# Understanding the Economic Development of Korea from a Co-Evolutionary Perspective[1]

**May 1, 2006**

**Joon-Mo YANG[2], Tae-Wan Kim[3], and Hyun-Ok Han[4]**

## Abstract

This paper applied a co-evolutionary perspective to understanding the economic development history of Korea, which is said to have shown almost miraculous economic growth. After reviewing economic policies and the economic situation over the last half-century, we categorized the dynamic competitive strategies of the government and recognized the co-evolutionary development. By way of illustration, we documented the case of Korean automobile industry from a co-evolutionary perspective. In conclusion, we argue that 'learning by doing' and the competitive dynamic strategies of the government and market forces are the key factors in understanding the forces underlying this economic success.

**Key words:** dynamic competitive strategy, learning- by- doing, co-evolution

**JEL Classification:** O33, O38, O53

1 This work was supported in part by Yonsei University Research Fund of 2004.

2 Professor of Economics, College of Government and Business, Yonsei University

Email: yangjm@yonsei.ac.kr Address: 234 Maejiri Heungeop-myeon Wonju-si Gangwon-do, 220-710, Republic of Korea Telephone: +82-33-760-2356

3 Associate Professor, Department of Economics, Dong-Eui University, Email: taewan@deu.ac.kr

4 Assistant Professor, Department of Economics, Pusan National University, Email: hhan@pusan.ac.kr

## 1. Introduction

Korea is known as a country that showed miraculous economic growth, but suffered a devastating economic crisis. Due to these contradictory experiences, there seem to be no clear-cut assessments of past Korean economic performance and the lessons derived from it. The controversies over what gave rise to the past economic performance are often accompanied by talk of political issues, political calculations, and even conspiracies. Therefore, it is a legitimate study to seek to extract the essence of Korean economic growth and any valuable lessons from it.

There are many issues involved in the causes of Korean economic growth; labor exploitation, the economic concentration of *chaebol*, Korean-type conglomerates, a laggard but supportive financial sector, and so on. In this paper, we would like to take a more fundamental perspective, namely, a co-evolutionary perspective, to review Korean economic history.

Whatever criteria are taken, no one can deny that the Korean economy has grown very well. We would like to derive the main lessons behind the economic path towards this success over the past five decades. As we know everything changes but change itself, and both the government and the private sector have responded to each other's changes in an ongoing dynamic way. Over the five decades, their strategies have changed, and the economy seems to have been moving towards a better form. In this paper, we have maintained a co-evolutionary perspective regarding the government policies and the private sector's responses, and investigated the role of the government that enabled the transition of the economy toward more knowledge based one. We strongly believe that these efforts will benefit us in building a prosperous future for the Korean economy, and hope that it will be similarly beneficial to other countries and building up their own economic prosperity.

Section 2 reviews the economic history of Korea from a knowledge-flow perspective. Section 3 puts forward appropriate questions to solve, and addresses the main forces behind the economic changes in Korea. Section 4 investigates what made the transition from the old to the new economic system. Section 5 illustrates the industrial development trajectory by studying the automobile industry of Korea. Section 6 rounds off with some concluding comments.

## 2. A historical review from a knowledge -flow perspective

### 2.1 Starting from scratch

### 2.1.1 Starting point: a review of the situation in the1960's and 1970's

Before we review the situation in the 1960's and 1970's, it would be worth mentioning the historical material base in Korea. Korea was traditionally an agriculture-oriented country and had a centuries-old landlord class. It was hard to expect the accumulation of commercial or industrial capital in these conditions. However, land reform in South Korea, which had begun with the passing of a land reform act in 1949, abolished the landlord class and initiated the transformation of land capital into industrial capital[5]. The government-run land reform induced landlords to give up their controls over peasants and enabled the state to draw support from peasants who benefited from the land reform. Eventually the government took over landlords' place in rural communities and the Korean War in 1950 reinforced this process. Both land reform and the Korean War destroyed the landlord class, thus giving the government a basis for implementing its policies. The transformation of land capital into industrial capital laid the foundation of the industrialization of the1960s and 1970s.

The beginnings of the economic miracle of Korea were not promising enough for there to be hope of any economic success. Due to the scarcity of natural resources, Korea's economic growth had to rely on its labor resources, which were qualitatively very poor. The illiteracy ratios in 1960 and 1970 were 27.9%, 11.6%, respectively (see KDI, 1995, for details). It took almost two decades before the government educational policy of attaining a high level of literacy finally paid off. This success was mainly due to government efforts to improve the educational environment, but the private sector was also involved in these efforts. Private firms operated their own special schools where their workers were able to continue to study and get even high school degrees.

The industrial structure was far from what we could expect to generate remarkable economic growth. Krueger (1997, p. 323) noted that almost all major exports were primary commodities in 1961, but by 1970 they had changed to labor- intensive manufacturing goods such as apparel and clothing, electronic products, steel products, plywood, footwear, and metal products. Up until the 1960s, Korea simply exported what it had without creating much value-added. Within a decade, the situation has totally changed. By the1970's, Koreans created much more value-added than they did in the previous decade. The conventional interpretation was that Korea's comparative advantage had shifted markedly. However, this transformation can be interpreted as showing that the knowledge base of the Korean economy kept increasing from the knowledge point of view. The next question naturally arising from this line of

[5] Landlords received government bonds convertible to industrial capital. Korea's land reform was relatively successful among capitalist countries in the sense that it had abolished the landlord class.(Shin(1997))

approach is who created the knowledge, and how was it distributed.

**Table 1: Structure of Exports, 1961 and 1970.**

| Rank | 1961 | | 1970 | |
|---|---|---|---|---|
| | Export | percentage | Export | percentage |
| 1. | Iron ore | 13.0 | Textiles, clothes | 40.8 |
| 2. | Tungsten | 12.6 | Plywood | 11.0 |
| 3. | Raw silk | 6.7 | Wig | 10.8 |
| 4. | Anthracite | 5.8 | Iron ore | 5.9 |
| 5. | Squid | 5.5 | Electronics | 3.5 |
| 6. | Other fish | 4.5 | Confectionary | 2.3 |
| 7. | Graphite | 4.2 | Footwear | 2.1 |
| 8. | Plywood | 3.3 | Tobacco/copper products | 1.6 |
| 9. | Grain | 3.3 | Steel products | 1.5 |
| 10 | Animal fur | 3.0 | Metal products | 1.5 |
| Total | | 62.0 | | 81.1 |

Source: Krueger (1997), p. 324 taken from SaKong (1993)

### 2.1.2 Role of government in building up the capacity for economic growth in the early stage

The main forces and basis for economic growth could not be created in a day, as the Korean government was well aware. In 1967, the Ministry of Science and Technology was established. It was responsible for research and development, science and technology, human resource development, international technology cooperation, science and technology improvement. The establishment of such a ministry, the first of its kind in a developing country demonstrated the determination of the Korean government to build up the knowledge base for economic development. In 1973, the Council of National Science and Technology Advisors was established in order to coordinate the policies, previously divided among many different government offices.

