KIEP Working Paper No.96-01 APRIL, 1996

Globalization and Strategic Alliance Among Semiconductor Firms in the Asia-Pacific: A Korean Perspective

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KIEP
Working Paper

KOREA INSTITUTE FOR INTERNATIONAL ECONOMIC POLICY

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1996. 4

This paper was originally prepared for presentation at AAMO-12 Management Conference & Exhibition, Managing Asia Pacific Business into the 21st Century, which was held in Singapore, November 6-8, 1995.

Contents

Section I. Introduction

Trade and investment liberalization have manifested in the new World Trade Organization(WTO) and in numerous regional agreements. Furthermore, the increase in the speed of transportation, the information revolution and the introduction of new telecommunications technologies have globalized the markets for many goods and services. As a result, competition between firms has become globalized, and national boundaries are no longer a barrier obstructing the flow of resources. Such competitive environment is helping firms allocate resources globally according to each nation's different comparative advantages. The impact of globalization can be seen in the expanded global reach of firms from the Asia-Pacific region. Fortune' s Global 500 List reveals that in 1994 U.S. and Japanese companies comprised 151 and 149 of the biggest firms, respectively; they are joined on this list by 8 firms from Korea, 5 from Canada, 3 each from Australia and China, 2 each from Taiwan and Mexico, and one from Hong Kong(*Fortune*, August 7, 1995).

With the world economy becoming borderless, a critical source of a nation's differential advantage is its possession of technological capabilities. However, since few firms have all the internal resources to cope with the ever-increasing and technologically-driven competition, they have to seek cross-border alliances with potential or actual rivals to cope with the intensified competition in the global product market, while they may compete against each other in other stages of technological development.

Today, multinational corporations are operating on a global scale. They use internationally sourced components and foreign production and research facilities. While dependency on local materials is decreasing as a result, the importance of the ability to organize a system of international sourcing has increased. In order to compensate for gaps in in-house technology, multinational firms must attempt to acquire those technologies deemed necessary for commercial competitiveness through

international alliances. The recent proliferation of inter-firm collaborations between American and Japanese firms conducting joint R&D projects or establishing joint R&D and manufacturing operations is an excellent indication that technology and product development are no longer within the purview of a single nation. Such international collaborations are taking place, because of the enormous costs and risks which high-technology industries incur.

The major purpose of this paper is to review cross-border alliances as catalysts for Korean firms in globalizing their business operations, especially in the Asia-Pacific region, and as strategies for their technology development and technology sharing. In this context, this paper tries to provide a perspective from a small country outside of the Triad powers. The three central questions raised in this paper are: One, I ask what implications the dynamically changing global environment have for the Korean management system and for the trade and industrial policy of the Korean government in the future. Two, an attempt is made to examine the role of the Korean government in facilitating the formation of technology alliances by asking how it has participated in enhancing competitiveness of the firm, and whether it has liberalized Korea's investment climate and properly protected intellectual property rights to a sufficient degree. Finally, due to the increasingly global nature of business activities, I question whether the rules of international trade manifested in the WTO are effective and objective in coping with bilateral trade disputes occurring in high-technology trade.

This paper relies on a case study of Korea's semiconductor industry in order to answer the three questions above for the following two reasons: One, the semiconductor industry requires an enormous amount of resources and continuous R&D investments in order to remain competitive in the global market. Consequently, Korean chip manufacturers have sought to minimize the rapidly increasing costs and risks pertaining to state-of-the-art projects, and/or to gain an access to newer technologies by establishing an international strategic alliance. Furthermore, due to

the extremely short products' life cycle and rapid technological change of semiconductor devices, it creates a very high entrance barrier for small-sized firms. The main players of the Korean semiconductor industry have been large-scale oligopolists, i.e. *chaebols*, who could meet global competition through their ability to mass produce at low costs and their financial capacity to absorb risks. Secondly, no other Korean industrial sector has experienced faster globalization than the semiconductor industry. Especially, the semiconductor industry is ideal for the analysis of the globalization process, due to its low transportation costs in relation to the value of the goods shipped, and for dividing manufacturing processes into stages and locating them globally according to different comparative advantages of each nation.

The paper consists of six sections. After the introductory Section I, Section II examines the expanding flows of intra-APEC trade and investments which have led to deepening interdependence among Asia-Pacific economies. Yet what draws our attention to Section II is that interdependence among Asia-Pacific economies is being supplemented by more powerful forces of globalization. Section III is the core part of this paper. After a brief conceptual review of strategic alliance, three major issues are discussed: First, the phenomenal growth of the Korean semiconductor industry, with its apparent technological strengths and weaknesses, is surveyed. Second, the ways in which Korea has achieved globalization of its DRAM business are analyzed by providing some recent transnational strategic alliances between Korean firms and American/Japanese counterparts. The third issue is to assess the role of the Korean government in promoting cross-border strategic alliances. Although the successful outcome of the UR negotiations eliminated several potential areas of trade dispute in the Asia-Pacific region, the New Agreement failed to provide sufficiently detailed provisions in dealing with bilateral disputes in the semiconductor trade. With its commitment to open regionalism, the APEC could supplement major weaknesses of the WTO by providing a useful forum to address

the problems in the semiconductor industry among the major chip producers in the Asia-Pacific region(i.e., the U.S., Japan, Korea, Singapore and Taiwan). Such argument is made in Section IV. The paper concludes in Section V by discussing appropriate future trade and industrial policies for Korea in light of some important lessons we can draw from the analysis of the nation's semiconductor industry which is largely "Chaebol-led and DRAM-focused".

