripherals (US) | Jan. 1995 | Investment (4%) in shares of US based firm specializing in HDD technology; joint development of HDD products. |
| AST Research (US) | Feb. 1995 | Investment (40.25%) in shares of US based computer company; broad range of commercial relationships including supply and pricing of critical components, joint product development, cross OEM-arrangements and cross-licensing of patent. |

Source: SEC 1995b

In addition to improving its competitiveness in consumer electronics, the investments reported in Table 7 make clear Samsung's desire to diversify further into the information technology sector. Samsung reports that in 1994 the structure of its sales was consumer electronics (38%), semiconductors (40%), and information systems (22%) (SEC 1995b). However, the share of information systems would be more or less 15% if a large proportion of components such as CRTs and computer monitors were excluded from it. Samsung's computer business had experienced only low growth despite a series of investments and alliances struck in the 1980's with leading US firms such as Hewlett-Packard, Micro-Five Corp., IBM, and Control Data. SEC's system design capability has lagged behind that of its Taiwanese rivals, and SEC's

OEM ratio for computer products was much higher than that of Taiwanese firms.[26] Its position in computer systems outside of Korea was particularly weak.

The recent major investment in AST Research provides Samsung an alternative means of overcoming its internal weakness in the computer business.[27] The agreement enables Samsung to share the AST brand name and to sell memory chips to the AST. SEC is actually not entitled to be directly engaged in the AST's management for the first four years of acquisition (Junja Shinmun, 9 March 1995).

However, Samsung's acquisition of foreign firms (except perhaps Lux and Control Automation Inc.) was not aimed at ameliorating Samsung's internal weakness in product design and development, but at acquiring frontier technologies seen as essential to the production of next generation products.

***Internationalization of Production***

Although Samsung's organizational strategy for the 90's revolves around consolidation, the strategy for its physical production facilities involves increasing movement offshore (Samsung 1993: 145).

Samsung's earliest overseas production efforts were a Portuguese joint venture operation started in 1982, a US subsidiary established in 1984, and a subsidiary set up in Mexico in 1988. They had competence in the production of CTV sets and many core components. By the end of 1988 it also had twelve sales subsidiaries outside Korea.

Following unsatisfactory results with U.S. production, Samsung focused more intensely on establishing low-cost manufacturing plants in Mexico, peripheral Europe, and Southeast Asia. Several factors stimulated this move. We have already discussed above the various factors eroding Samsung's competitiveness, including market saturation, loss of preferential tariff status and appreciation of the Won. But an important motivation may have come from the strategies of its rivals.

---

[26] In 1989, SEC's OEM ratio of computer products was as high as 80%, while in 1992, 50% of SEC's total revenues generated by computers and monitors came from OEM deals, with firms like IBM, Hewlett Parkard and Packard Bell. Taiwanese PC producers' OEM ratio between 1987 and 1991 varied between 41% and 47% (Ernst 1994b: 69-70).

[27] However, the deal was only achieved because AST was in dire financial straits, leaving some doubt as to the quality of the assets Samsung obtained for its $300 million.

Moves by Japanese and other Korean electronics firms seem to have induced Samsung to adopt a 'follow-the leader' strategy.[28] In the mid-1980s, Japanese companies such as Matsushita, Toshiba, Sony, and Sanyo started to move into Southeast Asia to establish production subsidiaries. For instance, Matsushita's foreign investment projects in Southeast Asia and China numbered five in 1987, four in 1988, three in 1990, four in 1991, three in 1992 and eight in 1993 (Itoh and Shibata 1994).

The consumer electronics goods produced by Japanese overseas affiliates started to penetrate into the low-end global market where Korean firms had predominated (although not under their own names) until the late 1980s. Here was a strong challenge for Samsung. The Japanese brand products made in the ASEAN region were cheaper than the products made in Korea. In the case of microwave ovens, the cost of the Sanyo product, manufactured in Southeast Asia for the OEM market, was 13% cheaper than that made in Korea.

The same is true for the components. Matsushita started to produce CRTs and tuners in Southeast Asia, and expanded into China (*Nihon Keizai Shimbun* 21 Apr 1992). Sony built a color CRT plant in Singapore (*Nihon Keizai Shimbun* 27 Nov 1989). Toshiba, Matsushita, and Hitachi also established CRT production in the US. Similarly, Asahi Glass and Nippon Electric Glass (NEG) set up overseas operations.

Strategies based on international production were also adopted by Samsung's Korean rivals. In 1988, Goldstar signed a contract with the Chinese government to acquire 165,000 sq. m. of land in the Zhuhai Economic Zone for the construction of a manufacturing plant to produce CTV sets and audio equipment to be sold on the Chinese market (*Nikkei News Bulletin* 20 May 1988). Around the same time, Goldstar moved into Thailand with Samsung right behind.

Finally, it should not be overlooked that Samsung's recent thrust into offshore production was enabled by its successful accumulation of technological capabilities which could now be transferred. Nearly all of Samsung's foreign affiliates are engaged in the production of standardized products, utilizing mass production capability transferred from Korea. It has been able to build on its initial forays into foreign production. Recently SEC transferred Park Byung Moon, who had been a head of an Indonesian affiliate for a couple of years, to India, where it is setting up a new CTV plant.

[28] The concept is developed in Knickerbocker (1973). For FDI of Korean electronics firms, see Jun and Simon (1992).