In order to overcome the shortcomings of technological capabilities for industrialization, the Korean government established industrial R&D institutes. The Korea Institute of Science and Technology (KIST) was founded in 1966 as an integrated technical center. In the 1970's, a number of specialized research

institutes were set up in the areas such as shipbuilding, geo-science, electronics, telecommunications, machinery, energy, and chemicals.

**Table 2: R&D expenditure (unit: billion won, %)**

| Source | 1963 | 1965 | 1970 | 1975 | 1980 |
|---|---|---|---|---|---|
| Government (A) | 1.2 | 1.9 | 9.2 | 30.3 | 180.0 |
| Private sector (B) | - | 0.9 | 1.3 | 12.3 | 102.5 |
| A/(A+B) (%) | 97 | 90 | 88 | 71 | 64 |
| R&D/GDP (%) | 0.25 | 0.26 | 0.38 | 0.42 | 0.77 |

Source: KDI (1995), p. 16

From Table 2, we can see how important the role of government was in the early stages of building the knowledge base. In the 1960's, government spending made up more than 90% of the total R&D expenditure. Even though the size of total spending itself was not large either absolutely or at relative to GDP, the start-up expenditure could spur the knowledge base formation and improve the capacity for innovation.

The Korean government also paid attention to the improvement of both the quality and quantity of tertiary education for innovation. Among the major measures it took to bring about improvements were the opening of the Korea Advanced Institute of Science (KAIS), a graduate school of applied science and engineering in 1975, and the allocation in 1977 of specialised areas of research to six major national universities, i.e., Kyungpook National University for electronic engineering, Pusan National University for mechanical engineering, Chonnam National University for chemistry, Chonbuk National University for metal and precision mechanical engineering, Chungbuk National University for civil engineering and architecture, Chungnam National University for engineering education.

These early efforts of Korean government became the basis for economic development as well as for knowledge accumulation. Even though these were highly appreciated, the actual outcome steps fell well short of what had been hoped for. There was a long wait before these efforts initiated endogenous knowledge creation, learning, and diffusion.

### 2.1.3 Role of the private sector in the early stages

In the 1960's and 1970's, creation of the knowledge base had just been initiated, so the private sector's activities in building it up for innovation could not be expected. Firms mainly focused on the near-term horizon in their business oriented activities, but the success of such business helped the private sector build up its own innovative capacity.

Knowledge can be learned and accumulated by doing business or by using technology. Knowledge is essential for innovations. However, innovation can be achieved even without researches. Cowan et al. (2000) argue that innovation without research deserves attention as an important source of technical advances. The private sector had no scope to spend resources on research and development, but it contributed a lot to expanding the knowledge-base of the Korean economy and to innovating of its own accord through engagement in business.

In the early stages, endogenous knowledge creation and innovation could hardly be expected but export industries have changed toward becoming relatively more knowledge intensive. From this we can easily conjecture that knowledge flowed into Korea from abroad.

**Table 3: Knowledge flows from abroad 1962-1981 (unit: US$ million)**

| Source | 1962-1966 | 1967-1971 | 1972-1976 | 1977-1981 |
|---|---|---|---|---|
| 1. Foreign Direct Investment | 45.4 | 218.6 | 879.4 | 720.6 |
| 2. Foreign Licensing | 0.8 | 16.3 | 96.6 | 451.4 |
| 3. Technology Consultancy | - | 16.8 | 18.5 | 54.7 |
| 4. Capital Goods Imports | 316 | 2541 | 8841 | 27978 |

Source: Kim and Seong (1997) p. 388.

Table 3 illustrates the various forms of knowledge flows. The direct form of technology transfer is foreign licensing. During the 1960's, the amount of foreign licensing was very small partly due to the very restrictive policy against licensing. The major form of knowledge flow was in the form of capital goods imports, which were usually accompanied by operating and maintenance manuals as well as customer service from abroad. While using the capital goods, private firms acquired applied knowledge as well as basic knowledge of the operation either through codified manuals or through face- to-face meetings with technicians from abroad. Technology consultancy provided Korean engineers with opportunities of gaining 'know-how' or tacit knowledge.

Foreign direct investment also triggered knowledge activities. It brought managerial skills as well as technology to Korea. The method of knowledge acquisition was mainly through "learning- by- doing." The government, however, tightened its control over foreign direct investment in 1970's in contrast to the policy trends of the 1960's. Korea in the 1970's experienced compressed economic growth, but FDI's role was relatively small compared to that in other countries such as Singapore. The Korean private sector built up its own capacity and knowledge for innovation by doing business with imported capital goods and relying on foreign debt. Therefore, it would be reasonable to conjecture that this explains why Korean business culture has been so distinctive and pervaded by the 'can-do-spirit', which was most especially characterized the attitude of the 1970s.

Overall, the private sector, even though it had only limited capacity to create new knowledge, expanded its own knowledge base either through learning by doing or through learning by using. The expanded knowledge base would enable it to cope with competitive challenges and to transform the industrial structure in the future.

### 2.2 Where we are: an assessment of the knowledge base

The urgent issues in the early 1980's after the two oil shocks of the1970's were economic stabilization and restructuring of industries that had revealed inefficiencies (mainly through over-investment in the HCIs (Heavy and Chemical Industries)). After the successful economic stabilization and reform of the industrial support system, Korea's economy shifted towards a more open economic system gradually in response to trade frictions and the demand for trade liberalization. Due to changes in the labor market situations, HCI promotion, and the increased capabilities of the private sector, Korea's economic structure evolved toward one with high ratios of capital and knowledge- intensive industries.

Table 4 shows the international market shares of Korea's major industries. High technology industries in Korea have shown rapid growth, and their international market shares have soared. Korea has become one of major producers of the communication devices and semiconductors, which mostly demand a high technological knowledge base. The knowledge base of Korea is gaining international competitiveness as its industries are becoming more competitive in the world market.

**Table 4: International Market Share of Major Korean Industries as of 2000**

(unit: %)

| Sector | Industries | International Market Share |
|---|---|---|

| | | |
|---|---|---|
| High Technology Industry | Communication Device | 5.5 |
| | Computers | 4.6 |
| | Semiconductors | 11.7 |
| | Fine Chemicals | 1.4 |
| | Biochemicals | 1.9 |
| | Advanced Materials | 1.3 |
| | Environmental Engineering | 1.1 |
| Traditional Industry | Machinery | 2.8 |
| | Motor Vehicles | 5.4 |
| | Electric Appliances | 8.1 |
| | Ship Building | 40.6 |
| | Petrochemicals | 5.1 |
| | Steel | 6.0 |
| | Textiles | 5.0 |
| Parts Industry | Electronic Parts | 4.9 |
| | Motor Vehicle Parts | 4.8 |
| | General Machinery Parts | 3.1 |

Source: KIET (2001), p. 29

Table 5 provides an international comparison of information and communication technology (ICT) infrastructure and ICT contributions to economic growth. Compared to advanced countries, Korea's ICT infrastructure is very competitive. For example, people in Korea are better equipped with mobile communication devices than those in Japan and U.S.A. This means that there are more opportunities for mobile-related business in Korea. The international ranking of Korea in e-commerce was higher than that of Japan in 2001. The contribution of ICT to economic growth in Korea was 3.8 percentage points during the period 1992-1997, which was far greater than that in U.S.A. and UK. The communications industry in Japan made a greater contribution to economic growth than that in the U.S.A., the UK, and Korea. KIET (2001a) shows that the innovation index of Korea relative to U.S.A. (U.S.A.=100) was 121 in 2000. Even though industry–university cooperation in R&D activities needs to be improved, Korea's firms and government are striving for competitiveness in world markets to innovation.