Section II. Growing Asia-Pacific Markets in the World Economy

1) Trade and Investment Linkages

The Asia-Pacific region is the most dynamic area in the world. The Asian NIEs in particular have recorded the fastest economic growth rates in the world over the last two decades. Trade and investments have been the driving force behind their economic success. Experts argue that the adoption of an export-oriented development strategy, based on labor-intensive manufacturing in which the Asian NIEs had comparative advantage, accounted for such a rapid economic growth.

In recent years, some notable changes have taken place in the pattern of manufacturing trade among Asia-Pacific economies. First, intra-regional trade has grown rapidly from 53 percent of the region's world trade in 1980 to 63 percent in 1994, deepening economic interdependence among Asia-Pacific nations. Second, as industrialization continues in Asian NIEs and as Asian NIEs improve their manufacturing and R&D bases, their trade with developed as well as developing countries will shift more toward an intra-industrial variety, strengthening de facto market integration in this region. Third, Asian NIEs' exports in the 1970s and 1980s, which were primarily based on OEM agreements (chiefly, with the U.S. and Japan), a

subcontracting-type of export orders, have been rapidly taken over by the low-wage economies, such as China and Vietnam, in the Asia-Pacific region.

The interdependence among Asia-Pacific economies has been deepened further by the increase in foreign direct investment (FDI). According to *Asian Development Outlook*, a large increase in FDI were implemented in China(about US$ 11.2 billion in 1992) and in ASEAN countries(about US$ 8.2 billion, excluding Singapore and Brunei). The expansion in intra-regional investments is in large part due to internal and external pressures on the major Asia-Pacific economies to maintain their international competitiveness by upgrading their industrial structures. Japanese labor and land intensive industries invested first in Asian NIEs and later in ASEAN to seek haven from its rising domestic wages and appreciating yen. In recent years, Japan's importance as a source of FDI(14.0% in 1991) has grown relative to that of the U.S.(10.4% in 1991). Despite such figures, U.S. still remains as an important investor in the Asian-Pacific region.

However, the rise in Asian NIEs as major intra-regional investors, accounting for about 77.3 percent(largely, Hong Kong:62.8 percent) of FDI in China and 25.7 percent in ASEAN countries in 1993, has become a remarkable phenomenon in the area of FDI in the Asia-Pacific region. As in the case of Japan in the early 1970s, due to high cost of production at home and price competition from ASEAN and China, Asian NIEs have found it increasingly profitable to shift production of labor-intensive products to low wage countries. By the 1990s, Asian NIEs had replaced the U.S. and Japan as the largest foreign investors in China and ASEAN countries.

2) Overview of Korea's FDI

Since their first FDI in 1968, Korean firms, as of December 1994, made 4,642 FDI projects for a total value of US $8.962 billion. Thanks to the government's supportive measures for FDI overseas, it was not until the early 1990s that Korea's

FDI began accelerating. At the beginning, Korea's FDI was mostly resource-oriented, and manufacturing investments were relatively small. However, as of December 1994, FDI in the manufacturing sector accounted for more than 50 percent of the total FDI. By region, about 34 percent of total FDI was in North America, 25 percent in Southeast Asia, and 12 percent in China.

Korea's FDIs were mostly resource- and market-seeking investments a natural extension of the export-led development strategy. Being quite different from what we would predict on the basis of the FDI theory, Korean firms have responded defensively to the trends of regionalization in the Asia-Pacific by trying to localize their production within the host countries. Rather than to globalize the firm's business strategy, FDIs were conducted to circumvent the cross-border barriers against Korean exports (Jun 1990, p.59).

3) Globalization of Business Activities

The changing pattern of international trade makes economic units more integrated with each other. The spread of global telecommunications allows instantaneous communication worldwide, thereby facilitating a very close coordination among all parts of global enterprise. Thus, FDI as a simple device utilizing low-cost local labor or to circumvent import restrictions is no longer effective in an increasingly competitive global business environment. As it was illustrated by Texas Instruments' recent direct investment in Taiwan and Singapore, which were motivated more by a desire to customize DRAM chips for the end-users there than to take advantage of lower labor costs(Sumita, p.30), a strategic response in production activities in the face of globalization and regionalization is an integrated network of production-specialized plants serving the world and regional markets.

What Korean firms need to do to globalize their business operations is to integrate FDI into an agressive strategy towards forming a global network of

production and distribution in accordance with changing comparative advantages of each nation. Perhaps, the Japanese way of organizing resources to facilitate globalization following the yen appreciation brought about by the Plaza Accord in 1985 could serve as a good example. The strategy of Japanese firms in such industries as automobile and electronics was the globalization of their business operations to optimize their production, R&D, global marketing, and global sourcing of parts and components. For instance, Sony, Matsushita and Aiwa have retained the Asia-Pacific region as a globally integrated production and distribution base to serve Asian neighbors and European markets (Pang, p.118).

In recent years, Korean chaebols have recognized the importance of globalizing their business operations through strategic alliances. And, as the Japanese exeperience illustrates, in order to accomplish a successful cross-border strategic alliance for whatever objectives, the participating party in the alliance may have to possess certain complementary assets which are desired by other participants joined in the alliance. In short, Korean firms must depart from its past practice of undertaking FDI as a means of exploiting low cost labor. They should find some new ways of transforming FDI into a strategic device to form a global network of production and distribution bases appropriate for each county.

