Knowledge Sharing Program

2016 Modularization of Korea's Development Experience:

The Development of Korea's Electronics Industry During Its Formative Years (1966-1979)

2016

Ministry of Strategy and Finance

KDI SCHOOL
KDI School of Public Policy and Management

2016 Modularization of Korea's Development Experience:

The Development of Korea's Electronics Industry During Its Formative Years (1966-1979)

2016 Modularization of Korea's Development Experience

The Development of Korea's Electronics Industry During Its Formative Years (1966-1979)

Title	The Development of Korea's Electronics Industry During Its Formative Years (1966-1979)
Supervised by	Ministry of Strategy and Finance (MOSF), Republic of Korea
Prepared by	KDI School of Public Policy and Management
Author	Wonhyuk Lim, Professor, KDI School of Public Policy and Management
Advisory	Joong-Hae Suh, Senior Fellow, Korea Development Institute (KDI) Cheonsik Woo, Senior Fellow, Korea Development Institute (KDI)
Research Management	KDI School of Public Policy and Management
Supported by	Ministry of Strategy and Finance (MOSF), Republic of Korea

Government Publications Registration Number 11-1051000-000756-01

ISBN 979-11-5545-186-1 95320

ISBN 979-11-5545-179-3

Knowledge Sharing Program

Government Publications Registration Number
11-1051000-000756-01

Knowledge Sharing Program

2016 Modularization of Korea's Development Experience

The Development of Korea's Electronics Industry During Its Formative Years (1966-1979)

Ministry of Strategy and Finance

KDI SCHOOL
KDI School of Public Policy and Management

Preface

The study of Korea's economic and social transformation offers a unique window of opportunity to better understand the factors that drive development. Within approximately a single generation, Korea transformed itself from an aid-recipient basket-case to a donor country undergoing fast-paced and sustained economic growth. What makes Korea's experience even more remarkable is that the fruits of Korea's rapid growth were relatively widely shared.

In 2004, the Korean Ministry of Strategy and Finance (MOSF) and the Korea Development Institute (KDI) launched the Knowledge Sharing Program (KSP) to assist partner countries in the developing world by sharing Korea's development experience. To provide a rigorous foundation for knowledge exchange engagements, KDI School has accumulated case studies through the KSP Modularization Program since 2010. Over the past six years, the Modularization Program has amassed 144 such case studies, carefully documenting noteworthy innovations in policy and implementation in a wide range of areas including economic policy, administration·ICT, agricultural policy, health policy, industrial development, human resources, land development, and the environment. Individually, the case studies convey practical knowhow and insights in an easily accessible format; collectively, they seek to share Korea's prosperity by illustrating how the country was able to kick-start and sustain its remarkable economic growth.

Building on the program's success over the past six years, we are pleased to present an additional installment of four new case studies and four e-content clips. The 2016 Modularization Program products were chosen based on the results of the careful analysis of topics in greatest demand in the KSP consultation program and comprehensive consultations with related ministries and specialists. The four new case studies discuss Korean experiences in the promotion of electronics industry, electronic commerce in advancing Korea's industrial structure, facilitation of resource management policies, and the developments in special economic zones.

In a further contribution to global knowledge sharing, the e-content topics feature Korean experiences in the development of Korea's major industries, including the automotive, electronic, shipbuilding, and cosmetics industries. Moreover, a total of 14 e-content modules have been uploaded to the World Bank's Open Learning Campus (OLC) in order to share Korea's knowledge with the international community.

I would like to express my gratitude to all those who were involved in the project this year. First and foremost, I would like to thank the Ministry of Strategy and Finance for its continued support for the Modularization Program. I would also like to express my heartfelt appreciation to the contributing researchers and their respective institutions for their dedication to research, to the former public officials and senior practitioners for the keen insight and wisdom they so graciously shared in their roles as advisors and reviewers, and also to the members of the KSP Executive Committee for their expert oversight of the program. Last but not least, I am thankful to each and every member of the Development Research Team for their sincere efforts to ensure the successful conclusion of the research project, as well as to Professor Taejong Kim for his supervision.

As always, the views and opinions expressed by the authors who have contributed to the body of work presented here do not necessarily represent those of the KDI School of Public Policy and Management.

December 2016

Joon-Kyung Kim

President

KDI School of Public Policy and Management

Contents | LIST OF CHAPTERS

Summary 12

Chapter 1

Introduction 15

1. Stages of Korea's Electronics Industry Development 17
2. Organization of the Study 24

Chapter 2

Industrial Policy and the Electronics Industry 29

1. Industrial Policy Debate 30
2. Definition and Characteristics of the Electronics Industry 36

Chapter 3

Background and Initial Conditions 41

1. Birth of Korea's Electronics Industry and Early Policy Response 43
2. Initial Conditions before the Introduction of Promotion Policy 50

Chapter 4

Electronics Industry Promotion Policy ····· 55

1. Five-Year Electronics Industry Promotion Plan (1967-1971) ····· 56
2. Policy Recommendation and Background Report for Electronics Industry Promotion ····· 59
3. Electronics Industry Promotion Law and Basic Plan ····· 78
4. Implementation System ····· 85
5. Major Policy Instruments ····· 87
   - 5.1. Strategic Domestic Market Protection ····· 88
   - 5.2. Financial and Tax Benefits ····· 89
   - 5.3. Industrial Complexes ····· 91
   - 5.4. Education and R&D ····· 93

Chapter 5

Corporate Strategy ····· 97

1. New Entry vs. Resistance by Incumbents ····· 100
2. Vigorous Competition and Capacity Development ····· 105

Contents | LIST OF CHAPTERS

Chapter 6

Assessment and Conclusion 113

1. Assessment 115

2. Conclusion 124

References 129

Contents | LIST OF TABLES

Chapter 1

Table 1-1 Development of Korea's Electronics Industry ····· 18

Chapter 2

Table 2-1 Literature on Industrial Policy ····· 34

Table 2-2 Classification of the Electronics Industry ····· 38

Chapter 3

Table 3-1 Domestic Consumption and Exports of Radios (1962-1966) ····· 51

Table 3-2 Localization Rate of Electronic Components (1966) ····· 52

Contents | LIST OF TABLES

Chapter 4

Table 4-1 Export Targets in the Five-Year Electronics Industry Promotion Plan (1967-1971) ···58

Table 4-2 Expected Impact of Promoting the Electronics Industry (1971) ·····64

Table 4-3 Japan's Designation of Products for Promotion and Provision of Support (1957-1967) ·····68

Table 4-4 Japan's Production and Exports of Electronic Products (1957-1967) ·····68

Table 4-5 Sources of Technology Licensing for Korea's Electronics Industry (1968) ·····71

Table 4-6 Five-Year Development Plan for Electronic Products (1969-1973) ·····74

Table 4-7 Products Designated for Promotion in the Eight-Year Electronics Industry Promotion Plan (1969-1976) ·····82

Table 4-8 Tax Reduction and Exemption Benefits for Important Industries ·····90

Chapter 5

Table 5-1 Market Shares by Firm in the Electronics Industry: 1969 vs. 1971 ·····106

Contents | LIST OF FIGURES

Chapter 1

Figure 1-1 Share of the Electronics Industry in Manufacturing and GDP (1970-2015) ····· 23

Chapter 6

Figure 6-1 Total Demand, Production, Imports, and Exports for the Electronics Industry (1968-1979) ····· 117

Figure 6-2 Production by Sector in the Electronics Industry (1968-1979) ····· 118

Figure 6-3 Exports by Sector in the Electronics Industry (1968-1979) ····· 119

Summary

The assembly segment of the electronics value chain provides a relatively easy point of entry for developing countries because it is labor-intensive, but compared with garments and footwear, the electronics industry has a high income elasticity of demand and a rapid pace of productivity improvement and provides significant spillover effects for other industries. Electronics can thus play a dual role in a nation's industrialization by not only creating jobs but also facilitating structural transformation.

After searching for new promising industries beyond garments in the mid-1960s, Korea began to nurture electronics as an export-oriented strategic industry by drafting the Five-Year Electronics Industry Promotion Plan in December 1966. The government benchmarked regional early movers such as Japan and Taiwan and consulted with the academic and business community to formulate comprehensive plans to support the development, production, and exports of electronic products designated for promotion. In 1969, the government enacted the Electronics Industry Promotion Law and drafted the Basic Plan for Electronics Industry Promotion (1969-1976) to provide the legal basis and action plan for the promotion of the electronics industry. For the implementation system, the Ministry of

Commerce and Industry formulated promotion policy, while the Fine Instruments Center (FIC), National Industrial Research Institute (NIRI), and Korea Institute of Science and Technology (KIST) provided support for overseas market development, quality control, and research and development (R&D).

The government provided space for Korean firms to grow by restricting the inflow of foreign imports in the early stage of the electronics industry development; however, to ensure that Korean firms develop their own capabilities instead of depending on protectionist measures indefinitely, the government provided incentives for them to develop, produce, and export electronic products and compete vigorously both in the domestic and global market. In addition, the government provided financial and tax benefits, while taking externalities into consideration. An industrial complex dedicated to the electronics industry was established to realize agglomeration economies, and the education and R&D system was strengthened as well. However, the government maintained an anti-consumption bias during the 1966-1979 period, impeding the expansion of the domestic electronics market.

Korean firms established partnerships with foreign companies, but accumulated their own capabilities without losing ownership. They improved their competitiveness by carrying out their own R&D, starting with the "reverse engineering" process of disassembling and reassembling foreign products. Over the long run, firms that proved successful were those that managed to develop capabilities to produce final products, components, and materials through R&D and vertical integration and to generate synergies from product diversification ranging from household appliances to information and communication sectors. By contrast, firms that stuck with labor-intensive assembly or only household appliances had to move their operations abroad or face a decline in performance.

The development of Korea's electronics industry provides useful lessons not only for the academic community engaged in the industrial policy debate, but also for developing countries seeking promising industries after garments and footwear. Korea's experience shows the importance of innovation and competition based on economic incentives, as well as the usefulness of international benchmarking and public-private consultation in identifying and promoting promising industries. In the case of Korea's electronics industry, what proved critical was a performance-based reward and discipline system that was consistent with the notion that the objective was localization with international competitiveness (or import substitution through export promotion), not localization per se.

Chapter 1

Introduction

1. Stages of Korea's Electronics Industry Development
2. Organization of the Study

Introduction

Korea's electronics industry is perhaps its best-known industry around the world. In terms of industry share of Korea's exports in 2015, electronics (semiconductors, wireless communications devices, flat-panel displays, computers, and consumer electronics) came in first at 27.6%, with world-class competitiveness in each of the product categories.[1] However, Korea's electronics industry did not always have such a high stature. In fact, until the mid-1960s, it was regarded as inferior to Taiwan-- to say nothing of the United States, Japan, and Europe. Over the course of a half century, Korea's electronics industry was able to catch up with the world leaders.

The rise of Korea's electronics industry has been the subject of many studies. Seo (2001) and the Compilation Committee for a 50-Year History of the Electronics Industry (2009) provided a chronological overview of Korea's electronics industry based on policy documents and company histories. From a political economy perspective, Kim (1996) emphasized that interaction between the government and interest groups played a key role in the making of promotion policy for the electronics industry, and Park (2010) analyzed

1. In terms of industry share of Korea's exports of $526.9 billion in 2015, electronics (27.6%) was ranked first, followed by automobiles and auto parts (13.5%), petroleum and petrochemical products (13.3%), general machinery (8.9%), vessels (7.6%), steel (5.7%), and textiles (2.7%). By product category, the electronics export share of 27.6% consisted of semiconductors (11.9%), wireless communication devices (6.2%), flat-panel displays (5.6%), household appliances (2.4%), and computers (1.5%). See the Ministry of Commerce, Industry and Energy, "Export and Import Trends in January 2016," Press Release (February 1, 2016).

the drafting and revision of production and export plans for the electronics industry in the 1970s. From a technology management perspective, Kim (1997) highlighted the innovation process of Korea's major companies, starting with reverse engineering and accumulating knowledge through their own R&D. Cyhn (2002) demonstrated that original equipment manufacturing (OEM) could play a useful role as an intermediate step for quality improvement and technology innovation in the international production network of the electronics industry.

This study looks at government policy and corporate strategy that played a critical role in Korea's rise as a leader in electronics, focusing on what might be called "formative years" from 1966 to 1979. During these formative years, the government set basic directions for the promotion of Korea's electronics industry, and firms established technology development and management strategies and began to engage in vigorous competition at home and abroad. A study on the development of Korea's electronics industry during its formative years would provide implications for the ongoing academic debate on industrial policy as well as lessons for developing countries that are looking for new promising industries after garments and footwear.

1. Stages of Korea's Electronics Industry Development

Based on changes in government policy and corporate strategy, Korea's electronics industry development could be divided into four stages, as shown in <Table 1-1>: early years (1959-1965), formative years (1966-1979), rapid rise (1980-1992), and sophistication (1993-present). Qualitative changes in government policy and corporate strategy are mainly used to periodicize Korea's electronics industry development, because it takes time for quantitative indicators to reflect qualitative changes in government policy and corporate strategy and there are no objective periodicizing points for quantitative indicators. As such, quantitative indicators are used in a supplementary way.