**Table 5: International Comparison of Infrastructure in Information and Communications Technology**

| Categories | Korea | Japan | US | UK | China |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| ICT infrastructure | | | | | |
| 1. Mobile communications subscribers per 1000 persons | 567 | 458 | 401 | 673 | 67 |
| 2.International ranking of e-commerce (IMD, 2001) | 23 | 31 | 3 | 16 | 39 |
| Contributions (% point) | | | | | |
| 1. Contribution of ICT to economic growth | | | | | |
| 1992-1997 | 3.8 | 4.3 | 1.2 | 1.4 | |
| Hardware | 1.2 | 0.2 | 1.1 | 0.8 | |
| Software | -0.4 | -0.2 | 0.2 | 0.1 | |
| Communications | 3.0 | 4.3 | 0.0 | 0.5 | |

Source: KIET (2001 a), p.113, p.118, p.119

**Table 6: International Comparison of Science and Technology R&D Performance**

| | Korea | Japan | US | China |
|---|---|---|---|---|
| 1. Scientific and technical papers published (2001) | 14,673 (15) | 70,655 (2) | 257,684 (1) | 29,441 (8) |
| 2. R&D Funds(2001) | | | | |
| Ratio to GDP | 12.5bil$ | 127.9bil$ | 282.3 bil $ | 1042.5 100mil Yuan |
| 3. Industrial property rights granted(2000) | 2.92% 126,395 | 3.09% 274,646 | 2.82% 284,454 | 1.23% 258,313 |
| 4. Technology trade (2001) | 619.1-2642.7 | 10178-11278 | 38668-16359 | |

Source: KITA (2004) p.36, p.109, 180

Table 6, however, tells us that Korea's performance in science and technology R&D as of 2004 left much to be desired. Fewer scientific and technical papers were published than in China, and the number of industrial property rights granted was smaller, too. Technology trade was still in deficit. Korea's economy was able to take advantage of ICT by providing a relatively good ICT infrastructure, but the knowledge-base needs to be upgraded in order to support sustainable economic growth. This is another challenge to

both the government and the private sector. Judging form the co-evolution between them, we can conjecture that they will adapt themselves to the new environment and thrive in it.

## 3. The Appropriate Questions

The Korean economy has shown the tremendous achievement in the successful transformation of the industrial structure to a more knowledge-based one. Who created the knowledge and made the miracle? The answer seems to be clear. The major innovative actions were taken by the private sector. It was firms that invested the greater proportion of the total national R&D expenditure, and it was firms that actually made innovation profitable. Therefore, we can safely argue that the private sector has been always the hero in the Korean economic success story. How about the government?

Porter et al. (2000, p. 9) posed the following puzzle: "If Japanese government policies and practices in fact accounted for the nation's extraordinary competitiveness, why was not Japan competitive in large, important industries where those policies and practices had been explicitly and prominently implemented?" They argue that the straightforward guideline for the industrial success is competition.

Applying this guideline to the case of Korea, we would seem to be hard to explain its success story. Many believe that Korea's government has been engaged in economic activities and has managed the competition. Actually this is an undeniable fact. Thus, we would like to pose a different puzzle about the behaviors of both the government and the private sector from that put by Porter et al. (2000): "How has the seemingly managed competition been compatible with the economic success?" Let us call this the Korean puzzle. Another somewhat simplistic perception about the strategy for the success concerns Korean firms' overall strategy; i.e. Korean firms simply imported intermediate goods and capital goods, processed them and exported them either as capital goods or as consumer goods.

Considering these two commonly-held perception about the Korean strategies, which would turn out to be wrong from Porter's argument, we are obliged to ask ourselves: "What was the role of Korean government in the past four decades; how we can solve the Korean puzzle, and finally what was the real force or strategy in getting things done?" The answers to these questions will be background for legitimate questions and tasks for further economic development in the future.

### 3.1 Business systems

Since the Korean policy regime underwent the inevitable change from import substitution to an export oriented policy, the economy has taken the path of dependence on the external sector and on foreign economies. Therefore, Korean firms had to face the international competition whether they were protected in the domestic market or not. This means that firms had to play by the international rules in the

international business system. They could export only products that had either price-competitive advantage or quality- competitive advantage.

Considering the situation of the early development stage of Korean economy, however, firms had to take advantage of low wages or economies of scale in the production. They had to rely on internationally-competitive companies, so they produced commodities on an OEM-basis or as subcontractors. As latecomers to the international market, some firms built large-scale factories which could enjoy economies of scale. This way of business was inevitable because most firms lacked knowledge about the international markets and know-how of making competitive commodities in quality. They had to import equipment, intermediate goods, and know-how. By engaging in these businesses, some firms acquired the business know-how, management skills, and knowledge of how to make their own competitive goods. Even though some firms became competitive in the capital goods sector, most firms relied heavily on foreign sources of the capital goods. Then how were firms able to mobilize the resources? In this respect, the government's policy of so-called managed competition in the domestic market and its preferential treatment of leading firms were effective at the outset of economic growth.

The establishment of an internationally integrated business system in Korea is largely the legacy of the export-oriented policy regime and the domestically-managed competition policy. Due to the weakness of the domestic market, many firms had to focus on international market. To survive in it, they had to rely on economies of scale, but the capacity required for economies of scale was relatively huge compared to the size of the domestic market. For example, one CEO complained that Hyundai would have to build a factory that could produce 56,000 passenger cars, whereas the size of the entire domestic car market size was only about 12,000 cars in the 1970's ( Kim et al, (1999), p.44). Therefore, if they failed to compete in the international market, they would fail any way whether the domestic market was protected or not.

We think that this export-oriented business system created a different attitude toward innovation and knowledge accumulation. Compared to the Japanese domestic market, the Korean domestic market is relatively small. Unlike the Japanese case and in contradiction to Porter's argument, Korean firms could not enjoy the protected market without innovation. This is the most important factor which led Korea's economy to prosper. Once we accept this logic, it would be more interesting to ask how the government policy helped firms to be competitive in the world market.

The Korean economy has become deeply intermingled with the international business system. The old system, where firms imported capital and intermediate goods from abroad and exported final goods, changed to a new more complicated system. It has evolved to a system that is capable of surviving against international competition.