Section III. Globalization and Technology Alliance in Korea's Semiconductor Industry

1) Forms of Technology Alliance

It is not the intention of this paper to go into a detailed explanation of what constitutes a strategic alliance. In view of our major interest in technology being considered as the overriding source of competitiveness in the global market, our

major focus is on technology development. According to Professor Michael Porter, technology development is one of the critical value activities. Suffice to say that in face of global competition, one major motive for cross-border alliances by Korean firms is to gain access to core technologies possessed by their alliance partners from industrial countries. Technology-motivated strategic alliances can take the forms of licensing, cross licensing, technology exchange, technology sharing, joint development, and second sourcing.[1)]

However, to maintain a mutually beneficial business relationship with alliance partners, Korean firms must offer as a quid pro quo some form of complementary assets, such as manufacturing capabilities, market access and the like. Gaining needed technology in return for offering something else would be an important global strategy for Korean firms.

2) Growth of Korea's Semiconductor Industry

In a brief span of just over ten years, Korea's semiconductor industry has emerged as one of the leading suppliers of chips in the world market. During the same time, Korea became the second largest DRAM exporter right behind Japan. There are currently about thirty domestic semiconductor producers in Korea, of which Samsung Electronics, Hyundai Electronics, and LG Electronics are the three chaebol members. They have begun eroding the once overwhelming dominance of Japanese producers in the industry.

With generous government support, Korea's semiconductor industry grew rapidly during the 1980s as OEM suppliers of computer chips to U.S semiconductor companies such as Motorola, Fairchild, IBM and Intel. Ever since Samsung, found-

1) Second sourcing is a type of manufacturing alliance. It is an arrangement whereby a firm is given permission to manufacture a product designed and developed by another firm as a second source of supply for customers, using the same technology.

ed in 1969, developed its first 64K DRAM chip in 1983 with the assistance in design, production and process technologies from Micron Technology of the U.S.A. through the Samsung-Micron technical licensing agreement, Korea's semiconductor sales soared by leaps and bounds. The yen's surge since the Plaza Accord, the boom in the global PC market, and the failure of the Japan-U.S.semiconductor trade negotiations in 1986 to agree on below-cost sales as normal pricing practices were golden opportunities for Samsung, then being exempted from the 1986 U.S. dumping complaint, to make enough money from the higher price of 1M DRAMs to recoup all the losses it had incurred over the past ten years. More importantly, the U.S.-Japan semiconductor negotiations, which made Japanese computer producers purchase foreign-made chips, helped to foster better cooperation between Japanese and Korean producers in the ensuing periods.

As a combined result of the factors listed above, Korean DRAM producers succeeded in eroding the overwhelming dominance of Japanese chip producers. Japan's share of the North American semiconductors market fell from 61 percent in 1987 to 52 percent in 1991, while that of the Koreans' increased sharply from about 7 percent to about 19 percent. In 1994, the Korean chip manufacturers emerged as one of the leading memory chip suppliers by capturing 22 percent share of the world DRAM market. Now, Korean semiconductor industry is a front-runner in the mass production of 4M, 16M and 64M DRAMs. In August 1994, Samsung unveiled a fully functional prototype of a next-generation 256M DRAM chip, the first computer chip maker to develop one. In 1994, Samsung, Hyundai, and LG had a combined chip revenue of US$ 8 billion, up from US$ 2 billion in 1992(*New York Times*, July 21, 1995).

Korea's semiconductor industry is highly trade-oriented. Compared to Taiwan, where import substitution has been the primary concern of its semiconductor sector, Korea has been export-led from the start. Korea exported assembly processing type DRAM chips, valued more than US $ 7 billion, some 81 percent of its domestic

production, in 1993. At the same time, Korea imported semiconductor materials and chip-making equipment valued at about $ 5 billion, nearly 75 percent of its domestic needs. Korea's total semiconductor sales at home and abroad was US $ 1.5 billion in 1990 and surged to US $ 8.5 billion in 1994, an annual average growth rate of more than 50 percent. Accounting for more than 8.5 percent of the country's total exports, semiconductors were the single largest export item in 1994. Although Korea has become the second largest DRAM exporter, Korea's semiconductor industry is extremely concentrated in the production of these memory chips. Of DRAM categories, the 4M accounted for 35 percent of the world production in 1993, and the 16M is expected to reach the 40 to 50 percent level soon.

3) The Level of Korea's Semiconductor Technology

Despite such dramatic and successful development in the Korean semiconductor industry, its technological level is still far from being self-sufficient. As Korea's substantial imports of semiconductor materials and semiconductor manufacturing equipment may suggest, Korea is not yet endowed with core technologies to be on par with neither the U.S. nor Japan. Korea excels largely in technologies for assembling, that is, mass production technology and wafer processing on which DRAM producers rely for their product competitiveness. Yet, when it comes to technologies needed for designing, testing and developing new products, Korea trails behind the U.S. and Japan by two to eight years. Reflecting on such technological constraints, the Korean semiconductor industry has embraced almost entirely in the DRAM as its technology driver.

In order to compensate for such in-house technology gaps, Korean industries in general and the semiconductor sector in particular have therefore been heavily dependent upon technologies borrowed from abroad. Due to increasing technology protectionism by the industrialized countries limiting the access to much needed

technology, Korean firms have been subjected to a variety of difficulties, such as refusal of licensing, patent protection, and infringement suits, in obtaining technologies.

In general, Korea has acquired technologies through FDIs, foreign licensing, foreign consultants, purchases of capital goods, subcontracting, utilizing research outposts in Silicon Valley as training centers for domestic manpower, and training Korean scientists and engineers in the U.S., Europe and Japan.