Table 1-1 | Development of Korea's Electronics Industry

	Early Years (1959-1965)	Formative Years (1966-1979)	Rapid Rise (1980-1992)	Sophistication (1993-)
Level of Technology	Assembly, Low level of localization	Production of consumer products, Localization of non-core components	Product diversification, Localization of core components	Quality upgrading, Leading development of core components and materials
Major product development	Radio (1959)	B/W TV (1966), Color TV (1976), Microwave oven (1978), VCR (1979)	PC (1981), TDX (1982), 64K DRAM (1983)	Mobile phone (1993), Flat-panel display (1999), Smart phone (2009)
Government Policy	Unsystematic (e.g., ban on smuggled products, campaign to send radios to rural villages, designation of industries specialized for exports)	Export focus, Anti-consumption bias, Designation of priority products and support for investment, Industrial complexes, Education and R&D	Shift from consumer electronics to ICT, National Backbone Network System, Development of leading technologies, Co-operative R&D	Infrastructure for informatization and e-government, Exploration and support for new growth engines through public-private consultation
Corporate Strategy	Inward-looking, Dependence on foreign technology	Outward-looking, Technology acquisition and adaptation	Development and production of core components, expansion of R&D	Focus on quality management, aggressive investment in R&D and mass production, fast-follower and innovator
Share of Electronics Industry (%)	0.90	3.54	6.23	30.32
	0.19	0.54	1.18	8.63
World Rank	-	11	6	4

Note: The share of electronics industry shows in percent terms the value added of electrical and electronic device manufacturing divided by manufacturing value added (top row) and GDP (bottom row), respectively, for the last year of each period (Bank of Korea, real GDP by economic activity, 1970-2015, in 2010 prices). However, figures for the last year of the early years, 1965, are quoted from KIST (1968). The final year of the sophistication period is the most recent year, 2015. 'World Rank' is the global rank of Korea's electronics industry based on the amount of output in the last year of each period (Reed Electronics Research, Yearbook of World Electronics Data, 1973-2015).

Source: Author.

For several years after Goldstar (today's LG Electronics) produced Korea's first radio in 1959, Korea's electronics industry was mainly focused on inward-oriented import substitution, and the government had neither a dedicated agency nor a comprehensive policy package devoted to the promotion of the electronics industry. However, after designating "radios and electrical devices" as one of 13 industries specialized for exports in July 1965, the government drafted in December 1966 a comprehensive plan to promote the electronics industry as an export-oriented strategic industry. At the time, Korea was looking for new promising industries, encouraged by its initial success with export-oriented industrialization focused on labor-intensive manufacturing (e.g., garments). While the electronics industry was labor-intensive in the assembly segment of the value chain, it was also regarded as a fast-growing industry characterized by a rapid pace of technological innovation, with large spillover effects for the economy. As such, it was designated as one of Korea's promising industries for the future.

The government legislated a specific promotion law for the electronics industry (1969), in addition to shipbuilding (1967), machinery (1967), petrochemicals (1969), steel (1970), and non-ferrous metals (1971), and provided various financial and tax benefits during Korea's heavy and chemical industry (HCI) drive as well. During the formative years for the electronics industry (1966-1979), the government strategically protected the domestic market, and provided incentives for private-sector firms to develop, produce, and export electronic products designated for promotion. In 1966, the Ministry of Commerce and Industry gave the Communications Sub-Division of the Electrical Industry Division the task to promote consumer electronics. Subsequently, in 1971, the Ministry created a division-level unit for promoting the electronics industry, and then elevated it to bureau-level in 1978. During these formative years, the government also set up an electronics industrial complex and established the education and R&D system to promote the electronics industry.

In the same period, many Korean firms entered the electronics industry and developed their core competence while engaging in vigorous competition. During the formative years, Korea's electronics industry went from assembling relatively basic products like radios to producing more sophisticated products like color TVs and raised technological capabilities to such a degree that it could realistically think about developing core components like semiconductors.

After the formative years, Korea's electronics industry entered a period of rapid rise (1980-1992), during which the government shifted its focus from consumer electronics to information and communications technology (ICT) and Korean firms diversified their products and developed core components and materials by greatly expanding R&D. The government lifted the anti-consumption bias of the formative years and tried to generate synergy between domestic consumption and exports, starting with its decision to allow color TV broadcasting in 1980. During this period of rapid rise for Korea's electronics industry, the government promoted ICT at the ministerial level, with the Ministry of Post and Communications in charge; whereas, during the formative years, a sub-division or a division-level unit had promoted consumer electronics at the Ministry of Commerce and Industry. In particular, the government dramatically raised the innovative capacity for ICT by investing 3 percent of Korea Telecom's revenue in R&D. During the same period, private-sector firms also greatly expanded their R&D, realizing that their continued dependence on the imports of core components and materials would limit their potential for success. As a result, Korea developed a digital switching system in 1982, and 64K DRAM in 1983 (third in the world, after the U.S. and Japan).[2]

2. For more information on the development of Korea's electronics industry since 1980, see Lim and Lee (2010)

Although Korea's electronics industry achieved a measure of success in product diversification and core component development, it was still regarded as second-class compared with the U.S. and Japan in the early 1990s.[3] However, in the ensuing period, the government and the private sector raised Korea's electronics industry to world-class level by aggressively investing in core competence and quality improvement. The government provided key infrastructure for informatization and e-government and worked with the private sector to identify and promote new engines of growth. In particular, the Ministry of Information and Communications, created in 1994, played a leading role in promoting ICT for more than 10 years. For their part, Korean firms pursued a fast follower-innovator strategy and aggressively invested in R&D and volume production. Although American or Japanese firms had first launched such products as the mobile phone, flat-panel display, and smart phone, Korean firms developed their own products shortly afterwards, and caught up with the first movers through aggressive investment and quality improvement. Furthermore, in some cases, Korean firms launched an innovative product ahead of incumbent leaders, as demonstrated by the success of the "phablet."[4]

3. Against this backdrop, Samsung Chairman Lee Kun-hee summoned executives in Frankfurt in 1993 and declared that he would concentrate on quality management with the determination to change everything and aim for the best in the world rather than settle for No. 1 in the domestic market (Lee 2011:106-130).

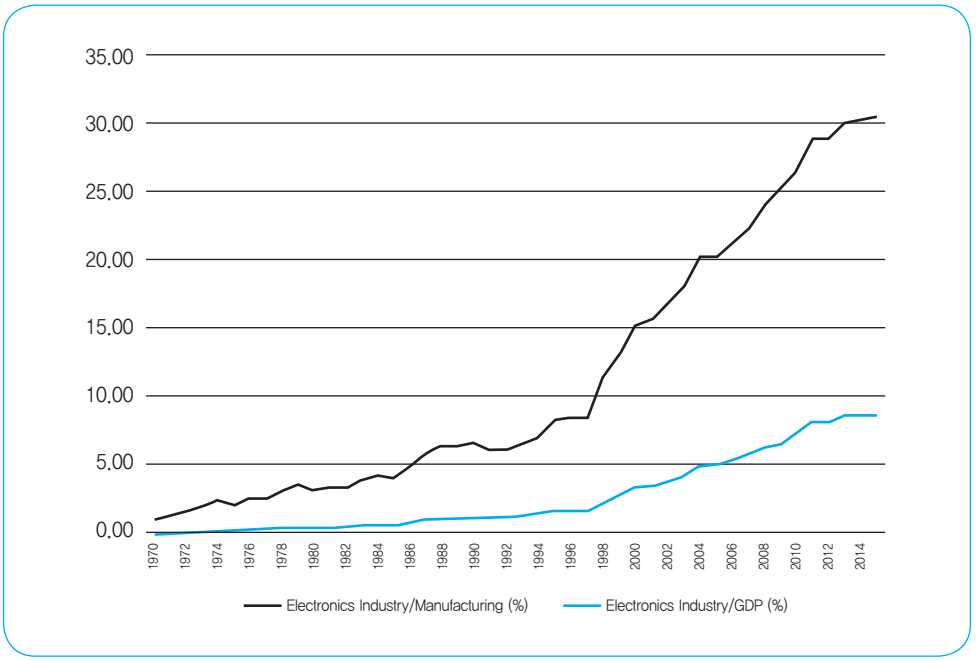
4. At the end of 2011, Samsung Electronics' Galaxy Note introduced the "phablet" (portmanteau of two words, phone and tablet) with its 5.3-inch screen, stylus-pen and long battery life. Critics who had been accustomed to the 3.5-inch screen of Apple's iPhone at the time criticized the Galaxy Note as "comically huge." However, when the Galaxy Note became a popular hit, they themselves became aware that the most important feature for the smartphone was no longer the phone function, but rather reading and writing (that is, browsing and texting). Inspired by the success of the Galaxy Note, Apple launched its own phablet with a large screen and stylus-pen. See Tim Bradshaw (2016), "Obituary for the Samsung Galaxy Note 7 after its untimely death," The Financial Times, October 13. Samsung Electronics' phablet is not in the same league of innovative products as Sony's Walkman, Motorola's mobile phone, Sharp's flat-panel display, and Apple's smartphone, but it is the first pioneering product developed by the Korean electronics industry.

In order to quantify the development of the Korean electronics industry, [Figure 1-1] shows the share of the electronics industry in manufacturing value added and gross domestic product (GDP).[5] The value added of the electrical and electronic device manufacturing industry, a proxy for the electronics industry, increased 2,141 times from 59 billion won in 1970 to 126,345 billion won in 2015, all in 2010 prices.[6] During the same period, the value added of manufacturing increased 74 times from 5,665 billion won to 416,644 billion won, and the GDP increased 22 times from 67,650 billion won to 1,464,244 billion won. As a result, the share of the electronics industry in manufacturing value added increased from 1.04% in 1970 to 30.32% in 2015, and the share of the electronics industry in GDP increased from 0.09% to 8.63% over the same period. More specifically, in 1979, the last year of the formative years for Korea's electronics industry, the share of the electronics industry in manufacturing value added and GDP was 3.54% and 0.54%, respectively. However, by 1992, it had increased to 6.23% and 1.18%, respectively, and then to 30.32% and 8.63% by 2015.

5. Of course, quantitative indicators alone are not enough to gauge the development of the electronics industry, but the share of electronics industry in manufacturing value added and in GDP are useful indicators of the relative success of the electronics industry.

6. At the Korean Statistical Information Service (KOSIS), statistics on the electrical and electronic device manufacturing industry are available from 1970; whereas, statistics on the information and communication industry, including software, are available only from 1996.

Figure 1-1 | Share of the Electronics Industry in Manufacturing and GDP (1970-2015)



Source: Bank of Korea, GDP by Economic Activity (Real, in 2010 Prices).

Over the past half-century, Korea's electronics industry has greatly improved its position in the world market as well. In 1967, Korea's production of electronic goods amounted to $55 million. It was only 1/400 and 1/67, respectively, of the U.S. and Japan's production. It was well behind Taiwan's production of $192 million at the time (Kim 1968:39). However, 10 years later, in 1977, Korea's electronics industry ranked 11th in the world, and its production increased to 3.5% of the U.S. and 6.9% of Japan's level and reached 81.0% of Taiwan's production (Lee and Yoo 1979: 102).

In 1992, Korea ranked sixth in the global ranking of the electronics industry, behind the United States, Japan, Germany, France, and the United Kingdom. Korea's electronics production was up to 13.1% of the U.S. and 14.2% of Japan's, and amounted to 1.7 times Taiwan's. In 2015, Korea ranked 4th in the global ranking of the electronics industry, behind China, the U.S., and Japan. Korea's electronics production reached 43.0% of the U.S. and 60.0% of Japan's, while remaining 1.6 times Taiwan's production. Korea's electronics industry had become a world leader either in terms of total output or per capita output.[7]

2. Organization of the Study

This study is organized as follows. After providing an overview of the ongoing debate on industrial policy, Chapter 2 looks at the economic characteristics of the electronics industry. The assembly segment of the electronics industry value chain is labor-intensive and relatively easy to enter from other labor-intensive sectors such as garments and footwear. However, the product design segment of its value chain is knowledge-intensive, and overall the electronics industry is characterized by a high income elasticity of demand and a great potential for productivity improvement. As such, the electronics industry could play a key role in the structural transformation of an economy.

Chapter 3 analyzes the initial conditions of Korea's electronics industry, before a comprehensive promotion plan was launched in 1966. In the United States, Japan, and Europe, major firms were producing radios, TVs, communications devices, and computers, building on the invention of the transistor in 1948 and development of the integrated circuit (IC) in 1958. In Korea, in 1959, Goldstar produced Korea's first radio based on vacuum tubes, using a plastic case rather than a wooden case, and a number of firms

7. According to the Yearbook of World Electronics Data, in 2015, China produced $ 603.5 billion of electronic products; the U.S., $ 237.5 billion; Japan, $ 170.3 billion; Korea, $ 102.1 billion; Taiwan, $ 64.8 billion; Germany, $ 62.3 billion; Malaysia, $59.0 billion; and Singapore, $ 58.2 billion. In terms of per-capita production of electronic goods in 2015, Singapore ($ 10,773) came in first, followed by Taiwan ($ 2,756), Korea ($ 2,035), Malaysia ($ 1,987) and Japan ($ 1,338).

followed suit by producing basic electronic products, largely relying on imported parts and components. Starting in the early 1960s, the government provided protection to Korea's electronics industry by imposing high import tariffs and cracking down on smuggled goods. It also provided support by conducting a campaign to send radios to rural villages, and began to encourage exports of radios and other electronic goods. However, there was no comprehensive policy package designed to promote the electronics industry.