Table 7 shows the results of the policy as measured by major export and import goods in 2003. Of total

exports some 41.8% consisted of capital goods, while the share of consumer goods in exports was only 29.7%. Major trading goods are from heavy and chemical industries. The share of intermediate goods in imports is 50.1%, and that in exports is 28.4%. This shows how deeply the business system of Korea is integrated into the international business system. What does this mean for us in solving the Korean puzzle? The private sector had to maintain its international competitiveness in order to survive international competition. Even though there was government protection and involvement, this was not of itself sufficient for firms to be successful without innovation on their own part.

**Table 7: Major Export and Import Goods in 2003 (mil. US Dollars, %)**

| Exports | Amount (Share) | Import | Amount (Share ) |
|---|---|---|---|
| Total | 193,817(100) | Total | 178,827(100) |
| 1. Intermediate goods | 55,108(28.4) | 1. Intermediate goods | 89,519 (50.1) |
| 2. Capital goods | 80,935(41.8) | 2. Capital goods | 66,947(37.4) |
| 3. Consumer goods | 57,565(29.7) | 3. Consumer goods | 21,075(11.8) |
| 4. Others | 209(0.1) | 4. Others | 1,286(0.7) |
| Industries | | Industries | |
| 1. Heavy and chemicals industry | 164,446(84.8) | 1. Heavy and chemicals industry | 119,635(66.9) |
| 2. Light industry | 24,081(12.4) | 2. Light industry | 13,070(7.3) |
| 3. Primary industry | 5,291(2.7) | 3. Primary industry | 46,122(25.8) |
| Major commodities | | Major commodities | |
| 1. Semiconductors | 19,535(10.1) | 1. Oil | 23,082(12.9) |
| 2. Automobiles | 19,119(9.9) | 2. Semiconductors | 21,082(11.8) |
| 3.Wireless Communication devices | 18,697(9.6) | 3. Petrochemicals | 5,987(3.3) |
| 4. Computers | 14,977(7.7) | 4. Computers | 5,672(3.2) |
| 5. Ship-building | 11,334(5.8) | 5. LNG | 5,082(2.8) |
| 6.Petrochemicals | 6,623(3.4) | 6.Steel Sheets | 3,320(1.9) |

Source: Korea Trade Information System (http://db.kita.net/)

### 3.2 The questions to be asked

The major industries and competitive industries have kept changing as time changes. This is not surprising, but as the economy develops, the transition from existing industries to sunrise industries creates political tensions and economic burdens. Human capital accumulation in the existing industry becomes obsolete, as to the embedded technology and knowledge. Firms and people cannot help but adjust themselves to new and risky businesses. Moreover, the transition takes a lot of time and patience. Korea's leading industries have changed. Did these transitions just happen or were they intentionally prepared?

Samsung started out in the semiconductor business in 1974 when it bought a semiconductor firm. It took almost 20 years for it to become the first in the world to develop16-Mega DRAMs in 1992 and to become the world leader both in production and in technology. Hyundai Motor Company started out in the automobile business in 1967, but it took seven years to build its own model. Business know-how cannot be acquired in a day. The external environment such as the growth and evolution of world markets is changing. There are two important characteristics in the industrial transition; one is that it takes time to get on the legitimate track of industrial growth, and the other is that the future of the growth trajectory of a particular industry is very uncertain.

Even though Porter et al. (2000)'s claim about competition is quite right, there is a room for government to intervene in the transition due to the time and risk involved in the transition. Therefore, we think the following questions are appropriate to ask: "How was Korea able to maintain competitive advantage in growing sectors and high-value added sectors? How was Korea able to catch the dynamic trajectories of those sectors? How did Korea deal with the risks related with the transition?"

## 4. Making the transition toward a knowledge-based economy

### 4.1 What are the real forces behind the transition to a knowledge-based economy?

Before we talk about the role of government which is of interest, we would like to discuss what may be the real forces behind the changes. Always among the most powerful and effective forces are market forces and expectations of them. As a latecomer, Korea was able to observe market forces and their future prospects before it started. The logic was simple; if it was possible to reduce the costs so that they had a price advantage, firms could export their products. The market size of light industry was large enough for many Korean firms to be engaged in it and be profitable. But light industry was not the leading industry in the world markets. According to UN statistics (UNSD Comtrade Database), the top imported

commodities in 1962 (the first year of the first five-year economic plan of Korea) were “petroleum and petroleum products,” “machinery other than electric,” “transport equipment,” “iron and steel,” and “textile yarn, fabrics, made up articles.”

Cha et al. (1997, p.22) argued that there were three reasons for the government plan to promote the heavy and chemical industries (HCI) in the 1970s; the first reason was for the purpose of constructing a domestic defense industry which was essential to enhance the nation’s self-defense capacity, the second was the need to cope with both increasing trade barriers against her labor-intensive exports and to raise the domestic wage-rental ratio, and the third was for the purpose of improving the country’s balance of payments. Even though controversies remain over the real causes, there were undeniable forces arising from demand of the world market underlying the successful development.

Changes have taken place in the world’s major imported commodities have occurred. In the 1960s, it would not be difficult to discern which industries would prosper. The risks associated with market prospects were not that large, but there was a relatively huge risk as to how Korean firms could compete in these industries against rivals in the developed countries. This was one of the difficult roles of the government: sharing the risks and creating an efficient environment. The industrial-complex approach was very effective in order to exploit the economies of scale and reduce the transportation costs (because the major industrial complexes were built near ports around the coast of the Korean peninsula).

In the 1980s, the importance of traditionally main industries such as “iron and steel” diminished and industries such as “miscellaneous manufactured articles, nes” and “electric machinery apparatus and appliances” came to see more active trade. This is interesting because it implies that the strategy and the target industry should have changed. Fortunately, however, the major trend of the government plan for the management of the economy was to shift toward more private sector-oriented and pro-liberalisation policies and liberalization favored policies.

**Table 8 : The world’s major imported commodities**

| year | 1962 | 1965 | 1975 | 1985 | 1995 |
|---|---|---|---|---|---|
| Top Imported Commoditi | Petroleum and petroleum products (10.7) | Machinery, other than electric (10.1) | Petroleum and petroleum products (18.4) | Petroleum and petroleum products (15.8) | Machinery, other than electric (14.5) |

| | | | | | |
|---|---|---|---|---|---|
| es (%) | Machinery, other than electric (10.5) | Petroleum and petroleum products (9.4) | Machinery, other than electric (10.8) | Machinery, other than electric (11.3) | Electric machinery, apparatus and appliances (12.5) |
| | Transport equipment (6.6) | Transport equipment (6.6) | Transport equipment (8.6) | Transport equipment (10.4) | Transport equipment (10.2) |
| | Iron and steel (4.7) | Iron and steel (4.8) | Electric machinery, apparatus and appliances (5.4) | Electric machinery, apparatus and appliances (7.2) | Petroleum and petroleum products (5.9) |
| | Textile yarn, fabrics, made up articles, etc. (4.5) | Electric machinery, apparatus and appliances (4.4) | Iron and steel (4.8) | Miscellaneous manufactured articles, nes (3.6) | Miscellaneous manufactured articles, nes (4.6) |
| Total Import | $112,459,192,832 | $170,714,182,656 | $820,414,021,632 | $1,799,651,549,184 | $4,861,086,203,904 |

Note: selected classification : SITC rev. 1

Source: UNSD Comtrade Database http://unstats.un.org

There was another change in the market: the change in the technology and knowledge aspects of the major imported commodities in the world market. Even though we have observed almost the same categories, the quality and the technological level demanded by the market kept increasing. In the case of the U.S.A., for example, the share of high-tech industry in the exports of manufacturing increased by 10 percentage points from 26% in 1970 to 36% in 1985. Japan showed a tremendous increase of 12 percentage points over the same period. Other countries experienced a similar phenomenon. In addition to this, the sharpest increases took place mainly in the 1980s. This evidence supported the contention that the market was moving toward high-tech industries. In response to these changes, Korean firms took actions to handle these changes and the government also changedrevised its policy regime.