From 1987 to 1992, the electronics sector ranked first in technology imports, for which both the U.S. and Japan accounted for 74 percent of the number of cases and 85 percent of the dollar amount. Korean firms had to bear a heavy financial burden for the imported technologies. From 1962 to 1982, the Korean electronics industry paid US$ 100 million in foreign patent fees. However, during the 1983-1992 period, the patent fee payment jumped to US $1.6 billion. Furthermore, in 1990, the electronics industry spent around US $4.7 billion on foreign licensing fees which constituted about 33.4 percent of the industry's total R&D expenditure(Jun 1992, p. 15).

Without its strenuous efforts to develop sufficient industrial infrastructure to facilitate the inward transfer of complex fabrication process technology from abroad, Korea will not make any progress in the buildup of its own manufacturing capability. In the technology catch-up effort, the government has played a critical role in creating a powerful institutional framework for research collaboration between the public and private sector to take place. Also, in view of greater difficulty in gaining ready access to core technologies without being able to simultaneously offer some form of complementary assets, the government has undertaken a new national R& D program to monitor global technological development and the availability of R& D resources. To cope with such growing need for higher technology, the government has introduced various incentives for product-oriented technologies and basic

research. As a result, R&D expenditures as the share of GNP increased sharply from 0.81 percent in 1981 to 2.17 percent in 1992, and according to the government's long-term R&D plan, it is expected to reach the four percent level in 1998.

Since 1993, Korea's technology imports have started to rise. This is so despite continuous complaints from Korean firms concerning developed nations' reluctance toward transfering their skill and technology. In view of the growing techno-nationalistic sentiments around the world and of the mounting pressures for protecting intellectual property rights, Korean firms' reaction is a surprising phenomenon.

In the case of the semiconductor industry, there are two major factors that seem to account for the increase in cross-border flows of technology in recent years. First, it represents the remarkable results of Korea's relentless efforts to upgrade its manufacturing and technology base over the past ten years or so. To gain greater access to newer and to more sophisticated technologies developed in the U.S., Japan, and the EU, Korean chip makers are now positioned to offer some form of complementary assets, such as production technology and supplies of DRAM chips, display screens just to name a few. As several cases of technology alliance between Korean firms and U.S./Japanese competitors will soon illustrate, Korean chip manufacturers have entered into a number of technology alliances to gain an early edge in the semiconductor field. Secondly, not only have international exchanges between researchers in different countries increased, researchers could leave their companies relatively easily to join other ventures as well. As a result, innovating companies can only maintain state-of-the-art technology only for short periods of time. For instance, by assimilating all the latest technology available abroad, Samsung Electronics has been able to close the time gaps between Korea and Japan in technology from two years in 64K DRAMs, to one year in 256K DRAMs, several months in 1M DRAMs, and virtually no time gaps in 4M DRAMs (Sumita, p.34).

Korean firms' response to technology development and globalization, that is,

the global mobilization of R&D resources, constitutes another major value activity. Unfortunately, detailed information with respect to cross-border strategic alliances is not easily available. Through various forms of technology alliance and collaboration with American and Japanese firms, there are selective cases that illustrate the ways in which Korean firms have achieved globalization.

4) Recent Cases of Technology Alliance

① LG - Hitachi Technical Tie-up

On march 1990, LG Group and Hitachi formed the first Korea-Japan technical tie-up for the production of 1M DRAM chips. The alliance was basically spurred by Hitachi's need for additional production facilities for 1M DRAMs and LG's need to acquire the chip technology and strengthen its technology capability so as to catch up with its rival Samsung in the DRAM race(Jun 1992, pp.34-35).

② Toshiba - Samsung Alliance

Toshiba, the world's largest manufacturer of DRAM chips teamed up, in December 1992, with Samsung Electronics, its competitor and the world's number two DRAM maker. Toshiba needed Samsung's production strength to help establish its version of a new type of chip called flash memory, and Samsung needed Toshiba' s technologies and patents.

③ Hyundai - AT&T Collaboration

In November 1994, to take advantage of the growing demand for non-memory chips, Hyundai Electronics acquired the non-memory business sector of AT&T for the price of US $ 300 million. This acquisition made Hyundai a front-runner in non-memory chip production.

④ LG - Synchrowork Alliance

LG Semicon teamed up with Japan's Synchrowork Company to jointly establish an ASICs (application specific integrated circuits) design center in Japan. They plan to design ASICs in Japan, produce them in Korea, and export them back to Japan. This alliance is a good example of second sourcing. This way LG Semicon can make the most out of Japan's core technology, while using largely Korean-made parts and components.

⑤ NEC - Samsung Alliance

In February 1995, NEC of Japan and Samsung agreed on a joint production collaboration of semiconductor chips for the European market. NEC is expected to supply Samsung with 100,000 chips a month in the form of wafers manafactured at NEC's plant in Livingston, Scotland. Since Samsung does not have a fully functioning manufacturing facility in Europe, it will process the wafers and assemble the chips at its assembly and test plant in Porto, Portugal(a joint venture with Texas Instruments). This alliance will complement each party, because the deal will enable Samsung to avoid duties of 14 percent on memory chips imported into the EU, while NEC will be assured of Samsung's supply of certain memory chips needed by its computer division at home in times of strong demand for DRAM chips(*Financial Times*, February 7, 1995).