Chapter 4 focuses on the government's policy to promote the electronics industry from 1966 to 1979. In December 1966, the Ministry of Commerce and Industry released the Five-Year Electronics Industry Promotion Plan (1967-1971). To promote the electronics industry as a export-oriented strategic industry, it highlighted key action items such as the priority allocation of funds, establishment of an electronics industry center, and creation of an electronics industry cooperative. In September 1967, at the invitation of the Korean government, Dr. Kim Wan Hee, Professor of Electrical Engineering at Columbia University, briefed President Park Chung Hee on promoting the electronics industry and recommended the enactment of the Electronics Industry Promotion Law, establishment and early release of promotion funds, and creation of the Electronics Industry Promotion Center. In 1968, in an extensive report, Dr. Kim submitted a detailed action plan in support of his 1967 recommendation. In 1969, the government enacted the Electronics Industry Promotion Law and set localization and export targets in the Basic Plan for Electronics Industry Promotion (1969-1976). Instead of creating a new electronics industry promotion center, the government used existing organizations as implementing agencies: namely, the Fine Instruments Center (FIC), National Industry Research Institute (NIRI), and Korea Institute of Science and Technology (KIST). Subsequently, in conjunction with the heavy and chemical industry (HCI) drive launched in 1973, the government designated electronics as one of six priority industries, and established production and export plans for

consumer electronic devices (e.g., color TV), industrial electronic devices (e.g., electronic calculator), electronic components (e.g., cathode-ray tube), and electronic materials (e.g., semiconductor materials). Instead of setting up a state-owned monopoly to promote the electronics industry, Korea used a performance-based reward and discipline mechanism and promoted vigorous competition, while providing some protection from imports. In addition, the government designated electronic products for promotion and supported private-sector firms to retain ownership and build their capabilities through joint ventures, technology licensing, and R&D.

Chapter 5 looks at corporate strategy. In the early 1960s, Goldstar was dominant in the domestic electronics market. However, in 1968, Taihan Electric Wire entered the consumer electronics sector, and in 1969, Samsung entered the electronics industry. Korean firms established partnerships with leading companies in Japan, the United States, and Europe, but accumulated their own capabilities without losing their ownership. In particular, they expanded their own R&D and made efforts to improve interaction with outside research institutes. In addition, they asked the government to reduce special consumption taxes and allow color TV broadcasting to facilitate the expansion of the domestic market in line with overseas exports. Over the long run, firms that proved successful were those that managed to develop capabilities to produce final products, components, and materials through R&D and vertical integration and to generate synergies from product diversification ranging from household appliances to information and communication sectors. By contrast, firms that stuck with labor-intensive assembly or only household appliances had to move their operations abroad or face a decline in performance.

Chapter 6 quantitatively assesses the development of Korea's electronics industry using production, trade, employment, and R&D data, and draws lessons not only for the academic community engaged in industrial policy debate but also for developing countries seeking promising industries after garments and footwear. Theoretically, in order to select a promising industry, it is necessary to identify industries that can play a leading role in the structural transformation of the economy thanks to a high income elasticity of demand and a great potential for productivity improvement. In this process, it is important to identify global market and technology trends, and analyze the industrial development and growth trajectory of countries with similar endowments as one's own. In order to effectively promote promising industries, it is necessary to protect domestic industries and to provide support, but the incentive system should be aligned so that performance-based reward and discipline mechanisms could work. In particular, it is important to have a system in which firms that cultivate core competence through R&D and perform successfully in the global market would continue to grow. In the case of Korea's electronics industry, what proved critical was the performance-based reward and discipline system that was consistent with the notion that the policy objective was localization with international competitiveness (or import substitution through export promotion), not localization per se.

Chapter 2

Industrial Policy and the Electronics Industry

1. Industrial Policy Debate

2. Definition and Characteristics of the Electronics Industry

Industrial Policy and the Electronics Industry

1. Industrial Policy Debate

Industrial policy, broadly defined, entails all effort to influence sectoral development and, hence, overall industry portfolio. Sector identification and promotion are essential for effective industrial policy. The target of industrial policy can be infant or emerging industries, mature or declining industries, or no particular industry at all. So-called "horizontal" industrial policy provides sector-neutral functional support (e.g., tax benefits for R&D); whereas, "vertical" industrial policy targets specific industries (e.g., shipbuilding) for promotion or rationalization. The instruments of industrial policy include: trade protection, to give "breathing room" to domestic industries; financial and tax benefits; support for human resource development and infrastructure; R&D; public-private consultation, especially with regard to information and risk sharing; and state-owned enterprises (SOEs). A performance-based reward and discipline system in an effective competitive and regulatory environment is not usually regarded as a policy instrument, but it can be a useful mechanism to achieve the objectives of industrial policy (Lim 2012).

To motivate theoretical discussion on state intervention, especially the rationale for sector targeting, we start by positing a baseline model, with uniformly income-elastic (homothetic) preferences and uniformly increasing labor productivity across sectors in an autarkic setting. Let us imagine what happens to aggregate growth and structural transformation in this model, where structural transformation is defined as the sectoral reallocation of economic activity across sectors. Because all sectors are assumed to have uniform income elasticity and uniform productivity improvement, and no international trade is allowed, the baseline model produces aggregate growth without any structural transformation, with sector shares of labor and output remaining constant while aggregate population and output increase over time.

What happens if we relax the assumptions of the baseline model? First, let us suppose that international trade is allowed, while the assumptions about uniform income elasticity and productivity improvement across sectors remain the same. This setting is closely related to the one for the classical theory of comparative advantage, where all sectors are assumed to be equal in importance, with no dynamic implications driven by differences in income elasticity and productivity improvement. The classical theory does not take into account the future prospects of the two sectors in terms of income elasticity and productivity improvement because it is basically a static theory.

Now, in addition to lifting the autarkic assumption of the baseline model, let us suppose that income elasticity and productivity improvement are not uniform across sectors. This possibility is explored in the theory of strategic trade, where some sectors are more likely to provide better prospects in terms of demand and supply than other sectors. For example, in a variety-expansion model of endogenous growth by Grossman and Helpman (1991), one homogeneous good has no potential for further improvement, and the other

good is characterized by a continuum of differentiated varieties whose cost of innovation is decreasing in the number of varieties already being produced (installed base) in the country (e.g., smart phone as a synthetic innovation). As a result, a tariff on variety goods can push the country onto a better growth trajectory. Once on this trajectory, the country stays on it even after the tariff is removed. Similarly, in a two-sector model by Matsuyama (1992), learning-by-doing, present in "manufacturing" but absent in "agriculture," is the engine of growth, and anything that increases the size of the "manufacturing" sector is good for growth. Because different sectors have different prospects for generating growth, endogenous growth models suggest that sector-specific government intervention could improve welfare. This provides a formal theoretical justification for a policy insight that was adopted by a number of countries historically to pursue industrial policy: Use international trade strategically and develop capabilities in income-elastic and productivity-increasing sectors to facilitate growth and structural transformation, with other things being equal.[8]

From a political economy perspective, however, government intervention may be driven by the private interests of politicians and other actors rather than concern for social welfare. In this regard, the extent to which lobbying activities are aligned with growth-generating activities is important for the growth implications of government intervention. The political economy approach has many variants, but the central insight is a simple supply and demand model of politics. The politician extends a rent to the private sector for a bribe in return or some form of political support, such as campaign contributions, the mobilization of votes, or even the delivery of economic growth, that helps to meet the politician's objective. In a "rent-seeking" state, politicians maximize their fortunes by extending rents to the private sector, with the distributive implications and distortions such an approach implies (Krueger 1974; Khan and Jomo 2000). By contrast, in a "developmental state," a political leadership, supported by a technocratic apparatus, seeks to maximize its political fortunes by delivering national development, typically in cooperation with the private sector (Johnson 1982;

8. For example, even if the income elasticity of demand for industry A is smaller than industry B, if demand for industry A is much larger than industry B, it would be advantageous to focus on industry A for the time being.

Amsden 1989; Wade 1990; Evans 1995; Woo-Cumings 1999).[9] In a related vein, North, Wallis, and Weingast (2009) compare a limited access order and an open access order. In a limited access order, the political elite manipulate the economic system and limit access to opportunities and create rents to sustain a dominant coalition. In an open access order, all citizens have the ability to form contractual organizations, and political, economic, and other forms of competition combine with impersonal exchanges and institutions to sustain order. Transitions from a clientelistic state to one capable of performance-oriented policies are rare.

As <Table 2-1> shows, scholars have a wide range of views on state intervention in general, and identifying and promoting promising sectors in particular. The rent-seeking and developmental state perspectives represent the opposite ends of the spectrum. Rodrik (2007) has tried to chart a third way between the two extremes. Because of the negative characterization of traditional industrial policy as incompetent and corruption-prone governments "picking winners" in a top-down manner without a concrete plan for implementation and phase-out, his "new" industrial policy has tended to emphasize "winners picking themselves" through experimentation and positive reinforcement, with some public support for the cost of discovery.

9. Johnson (1982), Amsden (1989), and Wade (1990) cover Japan, Korea, and Taiwan, respectively.

Table 2-1 | Literature on Industrial Policy

Perspectives	Insights on sector identification and promotion
Rent-seeking	Government can't and shouldn't pick winners.
Developmental state	Government can identify and promote promising sectors (in consultation with business).
Product space	Promising sectors are readily identifiable, but how do we go from the periphery to the core?
Self-discovery	Winners pick themselves, with help from search and problem-solving networks.
New structural economics	Latecomers can pick winners in mature industries by benchmarking early movers (based on comparative advantage).
Innovation-Competition Nexus	Government should target skill-intensive and competitive sectors and provide performance-based rewards.
Strategic risk-taking	Promising industries are readily identifiable through international benchmarking and experimentation, but the key is to take strategic risks, weighing the challenges of skill accumulation, scale economies, and complementary investments against the possibility of capacity underutilization and financial distress.

Source: Lim (2012), with some revision.

Lin and Monga (2010) go beyond "self-discovery" and advocate international benchmarking based on the late-comer's advantage. In particular, based on the notion of comparative advantage, they suggest that developing countries focus on "tradable goods and services that have been produced about 20 years in dynamically growing countries with similar endowment structures and a per capita income [measured in purchasing power parity] that is about 100% more than their own." However, more is likely to be needed if developing countries are to move beyond the middle-income trap, when catch-up economies may have to take considerable strategic risks to jump into non-mature industries to compete with advanced economies. This is not an easy task. In fact, countries tend to move through the product space by developing goods close to those they currently produce, and can reach

the core from the periphery "only by traversing empirically infrequent distances," which may explain why poor countries fail to converge with the income levels of rich countries (Hidalgo et al. 2007: 482).

The main argument against industrial policy is that it prevents competition and allows the government to pick winners in an arbitrary manner, thereby increasing the scope for the government to distort resource allocation through incompetence and corruption (or capture of the government by vested interests). However, there are examples of successful industrial policy that effectively targeted skill-intensive sectors and used existing or prospective competition to impose discipline and generate performance-based feedback mechanism. According to this perspective, as put forth by Aghion et al. (2010) and Nunn and Trefler (2010), industrial policy is compatible with competition policy, and the government should target skill-intensive and competitive sectors and provide performance-based rewards.

Finally, a strategic risk-taking perspective argues that promising industries are readily identifiable through international benchmarking and experimentation, but the key is to take strategic risks, weighing the challenges of skill accumulation, scale economies, and complementary investments against the possibility of capacity underutilization and financial distress. If a country makes huge investments to promote large-scale sophisticated industries but fails to achieve international competitiveness, the resulting capacity underutilization and financial distress may bankrupt its economy. In addition, even if technological challenges could be overcome at the individual country level, the world would be awash in overcapacity if too many countries build optimal-scale plants for the global market. This "fallacy of composition" effect further increases the risks of industrial policy. Accordingly, a country must carefully weigh the challenges of skill accumulation, scale economies, and complementary investments against the possibility of capacity underutilization and financial distress before embarking on ambitious industrial policy (Lim 2012).

2. Definition and Characteristics of the Electronics Industry

According to Article 2 of the Electronics Industry Promotion Law, which is the legal basis for the promotion of Korea's electronics industry, the electronics industry is an industry that manufactures machines and devices (electronic devices) utilizing the motion of the electrons in electronic tubes and semiconductors, as well as components and materials primarily used in them. According to the Enforcement Ordinance of the Law, electronic devices include radios, TVs, audio-frequency devices, communications machinery and equipment, wireless applications, electronic applications, and electrical measuring instruments. Components and materials that are mainly used in electronic devices include electronic tubes, semiconductor devices, integrated circuits, circuit components, acoustic components, device components, assembled parts, and other mechanical, metal and chemical components, as well as magnetic materials, insulating materials, conducting materials, semiconductor materials, and special materials.

According to the 9th revision of the Korean Standard Industrial Classification in 2008, the electronics industry in its narrow sense corresponds to the two-digit category of electronic components, computers, video, sound, and communications equipment manufacturing (26). However, as the use of electronic devices, components and materials has expanded, a broader definition of the electronics industry may include the manufacturing of medical, precision, and optical devices and watches (27) and parts of electrical equipment manufacturing (28). In addition, it could include the system and application software development and supply business (5822) in the publishing business (58) as a key element enabling the operation of the computer. In fact, the Electronics Industry Promotion Law, amended in 1981, stipulates that the 'electronic calculation organization' is included in electronic equipment,

and that the 'electronic calculation organization' consists of the machine organization that mathematically and logically processes information with the function of input, output, calculation, control and memory (hardware) and the technology organization for an efficient operation of the machine organization (software). <Table 2-2> shows the narrow definition of the electronics industry corresponding to the two-digit category of electronic parts, computer, video, sound and communications equipment (26).