Samsung's centralized structure has limited the transfer of technological capabilities to overseas affiliates, even as they face new competitive requirements. Samsung's affiliates have been forced to interact with a growing variety of economic actors, including those within the group. Hence, each organization in the network requires a greater autonomy to avoid bureaucratic paralysis in the network as a whole. In early 1995, shortly after a wave of administrative consolidation had swept over its Korea-based operations, Samsung extended the concept to its offshore production networks by designating five regional headquarters around the world.[29] Of the five, two were in Asia. Their locations—Singapore and Beijing—reflected the relative separateness of the two offshore production networks that had been created by Samsung in the region.

SEC's in-house R&D operations have also continued to be centralized. The hierarchical integration has failed to provide researchers and engineers with satisfactory R&D circumstances. According to company surveys (reported in Koh, 1992: 36), Samsung engineers complained most about: an unsatisfactory R&D working environment (54%); being overloaded with projects (30%); insufficient time for the feasibility study of future projects (27%); and being overwhelmed with documentation and paperwork requirements (26%).

Many of the organizational problems that hindered the development of effective product innovation in the past continue to plague SEC. Koh (1992) reported that production departments are seldom involved in the early stages of new projects, that projects were chosen by the corporation on the basis of their expected short-term impact on individual strategic business units, projects reflecting a longer-term outlook were likely to be suppressed by marketers or by the SBUs themselves, and that communication was poor among marketing and engineering departments and the company's R&D center (pp.36-7).

Perhaps to decentralize some of its innovator activities away from this inauspicious environment, SEC went overseas, establishing foreign design centres in order to upgrade its product development capability. The centers have been established in each of Samsung's main

[29] America regional headquarters (HQ), consisting of five sales affiliates, two production affiliates and four branch offices; Europe regional HQ, with eight regional sales affiliates, five production affiliates and five branch offices; China regional HQ, which has two sales affiliates, four production affiliates and four branch offices; Southeast Asia regional HQ, with two sales affiliates, four production affiliates and eight branch offices; and Japan regional HQ, consisting of one sales affiliate and one branch office (SEC 1995b).

market regions to help develop products better suited to local needs, following a pattern already well-established by its Japanese rivals.[30]

The first such center was established in the consumer electronics bastion of Osaka in 1991 with five employees for audio and video products. The following year, a center was set up in Frankfurt, Germany, for the development of products to be distributed in Europe. In 1994 SEC set up Samsung Design America in the US for consumer electronic products for the US market in cooperation with a local design corporation, IDEO (US). In early 1995, SEC established a product planning post in Southeast Asia for the development of regionally marketable product models. Its activity has currently been limited to collection of market information with only three Korean personnel.

Table 8 shows evidence suggesting that Samsung's regional focus began to pay off rapidly in its European market.

***Table 8***
***Local market share of Samsung brand products***

| Product | Country | 1991-1992 | 1993 |
|---|---|---|---|
| Microwave ovens | Spain | 4.5% | 11.1% |
| Microwave ovens | Netherlands | 16.0% | 24.2% |
| Facsimile machines | UK | 15.0% | 21.0% |
| VCRs | Spain | 10.7% | 16.6% |
| Cordless phones | Sweden | 20.0% | 23.0% |

Source: The author's interviews with SEC in Korea during Nov. 1994

SEC's market development activities were confined to the US and Europe. It is not surprising that recognition of the Samsung brand name in Asia is relatively weak.

[30] See Tsuda and Shinada (1995) and Baba and Hatashima (1995) for the recent trend of product development activities by Japanese electronics firms in East Asia.

**Samsung's Production Networks in Asia**

***Overview***

Asia has been an important destination for Samsung's direct investment for a number of reasons. In addition to the company's interest in recovering cost competitiveness by utilizing the low-cost resources available in Southeast Asia, it was also pursuing some of the major customers for its components as well as some of the world's most dynamic markets.

Table 9 shows how Samsung's network in Asia spread rapidly since 1989, when it opened a TV assembly plant in Thailand for low-end products. Samsung's production in Asia ranges from end-products to components, and has spread from ASEAN to China, Vietnam and India. Currently, the regional network has two central nodes located in Singapore and Beijing.

A Singapore-based purchasing office was established in 1991 to speed up the internationalization of production, in part by being a supplier of low-cost parts for Korea-based production sites. Ironically, the purchasing office has directly bought components from Korea-based components suppliers because it is cheaper than going through SEC headquarters in Korea. The office has grown dramatically since its creation and was eventually able to satisfy Singapore's requirements for the preferential tax treatment granted to regional headquarters.

***Table 9***
***Evolution of Samsung's International Production Networks in Asia***

| | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|---|---|---|---|---|---|---|---|
| Thailand | CTV | | | | VCR tuner, FBT, DY (SEM) | | W/M sales |
| Indonesia | | REF | VCR, Audio | | | | CTV, sales |
| Malaysia | | | MWO CRT (SED) | | CRT glass (SC) | | monitors |
| Singapore | | | IPO | | | | RHQ |
| China | | | | Audio products Audio components, keyboards (SEM) VCR transformers (SC) | VCR, VCR components | tuners, VCR heads, motors (SEM) | CTV |
| Vietnam | | | | | | | CTV |
| India | | | | | | | CTV |

Note: REF= refrigerators, W/M= washing machines, FBT= flyback transformers, DY= deflection yokes, CRT= cathode ray tubes, CPT= color picture tubes, MWO= microwave ovens, IPO= international procurement office, RHQ= regional headquarters

All affiliates established by SEC except as indicated.