⑥ LG - Zenith Collaboration

In July 17, 1995, LG Electronics bought a controlling stake(58 percent shares) in Zenith Electronics for US $350 million. LG will provide its production technology to Zenith in return for the access of HDTV and multimedia technology. Such arrangement will have spillover effects into demand for semiconductor chips. LG is Korea's first chaebol to establish a major presence in American consumer electronics.

⑦ LG - Samsung Alliance

LG and Samsung, the two major Korean electronics firms, signed an agreement for mutual cross-licensing of patents in July 1992, which amounted to more than 4,000 cases altogether. As the first important case of strategic alliance among domestic firms, it shows that no one company has all the resources to finance major technology investment. This alliance heralded the coming of a new era for strong cooperation between domestic rivals in the future in order to cope with the larger and stronger foreign multinational corporations.

5) Korea-U.S. Industrial Alliance

Since 1993, the Korean government has strongly advocated for the formation of industrial alliances between U.S.and Korean firms. What underlies the Korean government's push is that a bilateral technology alliance between Korea and the U. S. could provide a bulwark against Japanese technological challenges and capabilities and form a joint force to press for a more open market in Japan. Since the U. S. industry has a competitive edge on advanced technology, new product design and development capability, it is maintained by some Koreans that such resources could be combined in a complementary fashion with Korea's manufacturing strength, its world-class managers and highly skilled workforce so as to offset each other's structural weaknesses.

The U.S. and Korea have now an institutional framework in the form of Korean-U.S. Committee on Business Cooperation with which to explore a number of areas of industrial cooperation including the semiconductor sector. In 1994, the Federation of Korean Industries established, under the blessing of the Korean government, the Korean-U.S. Foundation for Increased Industry and Technology Cooperation(KUFIT) as a means for Korea to speed up industrial and technical collaboration with U.S. firms.

Another major reason for the Korean government to encourage Korean firms to make technology alliances with U.S.companies stems from the fact that imports of machinery and equipment from Japan have been the major sources of Korea's chronic trade deficits. Some Koreans have argued and believed that possession of core technologies could correct Korea's widening trade deficit with Japan, and consequently, they have blamed the Japanese government and Japanese firms for their reluctance in transfering technologies to Korea.

There are some evidences, however, where Japanese firms are reassessing their business strategy - as shown by the number of technology alliances they have made with Korean semiconductor firms. Japanese firms are realizing that in an increasingly borderless world economy, few firms have all the internal capacities to cope with the growing technologically-driven competition. Therefore, they are entering into strategic alliances with their counterparts and knowing that, to expand cooperation with their participating party in the Asia-Pacific region, they have to offer specific technologies in return for some complementary assets they desire from their partners. This is an important change in the existing behavior patterns of Japanese firms and implies that, since strategic alliance is basically a deal made between private firms and has proliferated due to market-driven forces after the mid-1980s, there seems to be very little that the Korean government can do to directly influence industrial alliances between Korean firms and American counterparts to the exclusion of others. A key element in building a realistic and successful U.S.-Korean industrial alliance is not to play the Japan-bashing card or to put blame unilaterally on Japan for Korea's trade deficit. Such alliance must convince the Americans that they can benefit more from a U.S.-Korean alliance than a U.S.-Japan alliance in terms of technology acquisition and market access.

6) Industrial Alliance Among Developing East Asian Countries

While Korean firms are increasing their efforts to acquire technological access through strategic alliance with both U.S. and Japanese firms, there are good prospects for strategic tie-ups between Korea and other developing Asian countries in the Asia-Pacific region, as they attach strategic importance to the semiconductor industry because of its spillover effects to other industries. Since 1970, semiconductors have been the single largest item of the electronics industry in ASEAN countries. Therefore, they have induced FDI actively and given various measures to promote the industry. The other side of the coin is that Korean firms have wished to halt the dominance of Japanese firms in the ASEAN countries by competing with them for local market share.

Yet the overriding reason that will drive the formation of strategic alliances between Korea and ASEAN countries is, while Korea has the world-class manufacturing technology and management knowhow as the proven leader in the production of DRAM chips, ASEAN countries have emerging markets, R&D assets, and abundant skilled labor. The KIET Survey on ASEAN firms (227) finds Indonesia, Malaysia, Thailand and Philippines having a strong demand for cooperation in the semiconductor sector - particularly in components and parts(KIET, pp.67-70). With a long background in semiconductor assemblying, Korea will find ASEAN countries not only as low cost sites for the memory chip production, non-memory devices and important consumer markets, but also as the base for implementing its international corporate strategies. In short, ASEAN will be the most important region for Korean firms' drive toward globalization.

7) The Role of Government in Strategic Alliances

The government can create a favorable environment for the formation of

international technology alliances in several ways. For one, since the semiconductor industry is highly technology-intensive, the government could build up the nation's technology base by enhancing the competition within the industry.

Fearing the weakening of the U.S. semiconductor industry as a result of Japanese competition in the high technology areas, the U.S. government responded in part by subsidizing R&D efforts of certain chip producers. In 1987, 14 leading U. S. semiconductor producers, with the financial support of the U.S. government in the form of US $100 million in annual subsidies, created a joint R&D consortium SEMATECH(*Se*miconductor *Ma*nufacturing *Tech*nology). Singapore's National Science and Technology Board intends to inject over S$ 2 billion into both private and public sector research projects to ensure its nation's long-term competitiveness in the electronics sector. MITI-sponsored research consortia in Japan and JESSI(Joint European Submicron Silicon Initiatives) in Europe are some other similar examples of a government-industry R&D consortium on manufacturing technology. Similarly, in Korea, the Ministry of Science and Technology(MOST) has played a crucial role in encouraging joint technology development among private firms by introducing an incentive system to provide differential subsidies on the basis of their R&D performance. This was meant to foster competition among the participating firms. In 1990, the Korean government also established the Inter-university Semiconductor Research Center at Seoul National University for basic semiconductor research and has provided it with equipment and funds since that time(Byun, p.715).