Table 2-2 | Classification of the Electronics Industry

Classification			Products
Semiconductors (C261)	C2611		Electronic integrated circuits
	C2612		Diodes, transistors and similar semiconductor devices
Electronic components (C262)	C2621	C26211	Liquid crystal flat-panel displays
		C26219	Plasma and other flat-panel displays
	C2622	C26221	Printed circuit boards
		C26222	Electronic component populated boards
	C2629	C26291	Electronic tubes
		C26292	Electronic condensers
		C26293	Electronic resistors
		C26294	Electronic cards
		C26295	Electromagnetic coils, transformers and other electronic inductors
		C26296	Electronic access cards
		C26299	Other electronic components
Computers and peripheral devices (C263)	C2631		Computers
	C2632	C26321	Memory devices
		C26322	Computer monitors
		C26323	Computer printers
		C26329	Other peripheral devices
Communications and broadcasting equipment (C264)	C2641		Cable communications equipment
	C2642	C26421	Broadcasting equipment
		C26422	Mobile phones
		C26429	Other wireless communications equipment
Imaging devices and sound equipment (C265)	C2651	C26511	Televisions
		C26519	Videos and other imaging devices
	C2652	C26521	Radios, recording, and playback devices
		C26529	Other sound equipment
Magnetic and optical media (C266)			Magnetic and optical media

Source: Korea Standard Industrial Classification, Ninth Revision.

The electronics industry is a typical "smile-curve" industry in terms of value added along the value chain. The R&D and product design segment of the electronics value chain is technology-intensive and high in value added, but the assembly segment is labor-intensive and low in value added, and the distribution and marketing segment is high in value added. Many developing countries with a comparative advantage in labor-intensive manufacturing entered the assembly segment of the electronics industry along with garments and footwear in the early stages of industrialization. However, unlike garments and footwear, the electronics industry has a high income elasticity of demand and a great potential for productivity improvement, which can play a central role in the structural transformation of the economy. In other words, the electronics industry has a dual feature of creating jobs in the early stage of industrialization and generating future economic growth. For this reason, many developing countries have been paying attention to the electronics industry since the 1960s, and Korea was no exception in this regard.

2016 Modularization of Korea's Development Experience
The Development of Korea's Electronics Industry During Its Formative Years (1966-1979)

Chapter 3

Background and Initial Conditions

1. Birth of Korea's Electronics Industry and Early Policy Response
2. Initial Conditions before the Introduction of Promotion Policy

Background and Initial Conditions

If the steam engine and steel led the first industrial revolution, and electricity and chemistry led the second industrial revolution, electronics and semiconductors made the third industrial revolution possible. The scientific basis of the electronics industry began to be established in the 19th century, and in 1897, the British physicist J.J. Thomson confirmed the existence of electrons much smaller than atoms. In 1904, John Fleming of the United Kingdom invented a bipolar diode that emitted and controlled electrons in vacuum. In 1907, Lee De Forest of the United States developed a triode by installing a grid between the anode and cathode. In 1896, Guglielmo Marconi had developed wireless communication, and the first electronic product to combine the triode and wireless communication is the radio. Since Westinghouse opened a radio station in Pittsburgh in 1920, the radio evolved into a product that could be operated at home. In 1934, EMI developed a practical black and white TV based on vacuum tubes. In 1946, the U.S. Army Ballistic Institute introduced ENIAC, the first computer based on vacuum tubes. In 1948, the Bell Labs announced the development of the germanium transistor and offered an alternative to vacuum tubes. In 1954, Texas Instruments (TI) succeeded in developing the world's first commercially successful transistor-based radio. In the same year, American broadcasters began broadcasting TV. In

1958, TI developed an integrated circuit (IC), in which individual semiconductor elements, such as conventional transistors, were mounted on silicon substrates of a certain size together with other circuit elements such as resistors and capacitors. Since then, the integration density of the IC has been continuously improved, making it possible to implement several functions in one device as well as to downsize and lighten the product. To sum up, the world electronics industry made remarkable progress in establishing the technology and product concepts of major electronic devices from around 1920, when the vacuum-tube radio was first produced, until the late 1950s when ICs were developed (Seo 2001:17-37).

Korea promoted electricity, telegraph and telephone business starting in the late 19th century during the Joseon dynasty (1392-1910) and began radio broadcasting in 1927 under the Japanese colonial rule (1910-1945). After liberation, some Korean firms focused on the production of electrical equipment such as electric bulbs, wires, batteries, transformers, and motors, but few could manufacture electronic devices and components. The Korean War (1950-1953) greatly increased people's interest in radio broadcasting. In the absence of domestic manufacturing capability, foreign radios had to be imported or smuggled into Korea, but as demand for radios increased and repair and assembly knowhow accumulated, the environment needed for the birth of Korea's electronics industry was created.

1. Birth of Korea's Electronics Industry and Early Policy Response

Against this background, Koo In Hoi, President of Lak Hee Chemical (today's LG Chemical), who was looking for a new business in 1957, decided to go into the electronics industry at the recommendation of Yoon Wook-hyun, Planning Director. Since Korea had no experience in developing electronic products at the time, there were doubts about the possibility of developing domestically made radios. There were also concerns about competition from smuggled foreign products. However, Yoon made three points in defense

of the decision to enter the electronics industry: First, Lak Hee Chemical could use its accumulated technical knowledge in plastics manufacturing to produce plastic cases for the radio, instead of bulky wooden cases. Second, the White Paper by Japan's Ministry of International Trade and Industry (MITI), among others, indicated that the electronics industry would have a promising future. Third, if necessary, Lak Hee could invite foreign engineers to solve technical problems. After much internal debate, on October 1, 1958, the first electronics company in Korea, Goldstar (Geumseong), was established.

Goldstar imported mechanical equipment from West Germany, and in 1959 launched its effort to develop the first radio model in Korea based on the Japanese Sanyo model. The person who was responsible for the design was Kim Hae-soo, an engineer who had accumulated a great deal of experience assembling and repairing radios while running a radio shop. Given the company's financial situation and technology level, as well as the poor industrial environment in Korea at the time, it would have been easier to produce the final product by importing most of the components. However, from the beginning, the company tried to localize and self-produce the components as much as possible. Although Goldstar imported key electronic components such as speakers, resistors, cores, and volume controls, the company produced its own chassis, knobs, transformers, screws, nuts, plates, and cords. In the end, imported components accounted for about one-third of the components used for the radio; the rest were self-made (LG Electronics 2008).

On November 15, 1959, Goldstar released the first domestic radio model, A-501. The monthly production target was planned at 2,000. The price was set at 20,000 hwan, which was 30% lower than the price of a similar foreign radio at that time. However, at the time, the price of 20,000 hwan was still burdensome, because it was more than three times the monthly salary of a university graduate, at 6,000 hwan.[10] The media gave a favorable coverage of the introduction of the first domestic radio model, but Goldstar found it difficult

10. For more information, see Korea Institute for Advancement of Technology (2012:69).

to overcome consumers' and dealers' prejudice against domestic products. At the end of 1959, the number of radios in Korea was 316,000, and most of them were foreign models. Goldstar's A501 was the first attempt to compete with foreign electronic products (Seo 2001:85).

Lak Hee's venture into the electronics industry was greatly assisted by its prior experience in a wide range of fields from the cosmetics industry to the production of cosmetic containers and plastic molding products, to PVC pipes and petrochemical products. Based on this experience, by reaching a certain level of accumulated molding, crafting, and machine technology, Goldstar had the ability to make radio cases in plastic instead of wood and to assemble and manufacture radios. Goldstar imported radiographing machines from West Germany for its own molding work and manufactured its own radio case in 1959 by developing the necessary technical manpower. Since the structure of electronic and electric products required a higher degree of precision than the daily products previously manufactured by Lak Hee Chemical, the company had to overcome many technical problems. Through this process, Lak Hee developed molding technology and increased the competitiveness of its plastics business. Thanks to this, in January 1960, the company was able to develop fan motors for electric fans. At that time, the localization rate of the press mold, core, punching, and pressing was 30%. The development of domestically manufactured motors promoted the production of electric appliances such as fans and refrigerators in the early 1960s (LG Electronics).

The Democratic government, which took office in the wake of the April 19 Revolution in 1960, drafted a five-year economic development plan and promoted a national construction project (Lee 2002). As part of this economic policy, the Democratic government proposed in a legislative bill in April 1961 that it would actively nurture the electronics industry by banning the imports of radio components, in addition to prohibiting the sale of certain

foreign goods. This legislative bill represented the first legislative attempt to promote the electronics industry since Korea's liberation in 1945 (Seo 2001:82). The bill was subsequently promulgated on May 10 as the Law on the Prohibition of the Sale of Certain Foreign Products, which could hinder domestic industries or were regarded as luxuries.[11]

Shortly afterwards, the military government, which seized power through a coup on May 16, cracked down on smuggled goods using this law, which was originally intended to protect domestic industries. When General Park Chung Hee visited the Goldstar factory in Busan in July 1961, the company complained that the production of radios was in danger of being stopped because of smuggled goods. Thanks to the ensuing crackdown on smuggled goods, Goldstar's radio sales increased from only a few thousand in 1960 to 137,000 in 1962. That was more than 40% of the 340,000 units sold in Korea in the same year (Seo 2001:85).

In addition to the prohibition of smuggled goods, another policy that turned Goldstar's fortunes around in its early years was a campaign to send radios to rural villages. This campaign, which had been initiated at Goldstar's suggestion, was launched in full scale in July 1962 by the Ministry of Public Information to promote the legitimacy of the military government and the necessity of economic development. This campaign continued until 1963, sending more than 200,000 radios to the country's farming and fishing villages (Seo 2001:86-87).

In the meantime, on December 31, 1961, the government started to expand the supply of TV receivers with the opening of the state-owned Korean Broadcasting System (KBS). In early 1962, the Ministry of Public Information started supplying 20,000 imported TVs and recommended that Goldstar start domestic production of TVs. However, TV production was delayed due to the difficulty in importing components given the dire foreign exchange situation at that time. In early 1965, Goldstar submitted to the government a plan to localize

11. The law prohibiting the sale of certain foreign goods was enacted on May 10, 1961, and was abolished on December 31, 1982.

TV receivers and export electronic products.[12] In response, the government decided to allow Goldstar's TV production in December 1965 under the condition that the localization rate exceed 50%, and that the imports of TV components be funded through foreign currency earned by exporting other electronic products such as radios (based on an export-import link system).

In 1966, Goldstar developed the first domestic black-and-white TV model, VD-191, though a technical alliance with Japan's Hitachi. Before the shipment of TVs, Goldstar requested an adjustment of tariffs and taxes. This request was made because if domestic import tariffs (30% on average), special tariffs (30%) and commodity taxes on final goods (30%) were imposed, Goldstar's TVs were likely to fall behind imported TVs in price competitiveness.[13] Many of the parts used for VD-191 were imported. As high tariffs and excise taxes were imposed, it would have been more advantageous to import final products directly rather than import key components and assemble with domestic components to manufacture TVs. The Ministry of Commerce and Industry accepted Goldstar's request to alleviate its tariff burden on imported components, and Goldstar was able to set a lower consumer price than imported TVs (Seo 2001:110-111).

12. Goldstar actively made policy suggestions in the early 1960s, including the crackdown on smuggled products and the campaign to send radios to farming and fishing villages. From a political economy perspective, Goldstar's pursuit of self-interest had a positive effect on the national economy, because it was materialized in accordance with the national policy objective of promoting the electronics industry. If Goldstar was not interested in localization and quality improvement and instead focused only on blocking the imports of foreign products and securing the procurement demand, Goldstar's pursuit of self-interest would have amounted to a typical rent-seeking activity. In this regard, a performance-based reward and discipline mechanism in a competitive environment helps to ensure that the firm's pursuit of self-interest is in alignment with the public interest.

13. In the model name VD-191, the V and D stand for vacuum tubes and desk type, respectively. 19 represents the TV screen size of 19 inches, and 1 stands for the first TV model. VD-191's material cost amounted to $ 47.90 per unit. When the foreign exchange rate of 272.5 won/dollar was applied, and import tariffs, special import tariffs, and excise taxes were imposed, the consumer price would be 87,683 won. At the time, the prices of Japanese black and white TVs were 78,000 won for the 17 inch type and 100,000 won for the 19 inch type. After the Ministry of Commerce and Industry lowered import tariffs on TV components, Goldstar was able to set the consumer price at 63,510 won (Seo 2001:110-111).

As shown above, until 1966, there was no systematic strategy to promote the electronics industry in Korea. Some policies were implemented. For example, the government protected domestic companies by prohibiting the sale of certain foreign goods and imposing import tariffs, and provided procurement demand by launching a campaign to send radios to farming and fishing villages. However, there was no strategic policy to enhance domestic added value through technology development and human resource development. It would not be an exaggeration to say that there was no policy focused on localizing core electronic components and securing circuit design technology at the time.

There were laws and ordinances stipulating technical standards and quality standards for the electrical and telecommunications industry or the manufacturing sector as a whole. Key examples included: Industrial Standardization Law (1961), to raise the quality and productivity of mining and manufacturing products and to simplify transactions and improve their fairness; the Law on Electrical Appliance Manufacturing Licenses (1966), which stipulated the necessary matters concerning the manufacturing license, type approval, sale and use of the equipment based on the Electricity Business Law (1962); and the Electrical Appliances and Technology Standards Ordinance (1966). These laws and regulations contributed to the elimination of defective products and the fostering of the electric and telecommunications industry by setting technical standards and quality standards, but it was hardly a policy to systematically promote the electronics industry.