Source: The author's interview and Samsung internal publications (various years)

The vertically integrated operations in China were set up more quickly than those in Southeast Asia, possibly reflecting the firm's increased confidence in overseas production. Since 1994, Samsung has announced the creation of other integrated production complexes in its strategic markets.[31]

[31] Two examples in Mexico and the UK are: (1) Tijuana integrated electronics complex is building factories in a land area of 600,000 sq. m. This complex is scheduled to be completed in 1996. It will contain a number of production subsidiaries belonging to SEC, SEM, SED, SC and Samsung Aerospace; (2) Wynyard industrial complex in the UK, where Samsung plans to invest $US 720 million, is building factories. The complex will cover an area of 750,000 sq. m. It plans to start producing microwave ovens, personal computers, monitors, fax machines, color CRTs, wireless phones, and DRAMs (SMM Nov 1994).

To date, interaction between Samsung's two Asian sub-networks has been mostly limited to CRTs sent from Malaysia to a China CTV affiliate and Chinese-made VCR components sent to a Thai affiliate. This is because two sub-networks were originally designed to serve two largely separate Asian markets. The key intermediary is the Singapore-based purchasing office, which purchases and distributes a huge amount of components among the Samsung affiliates and those of their Japanese counterparts in the regions.[32] However, the most important intra-firm transactions are still highly centralized, occurring between the affiliates and the Korea-based product division, or between the affiliates and the Korea-based global marketing division (in charge of export arrangements).

The separateness of the two sub-networks may prove a competitive disadvantage. Japanese producers in the region usually divide their product mix geographically according to the subsidiary's technological capability, facilitating the achievement of scale economies. By comparison, Samsung's production networks in Asia are still at a primitive stage, incorporating certain redundancies.

The weakness of Samsung's performance in the consumer goods sector meant that it found itself with excess capacity in its overseas plants. In practice, this has meant that the offshore plants are underutilized—in spite of their vocation to improve cost-competitiveness—because Samsung's employee evaluation system is oriented to performance at the plant level, making employees resistant to transferring production overseas when no activity would fill the void at the Korean plant.

This has been much less of a concern in the case of plants producing components, which have been able to sell the majority of their output to other firms operating in the region, particularly Japanese affiliates. Samsung's Asian networks have thus been able to build on the company's past history of OEM relationships with Japanese companies. For example, two component-producing subsidiaries - SEM-Thailand and SED-Malaysia - supply more than 80% of their output to Japanese companies.

In fact, Samsung's Asian television production network has been deeply enmeshed virtually from its inception with those established earlier by Japanese firms. For example, not only does the CRT producer SED-Malaysia sell the bulk of its output to nearby Japanese

[32] The purchasing office has been extended to form a link not only between two sub-networks and the Korea-based non-affiliated component suppliers, but also between the Korea-based production sites and a number of non-affiliated economic actors in the region.

affiliates of Sanyo, Matsushita, Sharp, and Funai, it also sources about a third of its total components from mostly Japanese suppliers such as NEG and Asahi.[33] Clearly, the establishment of offshore production has led to complex interdependence between Samsung and its Japanese competitors.

It was the presence of its Japanese customers that permitted Samsung to reduce the risk inherent in starting capital-intensive production overseas. For example, having already become a successful supplier of CRTs to Japanese CTV producers, SED could be reasonably certain that its Malaysian affiliate could meet demanding Japanese quality assurance requirements (SEM 1990: 238). SED-Malaysia fills a specific role in the regional division of labor of Japanese firms; by providing 14-inch CRTs, it permits the component subsidiaries of Japanese producers to specialize in larger, more higher-value added picture tubes.

Samsung's production presence in Asia is increasingly connected to marketing objectives. To that end, the firm has established ties with mainland and overseas Chinese partners, typically as a pre-requisite for market entry, in addition to establishing its own distribution channels. Its local joint ventures are thus the mirror of those it established in Korea in the 1970s with Japanese partners, trading production know-how for market access—only now the know-how is Samsung's.

In at least one case, an affiliate established for the local market (in Indonesia) was forced by poor performance to shift to exports. But more generally sales were able to shift from export to local markets.

So far these locally-oriented operations have achieved local and even regional linkage between production and marketing activities, but design and product development activities still belong to organizations in Korea: "... we continue to move Korea-based manufacturing sites overseas. Instead, leave the concept of design, development, research institutes at home" (Samsung 1993: 145). But this has left a void at affiliates for which the local market is important. For instance, the Indonesian affiliate distributing CTVs to the local market is searching for locally marketable products that differ from the products designed in Korea for global markets.

[33] Source: The author's interviews with Samsung Asian affiliates during July 1995. These relationships suggest that the "opening" of Japanese production networks in Asia since the early 1990s is due at least partly to the emergence of Korean component suppliers in Southeast Asia rather than to the use of locally-based suppliers. For discussion about Japanese electronics firms' international production networks in Asia, see Ernst (1994c).

In early 1995 SEC formed a new product planning post at its Singapore-based regional headquarters. The team was to concentrate on supporting product design and development activities targeted to the Asian regional market. Yet, there is no sign that this team has actively interacted with the group affiliates (or with non-affiliated organizations). Yet SEC is under pressure to carry out product design closer to individual markets as Japanese and European rivals have increasingly done, frequently co-locating product design with offshore production. Recently, a new executive officer that had worked for the department in charge of product development has been assigned to the Indonesian refrigerator affiliate, signaling a possible decentralization of product development within the region.

The component-producing affiliates are also experiencing product design difficulties. They currently lack the capability to implement minor changes requested by non-affiliated customers in the region, and are forced to forward all requests back to Korea. Samsung is thus unable to compete effectively with numerous other rivals which have already decentralized such capabilities. Thus one of Samsung's continuing challenges is to make the leap from mass to flexible production.