As the above cases of government R&D support in semiconductor-related areas illustrate, governments have become more active in technology development. However, as frequent bilateral conflicts over the acceptable methods of governments providing subsidies suggest, there must be a limit to both direct and indirect subsidies extended to such strategic industry. Although government assistance up to 75 percent in the case of industrial research and 50 percent in the case of pre-competitive development are not subject to countervailing duties under the new UR

Subsidies Agreement, one of the best way to resolve the R&D subsidies issue may be to allow rival foreign firms to participate in government-industry R&D projects of that country. Given the rapid pace at which cross-border corporate alliances and cooperations are taking place and the increase in R&D costs, it seems futile to confine research programs to domestic firms. Participation by foreign firms and cross fertilization of ideas in expanding government-industry R&D efforts will have beneficial spill-overs for the development of creative technology (Bergsten and Noland, p.143).

Second, in order to encourage and improve industrial alliances and competitiveness, it will be particularly important for Korea to continue receiving substantial flows of FDI and technology from such countries as the U.S., Japan and the EU in the future. Since FDI is a critical element in such ventures, policies that regulate the flow of such type of investment may have a chilling effect. On Korea's part, this will require making its investment climate more favorable to foreign investors. Due to seriously worsened business climate during 1988 to 1993, Korea fell behind other Asia-Pacific region countries and elsewhere in its ability to lure foreign investment. Since 1994, with the establishment of one-stop investment services, streamlined investment procedures, accelerated market openings, and other incentives for FDI in high-tech industries, Korea has begun regaining previous FDI levels. As of year ending 1994, FDI to Korea reached US $ 1.317 billion, a 26 percent rise from 1993.

Third, in view of growing techno-nationalistic sentiments around the world, better protection of intellectual property rights could play an important role in luring and fostering investment and technology development from industrial countries into Korea's high technology industries. The Korean government's efforts to protect intellectual property rights(IPRs) are being pursued in several ways. Addressing complaints from the U.S. business community, the Korean government has made significant and marked progress in improving its enforcement of IPRs. Various laws such as the Copyright Law, the Computer Program Protection Law, and

Customs Law have been revised since 1993 to combat computer software piracy. Whether these laws will be effectively enforced remains to be seen. More importantly, in order to have its own mask works protected as one of the world's leading DRAM chip producers, the Korean government instituted a statutory semiconductor mask works protection. Also, to coordinate enforcement activities to eradicate IPR infringement, the government established the National Prosecutor's Office. Overall, the protection of intellectual property rights in Korea has improved to the point where inadequate protection does not seem to be a major obstacle to trade and investment.

Section IV. Semiconductors and Trade Disputes Search for a Multilateral Resolution[2)]

Since the industry requires large initial outlays at the start of mass production, rapid technological innovation, and a steep learning curve, DRAM makers usually set the initial selling price of semiconductors at a level below marginal cost during the product's life cycle. However, this practice called forward pricing has been ignored by the U.S. dumping authorities as a normal pricing policy of a firm. The U.S. government computes arbitrarily a constructed value by excluding below cost sales from the dumping margin calculation, and such calculation results in artificially high dumping margins.

Although below cost sales are considered as perfectly normal business practices in the domestic market, a number of U.S. firms filed an anti-dumping suit alleging that Japanese semiconductor companies had reduced their prices in order to penetrate the U.S. market. Alarmed by the U.S. Commerce Department-initiated 256 K

2) Section IV owes much to M. Sumita, "Impact of Trade Policies on a Global Industry", *NRI*, 1995.

DRAM dumping case, Japanese trade officials prompted to negotiate a bilateral settlement with the U.S. to avoid any vexatious and costly legal actions.

Semiconductor Trade Agreement(SCTA) was reached between the U.S. and Japan at the end of August 1986. The agreement created a firm-specific price floor for semiconductors or fair market values for each Japanese producer. The price floor or fair market value was comprised of the average cost of production plus an arbitrary profit margin of 8% and general administrative expenses of 10%. The fair market value system which U.S. antidumping laws are applying to the Japanese DRAM chip manufactures has, however, a number of serious shortcomings. The first group of firms to produce the new DRAM chips had a "first-mover" advantage in that, by having entered the market first, they became the price leader. Such position enabled them to set prices at a level above their own fair market value (the floor price). The late entrants (primarily Japanese firms) were denied any possibility to catch up with the early entrants. Unless they dare to confront anti-dumping investigation, the late entrants would not attempt to cut the price of their new products below the floor price.

As we can see from the above description, the fair market value mechanism impeded the price competition that would normally have occurred based on the learning curve on production. There were two obvious flaws in U.S.'s anti-dumping laws. First, they had a seriously adverse effect on trade in the state-of-the art high technology products. Anti-dumping duties were frequently imposed on next generation products on the basis of an investigation conducted years earlier on first generation products. Such practices thus inhibited the introduction of more advanced products into the international market. Second, U.S.'s fair market value system artificially increased DRAM chip prices. For the U.S. computer makers, who are the largest purchasers of these chips, it was a detriment to their competitive edge on their computer products.