**Table 9: The share of high-tech industry in the exports of the manufacturing industry (unit:%)**

| year | 1970 | 1975 | 1980 | 1985 |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| U.S.A. | 26 | 25 | 27 | 36 |
| Japan | 20 | 18 | 24 | 32 |
| Germany | 16 | 15 | 16 | 18 |
| France | 14 | 14 | 14 | 18 |
| UK | 17 | 19 | 21 | 27 |
| All | 16 | 16 | 17 | 22 |

Note: All includes Australia, Austria, Belgium, Canada, Denmark, Greece, Iceland, Ireland, Italy, Netherlands, New Zealand, Norway, Portugal, Spain Switzerland, Turkey, and Yugoslavia as well as U.S.A., Japan, Germany, France, and the UK.

Source: Min and Choi (1994, p.42)

The private sector spent more on R&D. The government took measures for creating and building the innovation capacity. The ratio of R&D expenditure to GNP sharply increased to 1.73% in 1986 from 0.31% in 1971. According to Min and Choi (1994, p.43), NICs (Newly industrializing countries) including Korea sold more commodities in the high-tech industries, so their share of the high-tech commodities in world exports increased from 1.3% during the period of 1970-1973 to 7.56% during the period of 1985-1987, while the share of the OECD member countries decreased. The competition in high-tech industries will continue to be severe, while the market for their products will expand. The overriding task that the Korean firms should keep in mind is nothing but innovation in order to deal with these challenges. Therefore, the major and real forces are the market forces that have been requiring the private sector and the government to adapt themselves to the ever-changing market. They have had to evolve in order to survive.

### 4.2 Understanding government strategies

#### 4.2.1 Dynamic competitive strategies

Korea has shown a surprising record both in growth of incomes and of technological capacity. There must be a reason behind these successes. If there had been no favorable environment for economic success, then the agents' capacity must have been the source of the success. If there had been no strong evidence to believe in the initial capacity, then the system itself must have been effective. If the system created a crisis, then the success would have been a miracle. Most people call the Korea's economic success as "the Miracle of Han River." If we assess the policies and strategies of the Korean government and Korean firms in a static way, we have no option but to call it a miracle. If we, however, assess them from evolutionary perspective, then the co-evolution of the government and the private sector will explain how Koreans accomplished seemingly miraculous economic success

In order to understand the mechanism, we would like to remind readers of the evolutionary model of variation, selection, and retention; how variants are introduced, how selection leaves behind variants that were not fit according to the prevailing selection criteria, and how some variants are retained over time to create a historical trajectory.

The sources of variation were diverse: firms imported technology directly; inward foreign direct investment stirred up the established way of business; scholars and engineers trained abroad had many opportunities of working in firms and leading them; and innovation through learning by engagement in business was another source of variation.

The most important aspect of successful evolution is how successful variants are selected. Fortunately, the selection process turned out to be not too bad. Murmann (2003)'s story of how Germany moved from a laggard to an uncontested leader in the dye industry emphasizes the importance of competition and selection criteria of profitability. One of the elements of the rise to leadership of the German dye industry was the absolute number of entries and exits; 91 firms (78.4%) went out of business among 116 in 1914, which was the highest number as compared with Britain (76.5%) and U.S.A. (71.4%). Only the successful firms were remained. This was the retention process.

It is not hard to grasp whether the *chaebol* model, which is the economic development strategy of mobilizing resources to a small number of leading firms *and* their affiliated firms, could fit into this category. Within the *chaebol*, numerous variations have been tried. Initially, the *chaebol* started with small firms that showed tremendous success in their business. Such firms tried to expand their business territory, and formed a *chaebol*. With the help of a favorable policy environment, the *chaebol* tried variations. The most competitive firms were those firms affiliated with other *chaebol*. Some lead the other in some area; they had to compete among themselves. If they turned out to be successful, they were retained within the *chaebol*, which kept growing.

The "too big to fail" myth might have created a crisis, but the *chaebols* were leading the creation of the technological capacity, and the successful business models and know-how were retained within the *chaebol*'s internal system.

The Korean government has evolved for the past five decades; Variations or mutations came from the political regime changes or coup d'état. The changes in political regimes forced the government to change or to review its existing policies, and to raise new issues. Those who succeeded in making government policies that suited the new environment and solved the existing problems could enjoy promotion or gain high positions in the government hierarchy. Due to this selection process, the successful were retained within the government system.

Now from this evolutionary perspective, we argue that one of the reasons behind the success was that the government and the firms did not stick to one strategy, rather they tried to change their strategies when changes were needed, sometimes in a timely manner and sometimes a little bit late. In other words, they adapted dynamically. More importantly when the government changed its policies, it adopted a long-term vision and sought policy measures to achieve that vision. The government changed its policies and so did the private sector; they interacted with each other; in this sense, the co-evolution of these two entities was essential for building up the effective and successful system. Judging from this co-evolutionary perspective, we argue that the government has followed dynamic competitive strategies, and that the role of the government should be given credit for the success, while the private economic agents were the heroes of the economic success.

There are some essentials for a successful dynamic competitive strategy; recognition of the sources of advantage and their erosion in the competitive environment, and anticipation of the reactions (see Day and Reibstein (1997) for more details). Campbell (1994, p.372) argues that the role of the Korean state in technology policy had changed over time, from institution building and virtual dominance to partnership with the private sector for cooperation and occasional private sector dominance. Not only technology policy but also other fundamental economic policies have changed over time, considering the sources of advantages and environmental changes as well as the capacity changes and the reaction of the private sector. We think that this dynamic competitive strategy of the government effectively made the transition successful. Sometimes it did not work and sometime it achieved tremendous success, but there has been co-evolution between the government and the private sector, so that the government changed to an alternative dynamic competitive strategy when the original plan created problems. We argue that in practice this is the best and most effective strategy and that the Korean government took this strategy whether consciously aware of it or not.