But even as they try to exploit local markets, Samsung's Asian affiliates are part of a global production network, supplying a considerable number of components to Samsung affiliates in Europe and America. Examples include: SEM-Thailand which has supplied parts to SEC in Europe, Brazil and Korea; SED has exported 14-inch CRTs to Mexico; SEC-Indonesia has assembled PCBs for a Portugal based VCR plant; and SED-Malaysia has been supplying electron-guns for CRTs to SED-Germany, and SED-Mexico.

Much as its Japanese partners did in the 1970s, Samsung has trained the employees in its Asian affiliates, often by sending them to Korea, or by sending Korean trainers to the affiliate. The Korea-based plants play a central role in Samsung's regional technology network. This differs from the practice of Samsung's Japanese rivals in the region, whose training sites are increasingly offshore.

In 1990 forty technicians from the recently-established refrigerator plant in Indonesia were sent to a Korean factory for three months. One-third of the workers at Samsung's microwave oven plant in Malaysia were also trained in Korea, and Korean technical instructors also trained local workers (*SEMM* Jan 1993). A major glass bulb factory in Malaysia sent local technicians to Korea for training both before and after operations started (SC 1994:315). The

heads of production lines at a components plant in Thailand received more than three months training in Korea, and fifteen Korean technical instructors were dispatched to train local employees (*SMM* Sep 1989).

Little is known about the level of local linkages of Samsung's affiliates. One Indonesian affiliate reported local content ratios of 15% for audio components and only 5% for VCRs in 1992, its first year of production. At the Thailand CTV affiliate, the initial level of local content was about 10%. Within several years, the ratio of components sourced from local and nearby regional suppliers had risen above 50%. It was also reported that three Korean components suppliers moved to Malaysia to supply Samsung's microwave oven plant, showing that local content does not necessarily mean linkages to locally-owned firms. The Malaysian CRT plant is also anticipating the arrival of Korean suppliers. Dongguan Samsung Electro-Mechanics, a producer of audio components and computer keyboards in China, procures 80% of its materials from Korea versus 19% in China.

***Southeast Asia***

Samsung's operations in Southeast Asia started out somewhat tentatively, primarily focusing on assembling final goods for exports. As the company developed its capabilities to set up offshore production, it added output in core components requiring a larger initial commitment of resources. The experience of its network creation in Southeast Asia undoubtedly simplified the subsequent creation of other intra-group networks in China and in Europe.

Thailand was the starting point for Samsung's entry into Southeast Asia. In 1987 SEC set up a branch office in Bangkok. In 1988 it established a joint venture company—Thai Samsung Electronics—with Saha Pathana Interholding, one of the three biggest business groups in Thailand (*SMM* Mar 1989). SEC had a 51% share, and Saha Pathana 49%. SEC provided the management, technology, machinery and brand name, whereas Saha Pathana provided the land and local manpower, as well as knowledge of the local market. TSE started producing CTVs in 1989, with production rising steadily 500,000 per year in 1994 (SEMM, June 1994). VCRs were added in 1993, and washing machines two years later. TSE intended to distribute half of its output to the local market, and the rest to the US and the EC through SEC's marketing channels (SEC 1989: 626). The goal of 50% local sales had not quite been achieved by 1994, but the level has gradually increased.

Soon after setting up production in Thailand, Samsung established a 50:50 joint venture in Indonesia for refrigerator production with Maspion, a local distributor of consumer electronics products. Once again Samsung provided equipment, know-how, and a brand name, while Maspion provided a plant, labor and land (*SMM* Mar 1989). Originally the project was designed with the expectation that local market would absorb much of the output. Despite a capacity of 60,000 units per year, production reached only 11,000 units in the first year, 1990, and 20,000 in 1991. In 1992, the affiliate, Samsung Maspion Indonesia, changed its strategy and targeted regional and global markets, supported by its own overseas sales network. This strategy was successful and the affiliate has made a profit since July 1992.

In 1991, the pace of investment picked up. A second affiliate in Indonesia was established to produce VCRs and CD players for export.[34] Samsung controls 80% of PT Samsung Metrodata Electronics. The minority partner is Metrodata Indonesia, which had previously been the sole distributor of Samsung products such as monitors and office equipment. Production started in August 1992. The audio output was exported mostly to Europe and elsewhere in Asia. Video products were exported worldwide, but in Europe a previously-established VCR affiliate in Spain foreclosed much of that market. Most of the production was sold under the Samsung brand name, but it also undertook OEM sales with GE, Akai and other companies. In early 1995 the affiliate started to manufacture CTVs for the local market.

1991 was also the year that Samsung began production in Malaysia. One investment was an export-oriented plant producing microwave ovens, Samsung Electronics Malaysia, a wholly-owned subsidiary. All its products are exported to the US, Australia and Europe through Samsung's international marketing subsidiaries. Very recently, the affiliate was busy preparing to produce microwave ovens to be sold for the local market.

Also established was Malaysia Samsung Electron Devices, its first backward integration in the region, and its first offshore production of CRTs anywhere in the world. By 1989, SED was exporting more than 60% of its CRT production, mostly to Japan, Southeast Asia, Hong Kong and China (SED 1990: 490). SED Malaysia, a wholly-owned subsidiary, was set up

with an annual capacity of 1.7 million units, which has since been doubled, along with increases in the plant's automation level. Given the strong level of demand in the region, it's not surprising that the operation achieved profitability after only six months of operation. Less than

[34] Samsung had previously opened offshore VCR factories in the UK (1987) and Spain (1989).