In July 1965, in consideration of comparative advantage and effects on the balance of payments, employment, and inter-industry spillovers, the Ministry of Commerce and Industry included "radios and electric devices" among 13 designated export specialization industries (Kim 1990:115). However, the electronics industry had no special place. It was just one of the 13 industries deemed to have bright export prospects, including silk fabrics, ceramic products, rubber products, plywood, cotton fabrics, garments, and leather goods.[14]

14. See KOTRA (2002), p.23 for more detailed information.

In 1965, electronics exports reached $1.79 million (Lee 1975: 25), with $ 1.44 million for radios, and two-thirds of radio exports based on bonded processing (KIST 1968).[15]

Until 1966, there was no government body to formulate and implement a comprehensive plan to promote the electronics industry. The Electric Industry Division was established in 1964 as part of the Second Industrial Bureau at the Ministry of Commerce and Industry. The Electric Industry Division covered electricity, communications, electric wires, batteries, and lights, and it regarded the electronics industry as a part of the communications industry and had no official assigned to the electronics industry. Lee Man-hee, who was appointed to Director of the Electricity Industry Division in early 1966, added consumer electronics to the Communications Sub-division, but could not secure an additional staff. YoonChungwoo, head of the Communications Sub-division, had to take up consumer electronics in addition to communications for his portfolio. This kind of adjustment provided the basis for the government to draft a strategy to promote the electronics industry, but there was a limit to formulating and implementing policy at the sub-division level.

15. At the time, most of the radio exports based on bonded processing involved $ 1 transistor radios, led by the Dongnam Books, Shinsung Electric, IDR, and Jongro Sound (Namsung Heungup). Instead of bonded processing, Goldstar imported core components, assembled them with domestic components, and exported radios at the price of over $ 10. The Ministry of Commerce and Industry issued certificates for imported raw materials used in exports so as to provide exemption from custom duties. At the time, export inspection officials felt that Korea could export electronic products in earnest by looking at the monthly export trend information on Japanese products published by the Japan Machinery and Metals Inspection Institute (JMI) or Japan External Trade Organization (JETRO). For more information, see Yoon (2016).

2. Initial Conditions before the Introduction of Promotion Policy

By the mid-1960s, the Korean electronics industry had developed capabilities to assemble and manufacture basic electronic products such as radios using imported core components, but had yet to realize its full potential to produce and export electronic goods. KIST shed light on the status of the electronics industry in its 1968 report consisting of three sections: the economic status of the domestic electronics industry, the technical status, and conditions for growth.[16]

According to the KIST report, the share of the mining and manufacturing industry in GNP was 21.6% in 1965, and electronics device manufacturing accounted for only 0.9% of the mining and manufacturing industry, so that the electronics device manufacturing industry accounted for only 0.19% of GNP. In terms of the proportion of electronics manufacturing to GNP, Korea's figure in 1965 was so low as to be comparable to the U.S. in the early 1930s. However, in terms of growth, the electronics manufacturing industry showed its potential with its production index soaring from 100 in 1960 to 722.0 in 1965; whereas, Korean manufacturing industries as a whole increased from 100 to 177.5 over the same period. According to the 1965 Mining and Manufacturing Census, the value added ratio of the electronics manufacturing industry was very high at 43.0%.

In 1964, the export of electronic products was about $960,000, but since 1966, various components and devices other than transistor radios started to be exported and electronics exports rapidly increased to $ 3.6 million (Lee 1975: 25). However, at that time, the Korean electronics industry was not fully realizing its export potential, compared with neighboring economies. For example, in 1966, the U.S. imported $ 500 million of electronics products from the Far East, with Japanese products accounting for 80% and Korean products, only 0.35%. In terms of industry share of exports, electronics was ranked second for Japan, fifth for Hong Kong, sixth for Taiwan, but only 10th for Korea.

16. For more information, see KIST (1968).

In Korea, domestic radio products accounted for 60% of domestic consumption in 1962, and 87% in 1966. In the case of black-and-white TV, the supply rate of domestic products in Korea was 35% in 1966.

Table 3-1 | Domestic Consumption and Exports of Radios (1962-1966)

Year	Domestic Consumption		Domestic Supply Ratio (%)	Exports	
	10,000 Units	$ Million		10,000 Units	$ Million
1962	9.8	0.98	60	0.03	0.004
1963	14.5	1.63	65	1.17	0.105
1964	16.2	2.12	70	2.41	0.558
1965	22.0	3.08	85	32.1	1.441
1966	20.0	4.00	87	83.3	2.845

Note: Exports include bonded processing in 10,000 units (22.0 in 1965 and 69.2 in 1966).
Source: KIST (1968).

In 1966, the localization rate of most components was not even 40%, except for some items such as variable resistors, variable capacitors, and chassis. However, for core components such as semiconductors (transistors, integrated circuits, etc.), electronic tubes (vacuum tubes, cathode-ray tubes, etc.), and ferrites,[17] 100% were being imported.

17. In the 1970s, ferrite was localized by a mid-size company called Yugwang Ferrite.

Table 3-2 | Localization Rate of Electronic Components (1966)

Component	Annual Demand		Local Products ($Mil.)	Localization Ratio (%)
	Million Units	$Million		
Semiconductors	10.3	2.03	0	0
Electronic Tubes	0.62	0.25	0	0
Electrolytic Cap	7.52	1.75	0.53	30
Paper covered Cap	1.72	0.03	0.01	33
Magnetic Cap	11.8	1.18	0.18	15
Fixed resistor	23.4	0.19	0.06	31
Variable resistor	1.2	0.16	0.13	81
Ferrite	4.3	0.32	0	0
Speaker (Magnet)	1.14	0.23	0.07	30
Variable battery	1.1	0.30	0.18	60
Printed board	1.1	0.12	0.04	33
Chassis	1.1	0.77	0.54	70
Others	-	0.27	1.02	80
Total		7.60	2.76	36

Source: KIST (1968).

According to the KIST report, most of the Korean companies that produced final products were inefficient, and most of the work was done manually, and most component-manufacturing plants were using Japanese machines that were 4-5 years behind. The quality of Korea's household electronic devices improved to the level comparable to that of foreign imports, except for durability.

By contrast, almost all of the foreign-invested companies that were established in the mid-1960s had the latest equipment and were rapidly increasing exports centering on assembled and processed parts using low-wage labor. In 1966, the government consolidated the Foreign Capital Inducement Promotion Law (1960) and the Foreign Loan Repayment Guarantee Law (1962) and replaced it with the Foreign Capital Inducement Law (1966) ahead of the implementation of the Second Five-Year Economic Development Plan (1967-1971). The new law focused on attracting foreign direct investment from multinational corporations.[18]

Companies set up as joint venture included Central Trading (with Royal Pac in September 1965), Komi (with Komy in December 1965),[19] and Korea Microelectronics (with USKM in December 1965). 100% foreign-owned firms were established as well, starting with Fairchild Korea, set up to manufacture silicon transistors and diodes in April 1966, followed by Signetics Korea (July 1966), and Motorola Korea (March 1967) (Korea Electronic Industries Cooperative 1997:53-57, 161-167).

The KIST report, which outlined the economic and technological status of the Korean electronics industry, suggested that Korea had a great potential given that the electronics manufacturing industry was rapidly spreading to low-wage countries in the Far East. The KIST report noted that although the government was developing electronic products as export strategic products, there was an urgent need for market intelligence activities.

18. Korea had abundance of low-wage labor at the time, and the government introduced a variety of tax benefits and simplified administrative procedures to attract foreign direct investment (O 1996:394-395).

19. In 1965, American electronic companies were already in Taiwan. Set up as a joint venture between Korean and American companies, Komi showed that Korea had a bright potential for the electronics industry, which in turn helped to convince other American companies such as Fairchild and Motorola to invest in Korea (Yoon 2016).

In the mid-1960s, Korea's per capita income was only 1/9 of the U.S. and 1/4 of Japan's.[20] In their discussion of new structural economics, Lin and Monga (2010) proposed a criterion for international benchmarking based on the late-comer's advantage, suggesting that developing countries focus on "tradable goods and services that have been produced about 20 years in dynamically growing countries with similar endowment structures and a per capita income [measured in purchasing power parity] that is about 100% more than their own." According to this criterion, Korea in the mid-1960s was not in a position to move into the electronics industry because its per capita income only 1/4 of Japan's, not even half. However, since the labor-intensive assembly segment of the electronics industry could provide a relatively easy point of entry and domestic companies had already demonstrated their ability to export transistor radios, Korea could think seriously about promoting the electronics industry in a systematic way.

20. According to the Maddison Project, the per capita income in Korea in 1965 was $ 1,436 in 1990 Geary-Khamis international dollars, and the per capita income in Japan and the US was $ 5,934 and $ 13,419, respectively.

Chapter 4

Electronics Industry Promotion Policy

1. Five-Year Electronics Industry Promotion Plan (1967-1971)
2. Policy Recommendation and Background Report for Electronics Industry Promotion
3. Electronics Industry Promotion Law and Basic Plan
4. Implementation System
5. Major Policy Instruments

Electronics Industry Promotion Policy

1. Five-Year Electronics Industry Promotion Plan (1967-1971)

Based on the successful results of the first Five-Year Economic Development Plan (1962-1966), the government in the mid-1960s looked for promising industries beyond garments. Kim Ki-Hyung, who had worked as a researcher at an electronic ceramics institute in the United States, returned to Korea in the summer of 1966 and suggested to President Park Chung Hee that electronics and ceramics could be promising for Korea because both were labor-intensive industries.[21]

21. Kim Ki-Hyung majored in chemical engineering at Seoul National University and received his Ph.D. in engineering from Pennsylvania State University in 1961 and worked at Airco-Speer. When he returned to Korea in 1966, his younger brother was working as an assistant to the Deputy Prime Minister. After Dr. Kim gave a couple of newspaper interviews on the prospects of the electronics and ceramics industry in Korea, the Ministry of Commerce and Industry contacted him for his insights. After a meeting with the Ministry officials, he gave them a book titled A Ten-Year History of Japan's Electronics Industry Promotion, and said that he would shortly go on a mission to study science and technology policy in advanced countries at President Park's instruction. On December 5, 1966, the Ministry of Commerce and Industry announced its Five-Year Electronics Industry Promotion Plan. After returning from his mission, Dr. Kim teamed up with another member of the Economic and Scientific Deliberative Council to give a briefing on Electronics Industry Promotion Plan to President Park on March 9, 1967. In April 1967, Dr. Kim Ki-Hyung was appointed as the inaugural Minister of Science and Technology (Yoon 2016).

President Park expressed interest in promoting the electronics industry, and the Ministry of Commerce and Industry started working on a plan to promote the electronics industry. Subsequently, the Ministry of Commerce and Industry announced on December 5, 1966, the Five-Year Plan for Electronics Industry Promotion. The major goals were import substitution of electronic components, division of labor and specialization of assembly and parts factories, reduction of export costs, cultivation of technical experts in the electronics industry, and diversification of electronics export market. Park Chung-hoon, Minister of Commerce and Industry, announced the goal of developing the electronics industry as an export-oriented strategic industry, aiming to achieve $100 million in electronics exports by 1971. In 1966, Korea's total exports amounted to $250 million, and the electronics industry exports accounted for only $3.6 million. The plan thus envisaged that the electronics industry exports would increase by 30 times in five years. The Five-Year Electronics Industry Promotion Plan contained export items and export targets of 21 companies that were able to export at the time, such as Goldstar and Dongnam Electric.

Table 4-1 | Export Targets in the Five-Year Electronics Industry Promotion Plan (1967-1971)

Company	Export Items	Export Targets (thousand USD)				
		1967	1968	1969	1970	1971
Goldstar	Radio	1500.0	2000.0	3000.0	5000.0	8000.0
Samyang	Radio, Resistor	341.5	876.8	1220.0	1250.0	2050.0
Dongnam	Radio, TV	2225.0	5100.0	7700.0	9450.0	12300.0
Chunwoo	Radio	1730.0	2500.0	3000.0	3500.0	4000.0
IDR	Transistor Radio	400.0	800.0	1500.0	2100.0	2500.0
Marvel Korea	TV	566.7	3661.2	3709.9	4705.1	4705.0
Orion	Volume	1116.0	4128.0	5136.0	6996.0	7760.0
Donghwa	TV	240.0	600.0	840.0	960.0	960.0
Daeyang	Volume	337.8	600.0	1000.0	1000.0	1200.0
Komi	Transistor	2103.1	3400.0	5100.0	6800.0	8500.0
Korea Micro	IC	3448.5	5517.6	11035.0	17272.8	22370.4
Signetics Korea	IC	1540.0	1870.0	1980.0	1980.0	1980.0
Bumhan	Silicon Transistor	51.8	974.4	1349.9	1600.0	1900.0
Sudo Piano	Electric Guitar	680.0	870.0	945.0	1020.0	1320.0
Samhwa	Battery, Condenser	300.0	750.0	1200.0	1600.0	2500.0
Sammi	Volume, Radio	160.4	506.0	2190.0	6790.0	11878.0
Sunny	Crystal	857.1	4067.2	4307.2	4787.0	5072.2
Korea Electronics	CRT	77.5	96.0	117.0	140.0	180.0
Namsung	Radio	1620.0	3325.0	5320.0	-	-
Central Trading	Radio	1065.0	5050.0	4150.0	6250.0	7350.0
Jeonwon	Battery, Condenser	120.0	210.0	338.0	450.0	670.0
Total		20,510.4	46,902.2	65,138.0	83,650.9	107,195.6

Source: O (1996:307).