### 4.2.2 Making the transitions to a more knowledge-based economy

Korea has experienced fast economic changes, and Cha et al. (1997, p.76) and many others argue that there had been several distinct phases to the management of Korea's economic growth; the first phase is the period from 1963 to 1971 marked by President Park's promotion of the rapid growth of manufactured exports; the second phase is the period from 1972 to 1979; the third phase is the period from 1980 to 1987, which emphasized liberalisation of economic management; the fourth phase is that from 1987 to 1997, in which there were efforts to upgrade the industries; and the fifth phase is the period since 1998, which is characterized by a phase of transition to a knowledge-based economy. These phase distinctions coincide

with the political regime changes determined by the political process. Each political regime recognized the contemporary economic issues and changed the previous economic policy regime. In this sense, these distinctions can generally represent the regime shifts. The political regime changes, however, do not represent the true evolutionary aspects of the policies, because the government recognized the problems of the contemporary policies and tried to remedy them before the regime changes. In fact the government has been aware of the dynamic aspects of the policies.

Table 10 summarizes the dynamic competitive strategies since 1960. The perspective for an understanding of the government strategy is that of a cooperative game theoretic situation between the government and the private sector with a dynamic perspective. In each transition, the market gave the lead for change, the government reacted to the lead, and the market supplied the real forces behind the economic growth. Some policies failed partly because the market did not respond and give any economic incentive for the private sector to follow or partly because the government's policies were not compatible with the private sector's capabilities or responses. More importantly, dynamically-correct policies sometimes create time-inconsistency problems and off-equilibrium inefficiency from the static comparative-advantage perspective.

The HCI drive in 1970s created the overinvestment problems. Even though without the HCI drive policy in 1970s we cannot think of the Korean economy today, the dark side of the HCI drive policy forced the government to restructure it in the 1980s, which was actually its main agenda and the policy was changed to liberalization. The liberalization created favorable environment for the market to prosper. The private sector's capacity developed in this period allowed the economy to enjoy continuing economic growth and enabled the private sector to deal with technology competition in the near future.

In 1986, the government abolished the special industry promotion acts and promulgated an "Industry Development Act" emphasizing a functional approach without targeting industries. A couple of reasons behind this were that the previous targeting strategies already achieved their own goals while their effectiveness in the new environment was in doubt. The new functional approach also had measures for correcting the market failure and the imbalance of the economy.

The government-supported research institutes established since the 1960s and 1970s, and the tremendously expanded tertiary education institutes in 1980s (due to education policy) formed the background to deal with the challenges of the 1990s. Through out the 1990s, the market required increasingly higher levels of technology and knowledge, and industries were forced to follow the market trend. Due to the external market that the Korean economy depended on and liberalization, the private sector threw itself actively into competition for technology development. The major technology breakthrough occurred in the 1990s when 64-Mega DRAM chips and 22 inch TFT LCDs were developed for the first time in the world in 1992 and in 1995, respectively, and car engines were developed using

domestic technological capacity in 1991. The government also supported these activities for upgrading industry. Since the late 1990s, knowledge has become the most important factor for Korean economic growth. The transition to a knowledge-based economy was regarded as the most important theme of economic polices. (See OECD (2000) for more details.)

**Table 10: Formulating dynamic competitive strategies**

| Period/Policies/ tools | Category of strategies | Essence of Consideration in Dynamic Competitive Strategies |
|---|---|---|
| 1960s | | |
| Policy: Export Oriented growth | (S) | Competitive wages |
| | (E) | Nothing to lose |
| Tools: comprehensive export promotion measures [1)] | (A) | Strong will for economic success, No major incumbents |
| | (C) | Favorable international market, weak domestic market |
| | (AS) | Prepared for upgrading to HCI: 1967-1971 special industry promotional laws (machinery, shipbuilding, textiles, electronics, petrochemicals, iron and steel, and nonferrous metals) |
| 1970s | | |
| Policy: HCI drive plan in 1973 (Export Oriented growth) | (S) | Acquired business know-how (management skills) through learning by doing |
| | (E) | Increased wages |
| Tools: financial support, tax and fiscal incentive, market protection, administration regulation | (A) | The success of the previous business enabled firms to take more risks. |
| | (C) | Less favorable international market; expansion of the domestic market |
| | (AS) | Upgrading and building the knowledge base; Establishments of government-funded research institutes [2)] |
| 1980s | | |
| Policy: liberalization industrial restructuring | (S) | Competitive business skills, Competitive process technology, Accumulated private capital |
| Tools: deregulation, fight | (E) | Overinvestment in HCI |

| | | |
|---|---|---|
| against inflation, decrease in export support, improvements of legal system in favor of workers | (A) | Major incumbents, Market forces became effective. |
| | (C) | Pressure of domestic market opening Effective major competitors competed in the domestic market |
| | (AS) | Discussing the issues of the market failure |
| 1990s | | |
| Policy: Upgrading Industrial structure/ Globalization | (S) | Internationally competitive private sector; Upgraded knowledge base (technology capability, tertiary education institutes and graduates) |
| Tools: Supporting R&D for High tech industry, G7 project | (E) | Hike in wages, Needed reforms in the economic system |
| | (A) | The private sector was able and willing to invest in new business opportunities. |
| | (C) | Globalization (WTO) ; Increased international competition |
| | (AS) | Changing *chaebol* or the main engines of economic growth |
| 2000s | | |
| Policy: Knowledge Based Economy | (S) | Internationally competitive private sector; Upgraded knowledge base ; Diversity |
| Tools: | (E) | Ageing population, Erosion of “Can-do spirit” |
| Supporting Knowledge based activities | (A) | Heighhtened democratic demands from the workers. Global management of the private sector |
| | (C) | Globalization (WTO) ; Increased international competition |
| | (AS) | High powered small and medium sized firms |

Note: 1) Following the exchange rate reform (1964-65), the government abolished ad hoc export promotion measures such as direct export subsidies and the export-import link system. It also used the export targeting system, the support of the government-owned Korea Trade Promotion Corporation (KOTRA), and the Monthly Export Promotion Conference. See Cha et al. (pp.16-17) for details.

2) The Korea Institute of Science and Technology (KIST) was founded in 1966 as an integrated technical center to meet the country's industrial needs. In the 1970's, a number of specialized research institutes were set up. Each institute was desigined to develop capabilities in strategic areas like shipbuilding, geo-science, electronics, telecommunications, energy, machinery, chemicals, and so on.

See http://www.most.go.kr/most/english/grls_01.jsp for more details.

Notations: (S) denotes ‘source of advantages’, (E) ‘erosion of advantage’, (A) ‘anticipated reactions of

the private sector', (C) 'competitive environment' (AS) 'alternative strategies'.

**5. Understanding the industrial technology trajectory: the case of Korean automobile industry**

The role of the government has changed in a process of co- evolution with the private sector as the industrial structure becomes more complex. In the beginning of the development, the government took active measures in for building technological capacity. Through the process of technological development, the role of the government changed from institution building to partnership with the private sector, to advanced management of the national innovation system and knowledge-base. In building technological capacity, the role of the government may vary according to the types of technology. Campbell (1994, p.2) argued that the government played the leading role in the development of the TDX telephone switching system, through an R&D consortium, only a supporting role in the development of PCs and memory chips and only a minor role in biotechnology. In this section, we will investigate the government strategy in the automobile industry.