20% of its output went to Samsung's Thai television affiliate, with the rest being sold to nearby affiliates of Sanyo, Funai, PTI, Thomson and other companies.[35] By this time, clearly, Samsung had mastered the organizational skills needed to move production offshore.

This success undoubtedly helped Samsung decide to undertake a second round of backward integration in the region (SC 1994: 565). In 1992, Samsung received approval from its US partner Corning Glass Works to establish a glass bulb plant in Malaysia near the CRT affiliate. Once again, this was Samsung's first offshore production for this product. Initially, it had sought to reduce the risk by setting up a joint venture with Asahi Glass, a major Japanese producer. But when Asahi decided not to go ahead with the project, SC proceeded on its own, investing $25 million (SC 1994). Starting in 1993, Samsung Corning (Malaysia) assembled panels and funnels imported from SC-Korea, with an annual capacity of 2.5 million units. SC-Malaysia has diversified its product lines from 14-inch glass bulbs to 20 and 21-inch glass bulbs. It also plans to increase its vertical integration by building a glass fusion plant (SC 1994:316). SC-Malaysia is also expected to produce bulbs for plants established by the other major Korean CRT producers, Orion and Goldstar, in Indonesia, China, and Vietnam[36] (SC 1994: 561). SC-Malaysia planned to expand its production capacity to 3.6 million units by 1995, investing an additional US$200 million (*SEMM* Aug 1992).

Another component operation was started in 1993, this one in Thailand. SEM-Thailand, a wholly-owned subsidiary of Samsung Electro-Mechanics was actually announced in late 1990, but didn't begin operations until 1993 because it had to be sure of market demand (Jun and Kang 1994). It produces a variety of components, such as deflection yokes and flyback transformers for CTVs, and oil condensers for microwave ovens, plus other parts for audio-visual equipment (*SMM* Sep 1989). Its production capacity in 1993 was 1.4 million tuners, 2.4 million DYs and 3.9 million FBTs (EIAK 1993). Only about 10% of its output went to Samsung's local CTV affiliate, with the rest being distributed to unaffiliated companies in the region, particularly Japanese manufacturers such as NEC, Toshiba, and Sharp, along with small supplies to Samsung's Malaysia-based microwave oven plant and its Indonesian affiliate, Samsung Metrodata.

---

[35] This is based on the interview undertaken in July 1995 and see also Jun Yongwook and Sungyoon Kang (1994).
[36] In January 1993 Orion Hanel Picture Tube Co Ltd was incorporated in Vietnam with a production capacity of 1 million color picture tubes and 600,000 units of black and white CRTs. Production was scheduled to begin in December 1995. Goldstar plans to set up a color CRT plant in China (ElAK 1994). Orion and Goldstar are also planning to build CRT plants in Indonesia.

Table 10 summarizes Samsung's investments in Southeast Asia.

***Table 10***
***Samsung's Affiliates in Southeast Asia by Country***

| COUNTRY | AFFILIATE NAME | PRODUCTS, ESTABLISHMENT DATE |
|---|---|---|
| Thailand | Thai Samsung Electronics | CTVs, VCRs and washing machines, 1988 |
| | SEM-Thailand | CTV and VCR components, 1990 |
| Indonesia | Samsung Maspion Indonesia | refrigerators, 1989 |
| | Samsung Metrodata Electronics | VCRs and audio products, 1991 |
| Malaysia | Samsung Electron Devices (Malaysia) | CRTs, 1991 |
| | Samsung Electronics Malaysia | microwave ovens, 1991 |
| | Samsung Corning (Malaysia) | CRT glass bulbs, 1992 |

***China***

Samsung's network in China is actually divided into two relatively separate pieces, one of which is located at Tianjin, and the other in Guangdong Province. A new electronics complex has recently been announced for the Singapore-sponsored Suzhou Township, located about half-way between Samsung's southern and northern China plants.

In the early 1990s, Samsung selected Tianjin, which is close to Korea, as a strategic FDI location. SEC rapidly set up integrated operations to build first VCRs then CTVs. Samsung Aerospace Industries joined in this location to produce cameras for the local Chinese market.

Tianjin Samsung Electronics (TSEC) was SEC's fourth offshore VCR plant, and its second in Asia. It was established in early 1993 as a 50:50 joint venture with a state-run electronics firm. A total of US$64 million was invested in the vertically-integrated project, which produces VCRs, VCR decks and VCR drums. In 1995 it produced 400,000 VCR sets. Half of its products are being sold locally, while the remainder have gone to Australia and the former Soviet Union.

Just prior to the VCR affiliate, Samsung Corning set up a plant to produce rotary transformers for VCRs, a product it had made in Korea since the late 1980s (SC 1994). In late

1992, after the approval of Samsung-Corning's US partner, SC-Tianjin started to produce rotary transformers with a capacity of 800,000 units, which was rapidly expanded in the following months. From 1993, it added more sophisticated products such as four-channel rotary transformers, in addition to the two-channel type (SC 1994). SC-Tianjin planned to expand to a capacity of 5 million units per year by 1995 (SC 1994:561).

In December 1993, SEM established Tianjin Samsung Electro-Mechanics, an 80:20 joint venture with one of the state-run electronics corporations, to manufacture a variety of components which could be used in the VCRs produced nearby and in the CTVs that were soon to be produced. The total investment required was US$60 million. Production started in May 1994 with the following capacities: 3.6 million TV and VCR tuners; 2.4 million VCR heads; 3.6 million precision motors; 600,000 computer spindle motors (*SEM* Jan 1994). This is of course much more than can be absorbed by Samsung's local affiliates.