The Ministry of Commerce and Industry asked the companies how much they could export over the five-year period, and compiled the figures as export targets. Whether companies were overly optimistic or conservative in their projections, the Ministry respected their opinions (Yoon 2016). According to their projections, total exports in the electronics industry would jump from $ 3.6 million in 1966 to $ 20.51 million in 1967, and then increase to $ 46.9 million in 1968, exceeding $ 100 million in 1971. In other words, the electronics exports would rise six-fold in 1967, the first year of the planning period, and then

increase by about $ 20 million annually from 1968. This was a rather unrealistic projection, because exports would likely increase slowly in the early years and then accelerate, due to a gestation period for the construction of factories. However, aside from the accuracy of the projections, the export targets served as benchmarks against which progress could be measured. Moreover, since the targets were based on exports rather than domestic output, it could be argued that the plan emphasized international competitiveness from the outset.[22]

2. Policy Recommendation and Background Report for Electronics Industry Promotion

The government then invited Dr. Kim Wan Hee, who was a professor of electrical engineering at Columbia University, for advice on promoting the electronics industry. After receiving his Ph.D. from the University of Utah and working as a researcher at IBM, he had joined the faculty of Columbia University and become a tenured professor in 1963. He was a world-renowned authority in the field of electrical engineering. After making a field visit to factories and industrial facilities for four days, Dr. Kim prepared a briefing material to be presented to President Park Chung Hee. He was assisted by Yoon Chungwoo, Head of Communications Subdivision at the Ministry of Commerce and Industry, and Lee Taegu, Director at the Korea Electronic Industries Cooperative. The resulting policy recommendation thus incorporated the ideas of the experts in the academic and business community as well as the government. Dr. Kim made a briefing to President Park on September 16, 1967.[23]

22. According to the head of the Communications Sub-Division at the Ministry of Commerce and Industry at the time, when Korean electronics companies demanded stronger protectionist measures, the Ministry pointed out that stronger import restrictions might lead to reduced pressure on domestic producers to improve their product quality and asked them back whether they were interested in selling their products only in Korea or around the world (Yoon 2016).

23. For the full text of this policy recommendation, see Kim (1967).

This recommendation analyzed the problems and potentials of Korea's electronics industry from a comparative international perspective based on a deep understanding of the technology and industry, and then presented concrete measures for fostering the electronics industry in Korea. Dr. Kim highlighted the high value added and labor-intensive characteristics of the electronics industry and emphasizes the need for continuous R&D and a high degree of managerial skills to bring together specialized segments. In order for a company to succeed in the electronics industry, it must have the system integration capability to produce, procure, process, and assemble a large number of components in accordance with quality standards, in addition to R&D and marketing capabilities. In the electronics industry, much more parts are needed than in the conventional labor-intensive industries such as garments and footwear, and the share of R&D and marketing in the overall value chain is high, so that coordination and innovation are of prime importance. More precisely, what was required was not merely a shift from garments and footwear to the electronics industry, but development of capabilities suited for activities that demand greater coordination and innovation.[24]

Regarding adaptability, Dr. Kim pointed out that Korea had an abundant, low-cost labor force, with good dexterity and an excellent ability to learn and assimilate knowledge. He added that Korea had a good opportunity because of the manufacturing of household appliances was in decline in advanced industrial countries. Although the production and operation status of domestic electronics industry was still in its infancy, Korea had the potential to succeed in the electronics industry.[25] He emphasized that support should be given to electronic devices and parts as strategic export products.

24. See Lederman and Maloney (2012) for a recent discussion of the importance of activity or capability fostering policies, not sector promoting policies, focused on the value chain curve. They imply that a country that has developed high value-adding capabilities such as R&D and product design in a sophisticated industry finds it relatively easy to move into another sophisticated industry requiring such high value-adding capabilities. This logic is in line with the product space theory.

25. At that time, foreign investors were actively engaged in the electronics industry of Taiwan and Hong Kong. In particular, based on a consultation report prepared by Arthur D. Little, Taiwan was promoting the electronics industry as one of its promising industries for the future (Yoon 2016).

Dr. Kim then pointed out 15 issues faced by the electronics industry. He was concerned with well-known general issues such as: (1) the lack of research and development, (2) the small scale of most companies engaged in electronics, (3) the ineffectiveness of industrial development (4) the lack of information gathering and analysis activities on foreign technology and markets, (5) small size of the domestic market insufficient to support division of labor, specialization, and localization, and (10) the lack of measures to train technicians and skilled workers. In addition to these general issues, he highlighted a number of specific issues that had to be addressed for the promotion of the elecronics industry in Korea.

Dr. Kim emphasized that a legal basis must be provided to foster the electronics industry and that the relevant laws and regulations (trade transaction law, customs law, internal tax law, etc.) should be adjusted (Section 7). He noted that Japan started promoting the electronics industry in 1957 after the enactment of the Law on Provisional Measures for Electronics Industry Promotion. In fact, Japan's electronics production had amounted to $ 500 million in 1957, lower than West Germany or the United Kingdom, but in 1966 it surpassed $ 3,250 million, forging ahead of these European countries (Kim 1968: 15).[26]

Dr. Kim also pointed out that there were no specialized organizations in Korea's electronics industry to recommend policies to the government and to serve in leadership capacity for companies (Section 8).[27] For example, there was no organization like the Electronic Industries Association of Japan or the Electronic Industries Association (EIA) of the United States. In this regard, Dr. Kim pointed out that the sale of electronic products and transactions in parts and components cannot proceed smoothly due to the absence of a rigorous quality inspection and enforcement system and the resulting lack of trust among the companies.

26. The Korea Electronic Industries Cooperative, referring to the case of Japan, had proposed the enactment of an Electronics Industry Promotion Law at the first extraordinary general meeting held on May 30, 1967 (Korea Electronic Industries Cooperative 1997: 43).

27. On Dec. 5, 1966, in its Five-Year Electronics Industry Promotion Plan, the Ministry of Commerce and Industry had mentioned the need to establish an electronics industry center.

Furthermore, Dr. Kim lamented that there were no chaebol-class companies in the domestic electronics industry capable of responding to foreign companies (Section 9). He pointed out that before the inducement of foreign investment, the chaebol should be encouraged to enter the electronics industry. In fact, in the mid-1960s, only Lak Hee (currently LG), the third largest chaebol based on asset size, had entered the electronics industry, and the fourth-ranked Taihan, who was successful in the cable business, was considering entering the electronics business. However, other large business groups such as Samsung, Samho, Gaepung, Samyang, Ssangyong, Hwashin, Panbon, and Dongyang, did not have a firm plan to advance into the electronics industry.

In addition, Dr. Kim lamented that the high value-added potential of the electronics industry was being underestimated in Korea and that electronic products were regarded as luxury goods with excessive consumption taxes imposed on them (Section 13). As could be seen in the case of Goldstar's black and white TV, excessive tariffs and consumption taxes on electronic products were key factors impeding the expansion of the domestic market at that time. Without expanding the domestic market, it was difficult to promote division of labor, specialization, and localization based on economies of scale, and there was also a limit to producing and exporting products with international competitiveness. In addition, Dr. Kim pointed to a number of other problems affecting the electronics industry: the lack of a stable power supply system (Section 11), lack of enterprise rationalization in planning, management and organization (Section 12), and lack of industry-university cooperation (Section 14).

Dr. Kim then presented the following objectives to be accomplished by 1971 when the Second Five-Year Economic Development Plan was completed.

(1) Complete the industrialization and production system for electronic devices and components related to the first stage of electronics industry development (manufacture of household devices and terrestrial communication electronic devices).

(2) Complete research, development and manufacture of semiconductor devices and integrated circuits, which are key elements for entry into the second stage of electronics industry development (manufacture of electronic calculators, application of enterprise rationalization, and manufacture of electronic devices for space communication).

(3) Actively protect and promote domestic manufacturers (including joint ventures) to achieve annual exports of $100 million (total production of $150 million expected) for electronic products (household electronic devices and components, especially semiconductor chips and integrated circuits)[28]

(4) Ensure supply capability of wireless communication devices among defense electronic devices.

In Dr. Kim's assessment, in 1967, Korea was only entering the first stage of electronics industry development. Completing by 1971 research, development and manufacturing of semiconductor devices and integrated circuits, the core of the second stage, might be regarded as an overly ambitious goal. However, even if the goal was overly ambitious, it presented a clear vision for Korea's electronics industry: Korea would not settle for the labor-intensive segment of the electronics industry, but rather aim to complete the first and second stage of electronics industry development through the development and production of electronic devices and components, and move toward the third stage of promoting automation in both household and industrial use.

28. Dr. Kim's recommendation set the $100 million export target for the electronics industry in 1971, at the same level as in the Five-Year Electronics Industry Promotion Plan.

Table 4-2 | Expected Impact of Promoting the Electronics Industry (1971)

Exports	$100 million
Import Substitution	$35 million
Localization Rate	Household Electronic Devices: 90% or above Components: 80% or above
Employment	20,000 or above
Contributions to Related Industries	Inducement of input industries in machinery, metals, and chemical sectors
Improvement in Production Technology and Product Quality	Improvement in Circuit and Product Design, Product Quality Improvement through Scientification and Modernization of Technology
Rationalization of Industrial System	Systemization of Final Goods and Component Manufacturing

Source: Kim (1967:80).

In order to solve the problems mentioned above and to achieve the goals, Dr. Kim made three policy suggestions: (1) enactment of the Electronics Industry Promotion Law, (2) securing and releasing funds for the promotion of the electronics industry, and (3) establishment of the Electronics Industry Promotion Center. Dr. Kim recommended that the Electronics Industry Promotion Law include key provisions for fostering the electronics industry: designation of electronic products (devices, components, and materials) to be promoted, financial and tax benefits, education and training of technicians, localization and industrial division of labor, and promotion of exports. He estimated that 3.86 billion won would be needed from 1968 to 1971 for promoting the electronics industry, and over the same period, $5 million would be needed to purchase equipment and facilities to set up the Electronics Industry Promotion Center as a foundation.

In addition to preparing and presenting the briefing material, Dr. Kim met with business leaders to persuade them to venture into the electronics industry. In particular, in September 1967, he met with Lee Byung-Chul, Chairman of the Samsung Group, who was studying the electronics industry at the time, and answered various questions related to the electronics industry (Kim 1999:51). In addition, Dr. Kim provided advice and support to Korea Institute of Science and Technology (KIST), which he had helped to set up in 1966 as the first comprehensive science and technology research institute in Korea.[29] Thanks to these efforts, Dr. Kim Wan Hee was later called the "Godfather of the Korean electronics industry."[30]

President Park Chung Hee, who received the briefing from Dr. Kim for more than two hours, showed him a transistor sample that Motorola had presented when it was asking for the Korean government's permission to purchase a factory site. President Park said: "I was told this little chip is worth 20 to 30 dollars apiece, and a bag of them would be worth tens of thousand dollars. But since we still export only cotton fabrics, even if we sell a full train load, we could get only a few hundred thousand dollars." (Kim 1999: 16-19). As such, President Park had a great interest in promoting the high value-added electronics industry as a promising industry for the future.

After the briefing at the Blue House on September 16, 1967, the government commissioned Dr. Kim to conduct a $100,000 study on the promotion of the electronics industry. He asked KIST to investigate the status of the Korean electronics industry. For overseas market

29. In June 1965, the Korean Ambassador to the U.S. invited Dr. Kim Wan Hee to meet with Dr. Donald F. Hornig, Science Advisor to U.S. President Lyndon Johnson, before his scheduled trip to Korea to follow up on President Johnson's pledge to provide assistance to Korea in the field of science and technology. Dr. Hornig proposed to establish a university for science and technology education in Korea, but Dr. Kim explained that although there already were many universities in Korea, students could not find good jobs in science and technology after graduation. He added that a research institute in applied science and industrial technology could provide jobs for these graduates and also contribute to Korea's economic development. After his visit to Korea in July, Dr. Hornig commissioned the Battelle Memorial Institute to conduct a background study on the establishment of the Korea Institute of Industrial Technology and Applied Science (KIITA). This institution was established in 1966, with the name of the Korea Institute of Science and Technology (KIST) (Kim 1999: 60-62).

30. In today's terminology in industrial policy, Dr. Kim played the role of a network organizer in promoting Korea's electronics industry.

trends, he relied on Howard Chase, former U.S. Deputy Secretary of Commerce, who was running a market research and consulting firm. He also received assistance from more than twenty of his colleagues in the U.S.

Dr. Kim came back to Seoul in March 1968 with a delegation of U.S. experts. The delegation included W.J. Hennessy, Dean of Engineering at Columbia University, C.M. Harris, an academic authority on sound and audio, Howard Chase, President of Chase Corporation, and W. Hurley, President of Harvard Industries.[31] During their nine-day visit, the group met with President Park at the Blue House and exchanged opinions with government officials and business leaders.

Shortly after this visit, more than 30 representatives of the Korean electronics industry visited the U.S. in March 1968 led by President of Goldstar. During the 20-day visit, the Korean delegation was able to see for themselves the emergence of the silicon-based integrated circuit and the decline of the germanium-based transistor, now being relegated to low-wage countries. The U.S. visit provided an opportunity for Korean business leaders to realize the importance of semiconductors (O 1996:328-329).