Kim et al. (1999, pp. 31-33) analyzed the process of the technology development in the Korean automobile industry. According to their study, there are four stages in the development of this technology; the first stage is an initial accumulation of knowledge about making automobiles, the second stage is assembling, the third stage is manufacturing, and the fourth stage is creation using own technology.

The first stage was before 1961. There were several assemblers and parts suppliers that assembled cars with used car engines and parts and manufactured parts such as pistons, brake linings, and fan belts. In 1948, the government gave preferential treatment to domestic parts suppliers. Before 1950, there were only 13 parts which were produced domestically, but the number of domestic parts had increased to 500 by 1962. In 1955, Sibal Motor Company produced the first domestic car.

The second stage started with Shinjin Motor Company's "Sinseongho." Shinjin Motor Company entered into a technology alliance with Toyota and produced Coronas in 1966. Backing this development, were automechanics who got their training in military service. In 1966, a national certificate examination was held for motor vehicle mechanic license, which produced 3,303 certificate-holders out of 5,035 applicants. These steps contributed to the development of the car industry in Korea.

In 1967, the government policy changed to giving business permits only to firms that established technological alliances with advanced country carmakers. In 1972, Shinjin established GM-Korea with GM, and produced GM models instead of its previous Toyota model. By 1975, 72% of parts could be made in Korea. KIA introduced the Brisa, a Mazda model, in 1974. Of the parts used in manufacturing

the Brisa, 63% were made in Korea, and the ratio kept increasing to reach 89% in 1976. In 1968, Hyundai Motor Company manufactured Cortina, Ford-20M in a strategic alliance with UK Ford. Only 21% of the parts were sourced domestically, but the ratio also kept increasing to reach 28.9% in 1969, 31.3% in 1970, and 60% in 1975.

The third stage started with the production of Pony by Hyundai Motor Company. How was Hyundai able to develop its own model in 1974 and produce it in 1975? Hyundai invited George Henry Turnbull from British Leyland Motors Corporation to serve as vice-president. The magic was the combination of design from Italdesign, transmission and engine from Mitsubishi, technology transfer (bodies) from Perkinson, molds from Ogihara Mold Company, presses from France, and funds from the U.K. (Barclays) and France(Suez). From 1974 to 1977, six British engineers trained the engineers of Hyundai Motor Company. This project was encouraged by the government's "Long Term Promotion Plan for the Automobile Industry."

Thereafter, Korean car makers' innovations continued; in 1982, Hyundai developed "Pony-II," and exported it to Canada in 1984. Hyundai developed "Excel" and exported it to the U.S.A. after it had passed the FMVSS (Federal Motor Vehicle Safety Standards). It also dispatched its own engineers abroad for training; 83 persons in 1983, 166 persons in 1984, 276 persons in 1985, and 351 in 1986. Kia developed "Pride" on the basis of Mazda's model in 1987, and Daewoo developed its models from those of Opel. In the 1980s Hyundai, Kia, and Daewoo actively competed among themselves in the domestic market.

In the fourth stage, the major makers spent more resources on R&D. Hyundai Motor Company hired researchers as 10% of its total employees in 1993; Kia hired 7.9% in 1990; and Daewoo hired 10.1% in 1993. The number of Ph.D's among the researchers kept increasing in these three makers. Table 12 shows the researchers in the major car makers in the 1990s. This shows how much the major makers were concerned about improvements in technological capacity. The ratio of Ph.D.'s among researchers shows that technological development in 1990s was still concentrated on process technologies. According to survey results (Kim (1999), p.60), major Korean carmakers lacked the skills in all categories, especially in basic research, engine and transmission development, compared to the world's leading carmakers. It would be a challenge for the major Korean carmakers to overcome the technological gap that separated them from the world's leading automobile producers.

Co-evolution means evolving together. In other words, the private sector and the government have interacted and survived successfully, responding to the changing environment. The main characteristic of co-evolution is that it is dynamic. To survive, dynamic adaption is needed. As we can see from Table 11, the automobile industry and the government have interacted closely together. In the early stage, the government protected the domestic automobile industry. As domestic auto companies built up their competencies, the government lowered the level of protection.

**Table 11: Co-evolution of the private sector and the government**

| Year | Private Sector's Actions | Government Polices |
|---|---|---|
| 1903 | | Emperor Gojeong imported the first automobile in Korea from the U.S.A.. |
| 1955 | Sibal Motor Company manufactured the Sibal by using Jeep engines from the US Army. | Government's preferential procurement of domestic parts |
| 1962 | KIA, Sinjin Motor Company produced motor vehicles. | Protection of the domestic car industry |
| 1965 | Asia Motor Company moved into the industry | |
| 1967 | | Giving the business permits only to firms entering into alliances with advanced- country produces |
| 1968 | Hyundai started business with Ford Motor Company(UK) | |
| 1970 | Toyota was hesitant about continuing cooperation with Sinjin Motor Company.<br>Hyundai changed its alliance to GM.<br>(China vs Taiwan problem) | HCI drive of the government |
| 1974 | Hyundai produced the Pony as its own model | In 1973, the government announced "the Long Term Promotion Plan for the Automobile Industry." |
| 1984 | Hyundai established its own research institute. | Tariff 60% in 1986 |
| 1990's | More resources on R&D | Tariff 10% in 1994<br>(currently 8%) |

**Table 12: Researchers in Korean automobile industry**

| Company | Hyundai | | | Kia | | | Daewoo | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | 1990 | 1993 | 2000 | 1990 | 1993 | 2000 | 1990 | 1993 | 2000 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Researchers | 3418 | 4100 | 8000 | 1500 | 1700 | 5000 | 916 | 1373 | 3185 |
| Share in total employees(%) | - | 10.0 | - | 7.9 | 6.9 | - | 5.1 | 10.1 | 16.1 |
| Ph.D. holders | 14 | 16 | 80 | 11 | 20 | - | 12 | 25 | 64 |
| Master's-degree holders | 256 | 313 | 1000 | 105 | 135 | - | 61 | 255 | 704 |
| Share of Ph.D.'s in the total researchers (%) | 0.4 | 0.4 | 1.0 | 0.7 | 1.2 | - | 1.3 | 1.8 | 2.0 |

Source: Kim et al. (1999, p.50)

In assessing the development of knowledge and technology in Korea, the private sector's efforts should get the most credit for the success. Due to the export-oriented policy, domestic producers' main goal was survival against the competition in the international markets. In making their own models, it was essential that these should be internationally competitive. Even though all the major parts were sourced from the world market, the first models seemed internationally competitive. Another effort of companies was to diffuse this internationally competitive knowledge into their internal organization. That is, the knowledge should be embodied not only into the workers but also within the company itself. In order to close the gap, the companies dispatched employees abroad, and sought help from foreign engineers. In respect to knowledge management, however, the major carmakers needed to improve their practice. Kim et al. (1999, p.128) argued that the companies relied on the on-the-job training and overlooked the importance of investment in education and training.