In 1994, SEC formed Tianjin Tongguang Samsung Electronics, a 50:50 joint venture with the same partner as the VCR plant, to produce color TV sets. SEC invested US$30 million for a production capacity of 1 million sets. It is the largest of Samsung's overseas CTV plants, and recent annual output was 800,000 units, absorbing about one-third the tuner capacity of the nearby components plant.

Samsung Aerospace Industries appears to have made an unrelated opportunistic investment by setting up a 50:50 joint venture to produce cameras with a large local camera maker, Tianjin Camera. The total investment was a relatively small US$10 million. The target markets are China, Hong Kong, Thailand and Singapore. Its future expansion will be mostly dependent on the marketing efforts of the Chinese partner.

In southern China, Samsung established a smaller network for audio products. First came components, with Dongguan Samsung Electro-Mechanics, a wholly-owned subsidiary in Guangdong Province. It was technically the first offshore plant of Samsung's SEM branch, having been established in mid-1990, at the same time as several other Korean companies invested there, but production didn't begin until 1992. An expansion in 1994 raised production capacity: from 400,000 audio decks to 800,000; from 1.8 million audio speakers to 4 million; and from 100,000 computer keyboards to 300,000. Most of the output is shipped to Southeast Asia, China, America, and Korea (EIAK 1993).

Starting in late 1992, SEM's Dongguan affiliate began supplying audio components to Huizhou Samsung Electronics, another Guangdong affiliate. SEC owns 90% of the shares in this company, while its Chinese and Hong Kong partners hold 5% respectively. In November 1992, Huizhou SEC started production of audio products. Its capacity in 1994 was 540,000 units, and 15% of its production is sold on the local market.

Samsung is also involved in the Chinese telecommunications market. Samsung Sandong Telecommunications was set up in 1994 to assemble time division exchange (TDX) central office switches for local use, which had been developed by Samsung in cooperation with the Korean government. The joint venture with two local partners, one of which is a state-run telecommunications corporation in Sandong, represents an investment of US$20 million. It is currently producing 370,000 TDX switches.

In 1994, Samsung announced a $100 million dollar investment plan for Suzhou Township. The initial plants would be devoted to household appliances and the assembly of transistors and linear ICs for use in consumer electronics. Samsung Electro-Mechanics said that it would manufacture oil condensers and air conditioning motors there as well.

Table 11 summarizes Samsung's investments in China.

***Table 11***
***Samsung's Affiliates in China by Region***

| REGION | AFFILIATE NAME | PRODUCTS, ESTABLISHMENT DATE |
|---|---|---|
| Tianjin | Samsung Corning Tianjin | rotary transformers, 1992 |
| | Tianjin Samsung Electronics | VCRs, VCR decks and VCR drums, 1993 |
| | Tianjin Samsung Electro-Mechanics | VCR drum motors, tuners 1993 |
| | Samsung Aerospace Industries | cameras, 1994 |
| | Tianjin Tongguang Samsung Electronics | CTVs, 1995 |
| Guangdong | Dongguan Samsung ElectroMechanics | speakers, keyboards, etc., 1990 |
| | Huizhou Samsung Electronics | audio products, 1992 |
| Suzhou | Suzhou Samsung Electronics | refrigerators, microwave ovens, washing machines and air-conditioners, 1994 |

**Summary and Conclusion**

This case study of Samsung reveals a dynamic interaction between firm capabilities and international production networks. In the early stage, when Samsung was building capabilities, foreign linkages were needed for technology and marketing. As the group's capabilities grew, it ventured into international production. However, its capabilities in mass production were inadequate to ensure the success of its initial efforts to bypass trade barriers in its major markets by building offshore production bases there. It was only by following a re-orientation of its international production to low-cost operation in peripheral areas that it was able to correctly match its current capabilities with its network structure. Meanwhile, it has re-oriented the nature of its non-production linkages with foreign firms to help foster the development of the design and marketing capabilities it has lacked in the past, frequently through acquisition.

Internally, the Samsung Group's electronics activities have suffered from an almost complete de-linkage between production (in Asia), marketing (in the United States and EC), and

design and development (in Korea) over the two decades after the 1970s. This paper tends to confirm the argument by Kogut and Zander (1993: 635) that the key to successful international production is "... to recombine the knowledge acquired at home with the gradual accumulation of learning in the foreign market". Thus Samsung's affiliates in Southeast Asia were gradually able to increase the percentage of output sold in the local market, relying at first mostly on exports. Yet the continued centralization of product development has slowed the learning process in offshore affiliates.

Given the weakness of product development in the Korean electronics sector, it is possible that centralization is necessary during the period in which major innovation capabilities are acquired. But we have already seen that this leaves offshore production centers vulnerable as they try to penetrate local markets in competition with rivals who use minor change capability to tailor products for local customers.

The different technology management pattern established by Samsung's Japanese rivals seems to be relevant. The major Japanese consumer electronics firms have decentralized minor product change capabilities at many of their production affiliates in Southeast Asia, increasing the flexibility of their production networks and freeing up engineering resources in Japan for more valuable work.

Samsung's international production networks are also different from those of Taiwanese firms. While Samsung tends to focus on economies of scale, largely in consumer electronics products manufactured in a vertically integrated system, Taiwanese firms focus on economies of networking in the region that permit a large degree of flexibility to adapt to the rapidly changing information technology market. Thus, we can note in passing that this research supports the idea that international production systems have developed in divergent, rather than convergent ways.[37]

Korean industrial policies have been important for facilitating, and even inciting, the firms' international competitiveness by requiring foreign firms to transfer technology in exchange for market access, supporting exports, protecting the home market, and supporting research.