Dr. Kim Wan Hee prepared a background research report for the promotion of the electronics industry over the next few months. The background report, about 1,000 pages in length, consisted of four parts: (1) Overview and analysis of foreign industrial development policy, (2) Global market analysis for electronics industry promotion, (3) Policy recommendation for electronics industry promotion, (4) Concrete plan to establish the Electronics Industry Promotion Center.[32] Part (1) Overview and analysis of foreign industrial development policy covered general industrial policy issues, broadening the

31. The Journal of the Institute of Electronics Engineers published papers by Harris and Hurley in Volume 5, Issue 1 (April 1968).

32. According to Yoon Chungwoo, Head of the Communications Sub-Division at the Ministry of Commerce and Industry, who was dispatched to the U.S. to help Dr. Kim with his report, he returned to Korea with five copies of the report and distributed them to the Ministry of Commerce and Industry and related organizations, but all are missing today. Only the Korean-language summary of the report, which was used for briefing at the Blue House, is available at the National Archives. See http://theme.archives.go.kr/next/chronology/yearRecord.do?year=1968 for links.

policy perspective by analyzing strategies for attracting foreign investment and promoting promising industries. Dr. Kim visited San Juan in Puerto Rico and the Shannon Free Trade Zone in Ireland, the world 's first free trade zone, and also visited a science and technology park in the state of Georgia in the U.S. The other parts of the background basically added detail to the 1967 policy recommendation.

Dr. Kim came back to Korea in July 1968 and met with business leaders while the report was being translated into Korean and the briefing material was prepared. President Park Chung Hee had asked him to encourage them to enter the electronics industry. Dr. Kim highlighted global trends in the world electronics industry and talked about government support and promotion policies of advanced industrial countries (Kim 1999: 29-30).

On August 1, 1968, Dr. Kim gave a briefing to President Park Chung Hee, Minister of Commerce and Industry Kim Chung-yum, and other high-ranking officials for two and a half hours. In a section titled "Current Status and Prospects of the World Electronics Industry," Dr. Kim noted that electronics production per capita in 1967 was $107.8 in the United States, $36.1 in Japan, and $14.8 in Taiwan, while it was only $1.9 in Korea. However, he emphasized that Korea had the potential to catch up and succeed in the electronics industry.[33]

In his analysis of foreign industrial development policy, Dr. Kim noted that Taiwan had set up a free trade zone in Kaohsiung to attract foreign investment and provided education, culture, housing and amusement facilities in addition to infrastructure such as power, water, road, telecommunication, a port and an airport. He also mentioned that Taiwan exempted warehouse fees for raw materials for the first two years at the bonded warehouse facilities.

33. In 1967, the United States was the undisputed leader in electronics, with an output of $ 107.8 per capita, followed by Norway at $ 46.9, Sweden at $ 45.7, and West Germany at $ 37.9. The simple average of per capita electronics production in the countries that Dr. Kim surveyed was $ 12.9 (Kim 1968: 16).

In the case of Japan, Dr. Kim emphasized that the Japanese government had enacted the Electronics Industry Promotion Provisional Measures Law in 1957 and established a highly planned and focused production system moving from development research to volume production and then to rationalization. He emphasized that Japan, with similar natural endowments as Korea, was able to rise as the world's second largest electronics producer by designating priority items for promotion and providing support in three stages. He concluded that it was necessary for Korea to pursue systematic industrial policy.[34]

Table 4-3 | Japan's Designation of Products for Promotion and Provision of Support (1957-1967)

Stage	Products for Promotion	Provision of Support	
		Cases	Amount
Development research	34	570	Y3.1 bil. ($8.60 mil.)
Volume production	8	9	Y1.1 bil. ($3.04 mil.)
Rationalization	37	137	Y10.6 bil. ($29.46 mil.)
Total	79	716	Y14.8 bil. ($41.10 mil.)

Source: Kim (1968:28).

Table 4-4 | Japan's Production and Exports of Electronic Products (1957-1967)

	1957 ($mil.)	1967 ($mil.)	Growth Multiple
Production	466	3,600	9
Exports	22	1,045	48

Source: Kim (1968: 28).

34. In Korea, as in Japan, the government designated products for promotion and provided support to companies that made investment in the development and production of these designated products. However, unlike in Japan, the Korean government did not abide by the three-stage approach (development research → volume production → rationalization). Instead, it tried to reduce catch-up time by attracting foreign companies and forming technology alliances, given the wide knowledge gap between Korea and advanced industrial countries at the time (Yoon 2016). This policy is in line with a latecomer catch-up strategy prescribed by New Structural Economics.

In the case of Ireland, Dr. Kim noted that the country provided a temporary tax exemption to promote new industrial development. He emphasized that the government provided tax exemption for import-substituting or exporting companies from 1965 to 1980, giving a longer period of exemption for earlier investors. He added that Ireland set up Shannon and two other free trade zones, and established overseas branch offices in countries such as the United States and West Germany to attract foreign investment. Ireland also provided support for the supply and training of technical personnel. In the case of Puerto Rico, Dr. Kim noted that the tax exemption period was set at 10, 12, and 17 years, depending on the level of the province's development.

Dr. Kim emphasized that a research park or industrial park in the United States features research institutes in conjunction with engineering colleges and attracts companies accordingly. He cited the MIT, the Lincoln Lab, and other engineering colleges in the Boston area and the research industrial park centered at Stanford University in the San Francisco area.

In the next section, titled "Analyzing the global market of electronic products and development potential in Korea," Dr. Kim discussed the prospects of the whole range of electronic products: consumer electronic devices (radios, TVs, stereos, etc.), industrial electronic devices (electronic measuring devices, high-speed digital electronic circuit devices), data processing devices, electronic calculators, medical electronic devices, and military electronic devices. Since radios were already a promising export item for Korea, he recommended that the production capacity be increased three to four times within three years. He also suggested that Korea develop color TVs as well as small-size black-and-white TVs given the rapidly increasing demand for TVs worldwide. In the case of industrial electronic devices and medical electronic devices, Dr. Kim noted that it was difficult to

mass-produce them in view of the manufacturing process and demand, and argued that it was important to raise high-quality technicians with a good knowledge of electronic circuit design technology and secure high-performance parts and components. For data processing equipment, Dr. Kim thought that Korea should start by developing desktop electronic calculators. In the case of military electronic devices, he argued that it was necessary to develop high-performance small-sized radios and portable telephones since they were essential for national defense.

In "Suggestions for the Promotion of Electronic Industries," Dr. Kim further developed the contents of the 1967 policy recommendation as follows: (1) general policies for industrial development, (2) enactment of a special law for electronics industry promotion, (3) improvement of technical education (4) utilization and recruitment of overseas technicians; (5) technology information activities; (6) management of foreign technology transfer; (7) rigorous quality control and inspection; (8) market exploration and export promotion, (9) electronic industrial development as defense industry, and (10) other issues. Compared with the 1967 policy recommendation, these suggestions greatly emphasize technical capacity building.

General policies for industrial development included tax reduction and exemption for companies that developed new products,[35] reduction of taxes on imported parts and raw materials needed for product development, tax benefits and subsidies for R&D, and financial support for the purchase of capital goods and raw materials as well as the construction and operation of factories. Also included were proposals to attract joint ventures with top-class companies from leading technology countries and to strengthen administrative capacity by increasing the supply of technically trained government officials.

35. The government's policy to designate products for promotion and provide support to companies that invest in the development and production of these designated products can be compared with a self-discovery strategy prescribed by Rodrik (2007). However, in Korea's case at the time, as a latecomer in electronics, it was relatively easy for the government to designate products for promotion because information on what needed to be discovered was readily available.

As for technological capacity development, Dr. Kim noted that MIT had previously emphasized mechanical engineering, but by the end of 1960s, 60% of its students were majoring in electrical/electronical engineering. He argued that university education should be expanded and adjusted to meet global trends and that engineering education, in particular, should be made practical through university-industry cooperation. Dr. Kim recommended that the government establish an overseas technology information collection agency and create a technology officer position at embassies abroad, in addition to recruiting technicians from overseas. He also argued for the coordination of technology transfer for each product and emphasized the importance of promoting technology acquisition for basic electronic components.[36] According to his assessment of technology acquisition at the time, 40 out of 45 cases were sourced from Japan, and Dr. Kim recommended that Korea acquire advanced technology directly from the U.S. or Western Europe.[37]

Table 4-5 | Sources of Technology Licensing for Korea's Electronics Industry (1968)

	Japan	U.S.	Western Europe	Total
Consumer Electronic Devices	4	1	1	6
Industrial Electronic Devices	22	1	0	23
Electronic Components	14	0	2	16
Total	40	2	3	45

Source: Kim (1968:54).

36. Korea's technology licensing contracts, mostly for radios and TVs, included provisions for royalty payments at 2 to 3% of sales or 3 to 5 dollars per unit (Korea Electronic Industries Cooperative 1997: 55).

37. In his interview with Joongang Ilbo, Dr. Kim called for coordination of technology licensing under the proposed Electronics Industry Promotion Law. See "The Road to Electronics Industry Promotion: Korea's Electronics Industry as seen by Dr. Kim Wan Hee," Joongang Ilbo, July 20, 1968 (http://news.joins.com/article/1167767).

As for market development and export promotion, Dr. Kim pointed out that it was important to train and dispatch sales people with technical knowledge. For the defense industry, he called for advisors on military electronics, R&D on communications and radar equipment, and financial support to private sector companies engaged in development efforts. In addition to setting up research industrial complexes and free trade zones, Dr. Kim also suggested that the government provide for outbound investment to facilitate overseas marketing activities by Korean exporters. For example, he proposed that financial support be provided for the construction and operation costs of factories and branch offices engaged in prototype production in foreign countries.

Based on these discussions, Dr. Kim presented a concrete plan for the establishment of the Electronics Industry Promotion Center in the conclusion of his briefing. This section accounted for 23 pages out of the 81-page briefing material. The Electronics Industry Promotion Center would have the following missions: (1) development of electronic products and operation of prototype factories (pilot manufacturing), (2) technical education and training of high-quality technicians, (3) technology information activities and consultation and coordination with regard to technology acquisition (4) quality control and inspection, (5) market research (technological aspects) and export promotion, and (6) establishment and promotion of enterprises. In addition, by having the government consult with the center on electronics industry administration, the center would also have a policy consultation role. Furthermore, Dr. Kim even thought about expanding the center into a ministerial-level promotion agency by building on the new Ministry of Science and Technology and absorbing some of the functions of the Ministry of Commerce and Industry. In this regard, the Chief of Staff to the President had a similar idea at the time (Kim 1999: 31-32). In other words, since there was a limit to promoting the electronics industry through a sub-division unit within the Ministry of Commerce and Industry, the idea was to create a ministerial-

level promotion agency. This was in the same vein as the proposal to have the Ministry of Post and Communications and Korea Telecom lead the promotion of the information and communication technology sector in the 1980s, or to expand the Ministry of Post and Communications into the Ministry of Information and Communications in 1994 to lead the informatization drive.[38]

Dr. Kim said, "The electronics industry has such a short product cycle that it would be impractical to try to develop technology from scratch at home. We should acquire advanced technology as quickly as possible and develop export products." To achieve this objective, he proposed to establish the Electronics Industry Promotion Center and foster the electronics industry in a short period with national-level support (Kim 1999: 30). Dr. Kim envisioned that the Electronics Industry Promotion Center would pioneer R&D and move on to pilot prototype production, market diagnosis, improvement of the prototype, minimum volume production, and market development (confirmation of commercial viability), basically laying all the groundwork for volume production by the private sector. The draft Electronics Industry Promotion Law stipulated that after designating electronic products to be promoted, the government would provide support to private sector companies making investments to develop and produce these products. However, Dr. Kim felt that at least for the first few years, the Electronics Industry Promotion Center would have to lead the way.

38. See Lim and Lee (2010).

Dr. Kim presented the work to be carried out by the Electronics Industry Promotion Center during the period from 1969 to 1973 in a tabular form. After selecting core technologies and items, the Electronics Industry Promotion Center would develop and commercialize them and foster them as export items. In particular, the center would go beyond consumer electronic devices and focus on the development of electronic calculators and computers as well as core components such as semiconductors. For the first five years, the required amount of fund for the Electronics Industry Promotion Center was estimated to be 5,458.75 million won (19.85 million dollars), and the required number of personnel was 458 including 118 technicians and 340 skilled workers.

Table 4-6 | Five-Year Development Plan for Electronic Products (1969-1973)

	1969	1970	1971	1972	1973
Exports (15)		P.C. Modules Thick-Film Circuits Electronic Tubes Panel-Meter	Electric Meters Electronic Meters Power Source for Labs Magnetic Core Memory	Desk Electronic Calculator Punch Card Reader Small Computer Tape Recorder Plated-Wire-Memory	Small Electronic Calculator Fast Printer Automatic
New Products (32)	Semiconductor IC Print Circuit Thick-Film Tantalum Capacitor Electronic Tubes Moving Coil Panel Meter Tape Recorder	Nixie & C.R. Tube Ferrite Molding Magnetic Tape Korean-language Fast Printer Power Transistor Low-Current Small Light Bulb Micro-Switch	Bi-polar I.C. Diffusion Fast Printer Punch Card Reader Thin-Film Circuit Plated-Wire Memory Teletypewriter Glass-Epoxy Lamination	Photo-Battery Large C.R. Tube Multilayer Lamination Chemical Etching MOS I.C. Numerical Control Machine Copying Machine	Optical Fiber Photo-Sensitive Chemicals Semiconductor Materials Magnetic Materials
Technical Training (14)	Semiconductor & I.C. Basic Circuit Design, Basic Electronic Circuit Design Theory	Metering Circuit Metering Circuit Design Programming Packaging Techniques	Electronic Calculator Circuit Theory Process Control and Metering Technique	Electronic Calculator Design Metering Settlement Technique, Memory Device Design	Data Communications Theory, Metering Management, Telemetering Devices

	1969	1970	1971	1972	1973
Technology Development (21)	MOS Device Glass Fiber & Epoxy Lamination Electronic Calculator Korean Terminology Korean-language Fast Printer	Thin-Film Small-size Data Processor Computer Tape Recorder Computer Memory	Small Computer Design Data Communications Active Memory Large C.R. Tube	Telemetering Medical Data Processor Computer Graphics L.S.I	Electronic Optics, High Precision Scientific Instruments, Lasers, Digital Processing Devices
Government Support	Acquisition of Small-size Computers (Government, Center)	U.S. National Science Education Computer Rental Negotiation, University Courses on Electronic Calculator	Middle- & High School Courses on Electronic Calculator Basics Standardization of Forms for Data Processing	Establishment of University Computer Centers. Laws and Regulations on Data Communications	International Electronics Convention & Show Planning

P.C.: Printed Circuit

I.C.: Integrated Circuit

C.R.: Cathode Ray

MOS: Metal Oxide Semiconductor

L.S.I.: Large-Scale Integration

Source: Kim (1968:74-75).