In recognition of the fair market value system stifling the level of competition and efficiency of the semiconductor industry, a question may be raised as to whether the Semiconductor Trade Agreement accomplished anything. L. Tyson observes that, by stopping Japanese firms from dumping, SCTA encouraged the entry of non-Japanese producers into the U.S. market and undermined the pricing cartelization of Japanese DRAM manufacturers. Therefore, as Samsung and other semiconductor firms not subjected to the fair market value system were able to meet the U.S.' s need for chips, American fear of Japanese disruption in its market mechanism was considerably dissipated(Tyson, pp.126-127).[3)]

At present, international rules manifested by the new WTO do not seem to be adequate in dealing with trade disputes which originate from the ongoing globalization of the DRAM business. To overcome inadequacies that arose during previous semiconductor trade agreement in the future, the time has come to consider an appropriate multilateral framework for the present semiconductor industry.

In comparison with GATT's rules on dumping, the UR Anti-dumping Agreement (or the New Agreement) has a number of notable improvements. One improvement made by the UR's Anti-dumping Agreement is the partial recognition of below cost sales by calculating the dumping margins. Yet, only general standards for recognizing below cost sales are included in the New Agreement. These new standards restrict recognition of below cost sales only to the cases in which such sales occur at prices which do not provide for recovery of costs within the period from 6 months to one year. But the cost reduction could continue, and the peculiar nature of costs in the dynamic semiconductor industry does not fit neatly into such narrow periods agreed by the negotiators for the New Anti-dumping Agreement.

Anti-dumping measures have caused most of the intense and recurrent bilateral

3) In 1992 Micron Technology filed charges with the U.S. government, alleging that Samsung, Goldstar and Hyandai were dumping their memory chips in the U.S. market.

trade disputes among APEC members. In view of such restrictive effects of anti-dumping, APEC's EPG(Eminent Persons Group) recommends the creation of a task force to review the ways in which APEC countries are implementing their anti-dumping policies. Since the abuses in anti-dumping measures pose serious problems in predicting and securing market access, which in turn threaten the evolution of the Asia-Pacific economic community, the EPG further proposes that APEC should set up a non-confrontational, non-binding, and voluntary DMS(Dispute Mediation Service) as a complement to the WTO dispute settlement procedures.

In strategic response to inward-looking, and discriminatory trade blocs in Europe and North America, Korean firms have moved production sites inside importing countries in order to bypass trade barriers imposed on their exports. However, inadequately distinguishing between shifting production for legitimate reasons and for real circumventing purposes can cause newer risks. Such risks derive from New Agreement's failure to agree upon anti-circumvention measures. Anti-circumvention measures could discourage commercially legitimate moves toward global production, hence resulting in the distortion not only of trade but also of investment patterns.[4)]

What is really a disguised form of cross-border protectionism, stringent domestic content regulation could also retard globalization of production and sourcing activities. The regional value content requirement, which will increase from the current level of 40 percent to 67 percent in European markets, will force Korean firms to abandon local assembly operations in favor of integrated manufacturing systems which rely heavily on local resources. Similarly, unless NAFTA is prepared

4) In September 1995, a group of U.S. labor unions has filed a petition with the U.S. Department of Commerce, charging that Korean TV producers are circumventing the anti-dumping duty order on color TVs from Korea by assembling color TVs in Mexico using parts and components imported from Korea. This highly controversial action is believed to be the first application of new anti-dumping circumvention provisions under US law enacted as part of the US UR Agreements Act.

to stop screw-driver type assembly operations, a change to more restrictive origin rules under NAFTA will limit the expansion efforts of Korean firms in Mexico, for example.

In issues such as anti-dumping, rules of origin, R&D subsidies, technology transfer, competition policy, FDI, and the like, an APEC DMS could be a useful vehicle for more comprehensive discussion among Asian-Pacific nations concerning their semiconductor industries. To be concrete, the subject of discussions could be directed to ask whether the practice of forward pricing and the dynamic nature of costs in the semiconductor industry could be reflected in anti-dumping regulations; and whether regional economic arrangements are in compliance with WTO rules and open to the outside world.

APEC could also promote the formation of transnational alliances among firms in the Asia-Pacific region in two ways. Generally, since APEC is set to achieve a free and open market in the Asia-Pacific, it should encourage and lead APEC governments to reduce difficulties, uncertainties, and costs involved in cross-border economic transactions within the region. Specifically, since transfer of semiconductor technology has accelerated between firms and across borders, APEC could establish a center for technical information exchanges between developed and developing countries in the region. Such exchange channel can provide information regarding investment conditions, current status of high technology industries, and lists of firms that are seeking technical alliance but are deficient in information-gathering activities.

Section V. Conclusions and Policy Implications

In a brief span of just over ten years, the Korean semiconductor industry, which was targeted as a strategic industry by the government, has emerged as one of the leading suppliers in the world chip market. We have seen how global and

regional forces have influenced two of what Professor Michael Porter calls value activities: the pattern of production system and technology development of Korean semiconductor firms. Korean DRAM makers have utilized cross-border alliances as catalysts in globalizing their business operations and strategies to compensate for their deficiencies in in-house technology. Since 1990, the Korean semiconductor industry has become the most significant challenger to the Japanese in the DRAM market. Now, Korea should be heading toward manufacturing semiconductor equipment and non-memory devices in the future. This change in focus should increase further technological alliances with leading foreign semiconductor producers.