However, policy errors have also occurred. The first was near-sightedness in creating a top heavy industrial structure mimicking that of Japan but without that economy's underlying

[37] For similar conclusions, see Stopford (1994) and Ernst (1995).

dynamic of continuous upgrading of product design. The second involved the creation of a Korean innovation system with a relative weakness in basic research,[38] which may prove a major problem as Korea nears the technology frontier and can no longer license or buy all it needs from more advanced countries.

FDI has helped Korean firms maintain their competitiveness in low-end goods, but they have not completely succeeded in the transition to higher-value production back home that is required after a massive re-location of productive resources. They have partly responded by finding new, more complex products to mass-produce, such as advanced flat panel displays. But this merely postpones the transition to market-driven product development that will be necessary for continued competitiveness.

The recommendations of Ernst (1994b) that the Korean government should shift from "export-led market expansion" to "FDI-led market expansion", and that national innovation policies from "sectoral targeting" to "diffusion-oriented policies" appear sound. At the same time, the government must fundamentally change its traditional education system which is extremely uniform and no longer relevant under the new competitive requirements in order to build up the creative capability of human resources as suggested by Kim (1991).

The challenge for Samsung (and for other Korean electronics firms) in the context of its international production network is to successfully develop and transfer adaptive product design know-how to its offshore affiliates. Improvement of the competitive advantage of overseas affiliates is directly dependent on how quickly a firm can create and diffuse required capabilities which properly adapt to changing conditions. Deeper linkages within Samsung's organizational network both in Asia and around the world will be needed to face the next round of competition in the electronics sector.

[38] Several authors have identified a number of basic sectoral weaknesses of the national innovation and educational system in Korea (Kim Ilyong and Sangyong Chung March 1991; Kim Ilyong and Chiyong Kim; Kim Linsu 1991; Bloom 1992; Ernst and O'Connor 1992; Ernst 1994b). Particularly, Kim Linsu (1991) argues that "one of the major mistakes made by the Korean government in developing a national system of innovation has been its under-investment in higher educational institutions...., making all universities primarily undergraduate teaching-oriented rather than research-oriented... As a result, Korea has failed to develop a stock of highly trained scientists and engineers who will be necessary in the 1990s in order for Korea to sustain its international competitiveness."

## REFERENCES


Baba, Y and H, Hatashima, 1995, 'Capabilities Transfer of Japanese Electronics Firms to the Pacific Rim Nations: Towards Open Global Manufacturing?' In Eileen M. Doherty (ed.), *Japanese Investment in Asia: International Production Strategies in a Rapidly Changing World*, The Asia Foundation and BRIE, California.

Bellance, Robert H., 1987, *International Industry and Business: Structural Change, Industrial Policy and Industrial Strategies*, United Nations Industrial Development Organization: Allen & Unwin, London.

Bloom, Martin, 1992, *Technological Changes in the Korean Electronics Industry*, Development Centre Studies, OECD, Paris.

Cantwell, John, 1994, "Introduction: Transnational Corporations and Innovator Activities". In John Cantwell and John Dunning (ads) *Transnational Corporations and Innovator Activities,* Routledge, London and New York.

Cho, Dong Sung, 1983, *Hankuk-eui Jonghap-Muyeok Sang-sa (Korean General Trading Companies*), Seoul.

EIAK (Electronic Industry Association of Korea), 1989, *Junja Kong-up Samsip-nyun-sa* (The 30 Year History of Electronic Industry), Seoul.

----- , 1993, *Junja Sanup haewoi-tuja-upche directory* ( Directory of Foreign Investors of Electronics Industry), December, Seoul.

----- , 1994, *CPT Sanup Dong-hyang (*The Current Trend of CPT Industry), Seoul.

Ernst, Dieter, 1994a, 'Network Transactions, Market Structure and Technology Diffusion  Implications for South-South Cooperation,' In Lynn K. Mytelka (ed), *South-South Cooperation in a Global Perspective,* OECD, Paris.

Ernst, Dieter, 1994b*, What are the Limits to the Korean Model? The Korean Electronics Industry Under Pressure,* The Berkeley Roundtable on the International Economy (BRIE), University of California at Berkeley.

Ernst, Dieter, 1994c, 'Carriers of Regionalization: the East Asian Production Networks of Japanese Electronics Firms,' Working Paper No. 73, The Berkeley Roundtable on the International Economy (BRIE), University of California at Berkeley.

Ernst, Dieter, 1997, "Technology Management in the Korean Electronics Industry: A Paradigm Shift in the Korean Model", *Asia Pacific Journal of Management* (forthcoming)

Ernst, D., L. Mytelka and T. Ganiatsos, 1997b, "*Export Performance and Technological Capabilities - A Conceptual Framework",* chapter I in: Ernst, Ganiatsos and Mytelka (eds.), 1997

Ernst, D. and D. O'Connor, 1989, *Technology and Global Competition: The Challenge for Newly Industrialising Economies*. OECD, Paris.

----- , 1992*, Competing in the Electronics Industry. The Experience of Newly Industrialising Economies*, OECD, Paris.

Hobday, Mike, 1995, 'East Asian Latecomer Firms: Learning the Technology of Electronics' *World Development,* Vol. 23, No. 7.

Imai, Ken-ichi, 1992, 'Japanese corporate strategies towards international networking and product development', In Paul Sheard (ed.) *International Adjustment and the Japanese Firms*, Allen & Unwin & The Australia Japan Research Centre, ANU.