Strategic alliances and university-industry collaboration now get more attention, but there is still a gap between the perceptions of the industry and the readiness to meet these needs on the part of universities. Putting more investment into education and training and enhancing the technological applicability of universities' scientific knowledge to the industry represents a new challenge.

From this brief summary, it may be seen that the government's policies and the private sector have coevolved throughout the development of the automobile industry. The question of how much credit the government deserves for the success may be difficult to answer, but more importantly, its policies evolved according to the development stages. The preferential procurement of domestic automobile parts by the government, the technology-enrichment policy in 1967, the special plan in 1973, and domestic market protection until the 1980s led the technology competence enabling Korean carmakers to develop their own engines and cars in the 1990s. Now the policy of opening the domestic markets and supporting

knowledge-based activities will give the carmakers greater competitiveness.

The government polices evolved by roughly following the dynamic competitive strategies, while the private sector has developed its own knowledge base by sometimes influencing the government for its own benefit and sometimes responding to the government's call for innovation.

## 6. Conclusions

Co-evolution refers to successive changes among two or more ecological interdependent but unique species so that their evolutionary trajectories intertwine overtime, adapting to each other. When we look at the economic development of Korea from a co-evolutionary perspective, we can conclude that the private sector and government co-evolved successfully, adapting to each other whenever needed. In the 1960s and 1970s, the government initiated the knowledge base and the private sector responded to this by learning and expanding its knowledge. In the 1980s the government focused on the economic stabilization and reform of the industrial support system. Responding to this, the private sector became the main force of knowledge creation and accumulation. After the 1980s, the role of government became relatively less explicit and the importance of the private sector has been strengthened further. This implies that the government has adapted itself to the changing market created by the domestic private sector and global competition

Knowledge has lately received greater attention as a main source of transition in the Korean economy; corporate -strategy theorists in particular have emphasized the idea of the firm as a body of knowledge. Even though a more refined view of knowledge has recently come to the fore, knowledge has been very important in industrial activities and it can be accumulated by a supportive cultural and policy environment, which the government is responsible for fostering. Weber (1930, p.24-25) argued as follows:

> Now the peculiar modern Western form of capitalism has been, at first sight, strongly influenced by the development of technical possibilities. … But the technical utilization of scientific knowledge, so important for the living conditions of the mass(of the) people, was certainly encouraged by economic considerations, which were extremely favorable to it in the Occident. But this encouragement was derived from the peculiarities of the social structure of the Occident.

However, there are two major problems in building and economy based on the knowledge; the time requirement to build the knowledge base and the innovative environment, and the uncertainty and complexity of the system where the knowledge can work efficiently. The private sector is obliged to grope its way toward success.

Lee (1986, p.247), the late CEO and founder of Samsung, wrote in his autobiography as follows;

> Samsung started with consumer goods, and grew with heavy and chemical industries such as electronics, petrochemicals, shipbuilding, and mechanical engineering. Now it focuses on semiconductors, computers, and genetic engineering. … If Samsung had ignored the economic situation when it established Cheil Jedang (sugar refinery company) and Cheil Industries (textile company), and started with the heavy and chemical industries, then it would have got into difficulties.

Learning by doing may be a necessary step for accumulating knowledge and creating knowledge. Firms as knowledge processors are very important agents in this task. However, the system of knowledge processing and the environment for agents of innovation are continually evolving. The government is a key to change, so it should prepare a suitable legal and cultural environment for it. As Weber pointed out, magical and religious forces, and the ethical ideas of duty based on them have been among the most important influences on conduct.

Regardless of these difficulties, firms will continue to make efforts for innovation. Otherwise they will fail to compete and fall by the wayside. Societies will in any case compete more on the basis of knowledge. The capacity for innovation and the efficiency of the knowledge system of a nation is becoming a more and more important determinant of its welfare.

**References**

Campbell, J. R., 1994. Creating Technology Capacity: The Changing Role of the Korean State since the Third Republic. Miami University Ph.D. dissertation.

Cha, D-S., Kim, K. S. Kim, Perkin, D. H. (Eds.), 1997. The Korean Economy 1945-1995: Performance and Vision for the 21st Century. Korea Development Institute, Seoul.

Cowan, R., van de Paal, G., 2000. Innovation Policy in a Knowledge-Based Economy, A MERIT Study Commissioned by the European Commission. Publication no. EUR 17023

Day, G. S., Reibstein, D.J. (Eds.), 1997. Wharton on Dynamic Competitive Strategy. John Wiley & Sons, Inc. New York, NY.

Kim, L., Seong, S-M., 1997. Science and Technology: Public Policy and Private Strategy, In: Cha et al. (1997) pp. 383-425.

Kim, Y., Park, Y., Bok, D., Jo, H., Hyeon, Y., Hong, J., 1999. The Technology Capacity Development of the Korean Automobile Industry. Samsung Economic Research Institute, Seoul.

KDI, 1995. The Korean Economy 1945-1995: Performance and Vision for the 21st Century, The Proceedings of the International Conference 1995 to Commemorate Independence, Korea Development Institute, Seoul.

KIET, 2001a. Innovative Capacity and Industrial Development, Policy Report 447, Korea Institute for Industrial Economics and Trade, Seoul.

KIET, 2001b. 2010 Industrial Development Vision, Korea Institute for Industrial Economics and Trade, Seoul.

KITA, 2004. Major Indicators of Industrial Technology, 2003/2004, Korea Industrial Technology Association, Seoul.

Krueger, A.O., 1997. Korean Industry and Trade Over Fifty Years, in: Cha et al. (1997) pp.293-338.

Lee, B-C., 1986. Hoam Ja Jeon. Joong-Ang Ilbo, Seoul.

Min, K.H., Choi, K.S., 1994. The Vision and Development Tasks for the High-tech Industries in 2000s. KIET, Seoul.

Murmann, J.P., 2003. Knowledge and Competitive Advantage: The Coevolution of Firms, Technology, and National Institutions. Cambridge University Press, New York.

OECD, 2000. Korea and the Knowledge-based Economy, Making the Transition.

Porter, M. E., 1985. Competitive Advantage: Creating and Sustaining Superior Performance. The Free Press (A Division of Macmillan, Inc.) and Collier Macmillan Canada, Inc., New York

Porter, M. E., 1990. The Competitive Advantage of Nations. Free Press, New York.

Porter, M. E., Takeuchi, H., Sakibara, M., 2000. Can Japan Compete? Macmillan Press Ltd., Hampshire.

SaKong, I, 1993. Korea in the World Economy. Institute for International Economics, Washington, D.C.

Shin, Byung Sik, 1997. Je Il Gong Hwa Kook To J I Gae Hyuck Jeong Chi Kyung Je. Han Kook Jeong Chi Hak Hoi Jip, pp. 26-46

Weber, M., 1930. The Protestant Ethic and the Spirit of Capitalism. George Allen & Unwin LTD, London.