Korea's impressive performance as one of the top suppliers of DRAM chips worldwide is something to be emulated by latecomers. Yet, one wonders if Korean semiconductor industry's unique characteristics are vulnerable to changes in the market and the technology. In short, the DRAM segment dominates Korea's semiconductor industry in which chaebols wield enormous market and production power. Such unique features of the Korean semiconductor industry could present several major important policy issues with respect to Korea's trade and industrial policies in the future.

In Korea today, chaebols' concentration of economic power and their potential adverse impacts on the economy have become central issues in economic and political debates. Naturally, a search for a more competitive and liberal economic order has been intensified. This is also true for Korea's government-designated and chaebol-led semiconductor sector. With their government support, their ability to mass produce at low cost, their financial capacity to take risks, their massive R&D spending, and their economies of scale, Korean chaebols have established a competitive superiority over the chip market. In a closed market system, competition among few could result in efficiency losses. Since in Korea, foreign competitors have access to its markets, it is not necessarily detrimental to the end-users. But in order to reduce business concentration in the semiconductor industry, more competitive

pressure should be exerted. This could be achived by further removing entry barriers for foreign company and vigorously enforcing fair trade law and competition policy.

It is, however, chaebols' excessive business diversification that may impinge their competitiveness in the global semiconductor market. Although the association between diversification and inefficiency has not been fully supported empirically at the present time, it is very clear that chaebols have over-extended themselves by being involved in too many technically unrelated areas. As global competition heats up and the Korean government no longer expects to play the role of an insurer of business failures, a practice that was performed by past authoritarian regimes, it is questionable whether a firm could attempt to diversify into so many different areas of business without the fear of bankruptcy. In a globalizing market, chaebols first ought to identify its core competency and concentrate on a small number of product-lines. Focusing on related product-lines will ensure investment and international competitiveness in the semiconductor business. An excessive diversification could be a detriment to innovative technological development. Technological development could be carried out more efficiently by specializing in a few main lines of business. Also, chaebols should not compete with small-and medium-sized domestic firms, but with foreign competitors who are comparable in terms of firm size, international access, and world market position. Without chaebols' realization of the present structural imbalance existing between large and small-and medium-sized firms in resources and technologies, further development of Korea's high technology industries can be seriously hampered.

The most significant trends in the semiconductor market are now the growth in the non-memory segment, i.e., the ASICs and Logic devices(microprocessors)(Park, p.190) and the emergence of China and ASEAN countries with technological capacities. China and ASEAN countries' involvement in the middle-to low-end DRAM market might become a threat to Korea. In this changing global business environment, one may ask whether Korea's currently "Chaebol-led, DRAM-focused" sem-

iconductor industry could survive or remain competitive by maintaining an annual sale levels of US$ 6 to 8 billion(Park, p.182). Should the Korean industry desire to push towards an ASIC, a technology that requires a flexible manufacturing process to meet diverse customer needs and technology designs, a new internal organization and management system should be devised. Furthermore, a corporate environment which accepts creative individuals with their idiosyncracies and more flexible entrepreneurial business units that can respond quickly to changes in the market and the technology is desired.

With the world economy becoming borderless, globalization of the Korean economy and Korean business is inevitable. Though the Korean government has made sweeping liberalization and deregulation reforms since 1993, it will have to further develop necessary strategies and organizational structures to cope with the changing international environment. As Korea's competitive position is bound to change continuously, Korean firms will have to rationalize their production systems. The production of low-technology items will continue to be transferred to developing countries in the Asia-Pacific. Also, Korean firms will have to accelerate their outward foreign direct investment, not as a defensive device to overcome rising domestic factor costs or import restrictions in host countries, but as a strategic device to form a global network of production and distribution based on each nation's comparative advantage. Despite Asia-Pacific region's diversity in terms of size, stages of economic development, industry structures and political regimes, Korea will find the region replete with complementary assets and opportunities for mutually beneficial cooperation.

In today's high-technology industries, no single firm can control all the critical technologies. In order to remain competitive in a globalizing market, a firm may want to cross-fertilize with either their domestic or foreign participating party. Korean firms will be attracted to Asia-Pacific region's emerging markets, skilled manpower, and assembly technology.

An economy that is trade dependent and has prospered in a relatively liberal world, Korea must support a free and open world trading system underpinned by the WTO. The close interface between business and government is becoming less justified. The government's explicit targeting of specific sectors and ensuing generous subsidies are no longer allowed under the WTO regime. The government must continue liberalizing its economy in all directions and give market mechanism a fair chance to function properly in allocating limited resources. In a similar vein, the Korean government must direct its efforts in removing such foreign investment barriers as lax enforcement of the protection of IPRs, shortages of social overhead capital, labor-management tension, control-riddened financial sector, and webs of government regulations.

After adopting some outward-oriented reform policies in 1978, China has dramatically expanded its participation in international trade and investment. Particularly, the strong Pacific orientation of China's trade and investment links have brought forth beneficial impacts on the export-led economies of the Asia-Pacific region. By currently calculating GDP based on purchasing power parity, the World Bank estimates that China will become the third largest economy in the near future. Such growth potential will sustain the expansion of trade and investment among Asia-Pacific countries. Therefore, it is important that the process of conforming China's trade and investment policies with multilateral rules will be extremely important for the Asia-Pacific economies and the liberal trading system.

With the emergence of a new world economic order symbolized by the WTO and given the new momentum in the Asia-Pacific region due to the expanding stance of APEC, there is a great potential for cooperation between Korea and developing economies of the region in building a mutually beneficial division of labor in the semiconductor industry.

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