Itoh, M. and J. Shibata, 1994 'A study of the operations of Japanese firms in Asia: the electrical machinery industry', a conference paper presented to the Twenty-First Pacific Trade and Development (PAFTAD 21) in Hong Kong.

Jun, Yongwook, 1987, 'The reverse direct investment: the case of Korean consumer electronics Industry', *International Economic Journal*, 1(3), Autumn 1987.
Jun Yongwook, 1992, 'Strategic Responses of Korean Firms to Globalisation and Regionalism Forces: the Case of the Korean Electronics Industry, Global Business Seminar', paper prepared for the conference "The Impact of Globalisation and Regionalisation on Corporate Strategy and Structure Among Pacific Rim Firms", August 3-7, 1992 Sapporo, Japan.
----- , 1994, *'Global-sidae-eui Hankuk-junja-sanup-eui Kukje-hwa Bang-hyang* (The Direction to Internationalization of the Korean Electronics Industry for the Global Age)', *Junja-sanup Haewoi-tuja Jun-ryak forum*, April, Electronic Industry Association of Korea, Seoul.
Jun, Yongwook and D. F. Simon, 1992, 'The pattern of Korea's foreign direct investment: implications for the internationalization of China's economy,' In Ross Garnaut and Liu Guoguang (eds.), *Economic Reform and Internationalization: China and the Pacific Region,* Australian National University and Allen & Unwin.
Jun, Yongwook and Sung-yoon Kang, 1994, *Samsung-junja Bumun-eui Kuk-jae Network Jun-ryak: Dongnam-a Saeng-san Network Sare* (International Networking Strategy of Samsung Electronics: A Case of Production Networking in Southeast Asia), Chung Ang University, Seoul.
Jun, Yongwook and Jung-wha Han, 1994, *Cho-u-ryang Ki-up-euro Ka-nun-kil* (A Way toward a best firm: The Growth and Change of Samsung), Seoul.
Kim, Ilyong and Chiyong Kim, "Comparison of Korean to Western R&D: Project Selection Factors for New Product Development." Science and Technology Policy Institute, Advanced Institute of Science and Technology (KAIST) mimeograph, 1991.
Kim, Ilyong and Sunyang Chung, 1991, "R&D Cooperation Between Large Manufacturing Companies and Suppliers." Science and Technology Policy Institute, Advanced Institute of Science and Technology (KAIST) mimeograph 1991.
Kim, Linsu, 1991, "National System of Industrial Innovation: Dynamics of Capability Building in Korea." Working Paper 91-1, Business Management Research Centre, College of Business Administration, Korea University, Seoul, 1991.
Kinugasa, Yosuke, 1982, 'Japanese firms' foreign direct investment in the US: the case of Matsushita and others', In Akio Okochi and Tadakatsu Inoue (eds.), *Overseas Business Activities*, University of Tokyo Press, Tokyo.
Knickerbocker, F. T., 1973*, Oligopolistic Reaction and Multinational Enterprise*, Harvard University Press, Boston.
Koh, Dong Jin, 1992, 'Beyond Technological Dependency, Toward an Agile Giant: The Strategic Concerns of Korea's Samsung Electronics Co. for the 1990s', MSc thesis unpublished, Science Policy Research Unit, University of Sussex.
Kugot, B. and U. Zander, 1993, 'Knowledge of the firm and the evolutionary theory of the multinational corporation', *Journal of International Business Studies*, Vol 24, No 4.
Lall, Senjaya, 1983, *The New Multinationals: The Spread of Third World Enterprises*, Chichester, John Wiley.
Samsung 1993, *Samsung Sin-kyung-yeong: Na-bu-teo Byun-haiya-handa* (The New Management of Samsung: get myself changed), Samsung group, Seoul.
SEC (Samsung Electronics Co. Ltd), 1989, *Samsung Junja 20-nyun-sa* (The 20 Year History of Samsung Electronics), Seoul.
----- 1995a*, Guide to Out Bound Presentation Kit*, Global Operations Division.

------ 1995b, Samsung Electronics in Brief.
SEM (*Samsung Jun-ki Sa-bo*: Samsung Electro-Mechanics' Monthly Magazine), Jan-Dec 1994.
SEMM (*Samsung Jun-ja Sa-bo*: Samsung Electronics' Monthly Magazine), Jan 1990 -Dec 1994.
SED (Samsung Electron-Devices Co. Ltd), 1990, *Samsung Jun-kwan 20-nyun-sa* (The 20 Year History of Samsung Electron-Devices), Seoul.
SC (Samsung Corning Co. Ltd), 1994, *Samsung Corning 20-nyun-sa* (The 20 Year History of Samsung Corning), Seoul.
SMM (*Samsung Sa-bo:* Samsung Monthly Magazine), Jan 1980-Dec 1994.
SST (Samsung Semiconductor and Telecommunications Co. Ltd), 1987, *Samsung Ban-do-he-tong-sin Sip-nouns* (The 10 Year History of Samsung Semiconductors), Seoul.
Stopford, John M., 1995 "Competing Globally to Create and Control Resources," paper prepared for the conference, *Globalisation and Regionalisation: Implications for the Asian NIEs, East*-West Centre, Honolulu, Hawaii, August 15-17, 1994.
Tolentino, Paz E.E., 1993, *Technological innovation and Third World Multinationals*, Routledge, London.
Yu, Sengjae, 1989, 'Korean Electronics Enterprises : Growth and Strategies', in Dong-Ki Kim and Linsu Kim (eds.), *Management beyond industrialization: readings in Korean business*, Korea University Press, Seoul.