Dr. Kim's Background Report for Electronics Industry Promotion had a profound impact on policymaking for the next decade, and it also served as a guide for investment for companies interested in the electronics industry. President Park accepted most of Dr. Kim's recommendations and prompted the Ministry of Commerce and Industry to draft a special law and a basic plan for electronics industry promotion. He also supported the idea of providing tax benefits to foreign investors similar to Ireland's and establishing a dedicated electronics industrial complex, in addition to setting up research institutes and expanding electrical engineering at universities.

However, the establishment of the Electronics Industry Promotion Center, which was the most important proposal in Dr. Kim's report, was not followed through. The President and Minister of Commerce and Industry both felt that there was no suitable person to take charge of the Electronics Industry Promotion Center other than Dr. Kim. However, Dr. Kim was not willing to give up his professorship at Columbia University as a world-renowned scholar in the field of electronics at the time. In the end, President Park decided not to establish the Electronics Industry Promotion Center and instead utilize three existing institutions: the Fine Instruments Center (FIC), National Industrial Research Institute (NIRI), and Korea Institute of Science and Technology (KIST) (Kim 1999:31). Although the Electronic Industries Association of Korea (EIAK) was established in 1976 and Dr. Kim returned to Korea in 1978 to serve as its second president (1978-1982), it was basically a business association to gather support for the electronics industry, without the R&D and pilot production missions envisioned for the Electronics Industry Promotion Center.[39]

39. President Park Chung Hee asked Dr. Kim Wan Hee to return to Korea to play a key role in promoting Korea's electronics industry even after 1968, and consulted with him through more than 100 personal letters. However, due to several reasons, Dr. Kim lost a chance to work with him. In 1978, Dr. Kim accepted the chairmanship of the Electronic Industries Association of Korea (EIAK) at the request of O Won-chul, Senior Economic Secretary to President Park. However, when President Park learned of Dr. Kim's new position, he allegedly said, "What could he do there?" (Kim 1999: 95-96). EIAK had only a limited range of manpower and all its major decisions had to be approved by the Director-General of the Electronics and Electric Industry Bureau at the Ministry of Commerce and Industry. EIAK was the predecessor of the Korea Electronics Association (KEA).

Without the Electronics Industry Promotion Center to lead development and pilot production efforts, a new system began to emerge in which private sector companies engaged in vigorous competition and set up their own R&D, production, and marketing operations. Over the long run, this may have been a better outcome than the one dominated by the Electronics Industry Promotion Center, which was supposed to cover a wide range of activities from pioneer R&D to minimum volume production and market development. For the first few years, a system led by the Electronics Industry Promotion Center could have proved useful in establishing the industrial base; however, given that the center would have had neither high-powered profit incentives nor the threat of bankruptcy, its effectiveness likely would have been limited as it went beyond R&D and prototype production to cover market diagnosis, minimum volume production, and market development. Furthermore, under such a system dominated by the Electronics Industry Promotion Center, private sector companies likely would have heavily depended on it for R&D and prototype production and might have been slow in developing their own innovative capacity. From a dynamic perspective, it would be better for private sector companies, engaged in vigorous competition, to realize the importance of innovation and build up their R&D, production, and marketing operations, and for public institutions to take up missions characterized by large externalities.[40]

40. In particular, those with no business acumen or experience may find it difficult to implement ideas into practice. Dr. Kim Wan Hee himself tried to help establish a joint venture involving a Korean-American businessman, but it failed to get off the ground when the businessman requested a government guarantee against losses. President Park Chung Hee supported a former army general to set up a semiconductor company called New Korea Electronics, but it could not even commence production due to a patent infringement suit filed by an American company (Kim 1999: 57-58, O 1996: 349-350).

3. Electronics Industry Promotion Law and Basic Plan

The Electronics Industry Promotion Law, enacted and promulgated on January 28, 1969, aimed to contribute to the modernization of industrial facilities and technologies and the development of the national economy by promoting the electronics industry as a national backbone industry. The Electronics Industry Promotion Law was based on the policy recommendations by the Korea Electronic Industries Cooperative and Dr. Kim Wan Hee in 1967, and was in the same vein as Japan's Law on Provisional Measures for Electronics Industry Promotion in 1957.

The Electronics Industry Promotion Law became the legal basis for industrial policy pursued by the government. It provided the legal basis for the Electronics Industry Promotion Basic Plan (1969-1976) as well as the construction of Gumi Electronics Industrial Complex. The law gave the Minister of Commerce and Industry the authority to designate electronic products for promotion and to provide necessary support. For companies to receive benefits stipulated in the law, they had to register in accordance with the Ministry of Commerce and Industry ordinance, and the government had to raise long-term, low-interest funds for electronics industry promotion.

The Electronics Industry Promotion Law differed in two respects when compared with the Shipbuilding Industry Promotion Law (1967) or the Machinery Industry Promotion Law (1967), enacted two years earlier. First, the Electronics Industry Promotion Law stipulated that the government should designate products to be promoted. This approach was distinguished from the one adopted for the Shipbuilding or Machinery Industry Promotion Law, which aimed to promote the industry as a whole without designating specific products. In particular, Article 3 of the Electronics Industry Promotion Law stipulated that the Minister of Commerce and Industry should designate and publicize electronic devices, components, and materials for promotion in order to encourage (1) development of manufacturing

technology, (2) specialization, systematization, and volume production, and (3) improvement of performance and quality and reduction of production cost. The designation of products for promotion had a practical meaning because the designated products were to be supported by relevant laws and regulations (Lee and Yoo 1979: 279). This approach was in line with Japan's electronics industry promotion policy, which designated products for promotion to facilitate development research, volume production, and rationalization of production. This approach could be effective for latecomers when products to be promoted are clear, viewed in comparison with early movers; however, when the latecomers' advantage is reduced or when the uncertainty of innovation is large, this approach may hinder the development of alternative products or processes.[41]

Second, the Electronic Industries Promotion Law implied that financial support for the electronics industry should be financed through the general budget instead of a dedicated fund based on the Budget and Accounting Law. Specifically, Article 9 of the Electronic Industries Promotion Act did not include a provision for the government to issue government bonds when necessary to raise promotion funds, unlike the Shipbuilding and Machinery Industry Promotion Law. If the general budget for electronics industry promotion was not sufficiently secured, the lack of provision for a dedicated fund would limit the ability to pursue large-scale development and production projects (Lee and Yoo 1979: 307). In other words, it meant that commercial principles would be employed to a greater extent to promote the electronics industry, compared with the shipbuilding and machinery industries (Yoon 2016).[42]

41. For example, resistors and condensers are basic components that go into many electronic products. In order to improve their quality or standardization, electronic companies continue to develop better production technology or alternative materials. However, if resistors and condensers are excluded from the list of products designated for promotion by the government, on the account that they have already been localized, efforts to come up with better production technology or alternative materials would be at a disadvantage (Lee and Yoo 1979: 308).

42. The Electronics Industry Promotion Law was absorbed into the Industrial Development Law in January 1986, along with the promotion laws of other industrial sectors such as shipbuilding, machinery, steel, petrochemicals, nonferrous metals, and textiles.

After the promulgation of the Electronic Industries Promotion Law, the government established the Basic Plan for Electronics Industry Promotion (1969-1976).[43] The government planned to invest 14 billion won in promotional funds during the eight-year period, and achieve the export target of $400 million for the electronics industry in 1976, the concluding year of the Third Five-Year Economic Development Plan. In addition, the Basic Plan for Electronics Industry Promotion aimed to move the Korean electronics industry beyond components subcontracting and improve its international competitiveness as a producer of final goods, raising the share of electronic devices in total electronics exports from 19% to 40% over the plan period.[44]

The four goals of the Basic Plan were: (1) development of designated products, (2) achievement of export targets, (3) improvement of the localization rate, and (4) creation of promotion funds. Promotion strategies included: (a) establishment of an industrial development system through systematization (specialization) among devices, components, and materials; (b) development as an export-oriented strategic industry by actively attracting foreign investment and international division of labor, as well as strengthening international competitiveness; (c) improvement of the localization rate through tax exemption on newly developed products and expansion of the market. Here, "localization" did not mean replacing foreign products with domestic products even if the quality of domestic products was inferior. Rather, it meant import substitution to take place naturally by developing and producing exportable domestic products (Yoon 2016). In development economics, "import

43. Originally, this was a five-year plan (1969-1973), but it became an eight-year plan (1969-1976) to align with the completion of the Third Five-Year Economic Development Plan (1972-1976).

44. Total exports of electronic products jumped from $ 6.54 million in 1967 to $ 19.43 million in 1968. In 1971, the export target was $ 100 million, but the actual outcome was $ 88.6 million. Starting in 1973, the actual exports exceed the targets. In 1976, the exports of electronic products reached $1 billion, well beyond the target of $ 400 million (O 1996: 351-353).

substitution" is often used as a concept contrary to "export promotion," but "localization" in the Basic Plan for Electronics Industry Promotion meant import substitution through export promotion.[45]

According to the Basic Plan, the Ministry of Commerce and Industry designated 95 items for promotion, including 54 electronic devices, 29 electronic components, and 12 electronic materials. It set the first phase from 1969 to 1971, and the second phase from 1972 to 1976. Companies that submitted workable business plans to develop and produce these designated items received financial support. These items were selected based on public-private consultation between the Ministry of Commerce and Industry and the FIC and Korea Electronic Industries Cooperative, building on Dr. Kim's background report (O 1996: 335). Of the total promotion funds of 14 billion won, the government allocated 12.4 billion won to manufacturing companies and 1.6 billion won to research institutes and promotion agencies.

45. In fact, an inward-oriented import substitution strategy can lead to inefficiency by replacing foreign products with domestic products even though the quality of domestic products may be lower than that of imports. An outward-oriented import substitution strategy emphasizes internationally competitive product quality from the outset.

Table 4-7 | Products Designated for Promotion in the Eight-Year Electronics Industry Promotion Plan (1969-1976)

Classification	Category	Designated Items
Stage 1 (1969~71)	Basic electronic components (17)	Resistors, (fixed/variable) condensers, speakers, miniature transformers and coils, cathode ray tubes, earphones, microphones, ferrite cores, PC panels, electric plugs and jacks, switches and sockets, connectors, rod antennas, transformers, relays, batteries, permanent magnets
	Semiconductor integrated circuits and other electronic components (10)	Diodes, transistors, ICs, small motors, electron tubes & electron guns, pickups, calculation indicator boards, handsets, tuner FM/TVs, crystal oscillators
	Consumer electronics (10)	(AM/FM) radios, car radios, (black and white/color) televisions, recorders, recording players, electronic instruments, hearing aids, intercom, other electronic devices
	Industrial electronics (10)	Special telephones, fixed station wireless transmitters and receivers, mobile station wireless transmitters and receivers, navigation aids, fish finders, radio broadcasting equipment, radar (for fishing), automatic train stoppers and centralized control, cable communication devices, X-ray devices
	Electric measuring apparatus (9)	Multi testers, signal generators, oscilloscopes, laboratory power supply, Tube/Tr checker, industrial instruments, measuring devices, electrocardiographs, industrial precision instruments
	Electronic materials (7)	BaTio3, insulating materials and adhesives, ferritic materials, headers, phosphor bronze panels, ceramic materials, other electronic materials
Stage 2 (1972~76)	Electronic components (1)	1) to develop special components and standardized products with regard to the basic electronic components of the Stage 1 2) electronic memory devices
	Semiconductor integrated circuits and other electronic components (2)	1) to develop special components and standardized products with regard to semiconductor integrated circuits and other electronic components 2) magnetic heads, recording tapes
	Consumer electronics (1)	1) to develop special and new varieties and high-quality articles with regard to the consumer electronics of the Stage 1 2) recorders

Classification	Category	Designated Items
	Industrial electronics (12)	Electronic copying machines, TV cameras, electronic typesetting machines, recorders, automatic control system, digital electronic devices, materials display unit, industrial TV devices, teletype writers, temperature controls, TV broadcasting devices, electron microscopes
	Electric measuring apparatus	to develop special varieties and standardized products with regard to the electric measuring apparatus of the Stage 1
	Medical apparatus (6)	audiometers, hematomanometers, electronic health check machines, polygraphs, electronic remote electrocardiographs, hemacytometers
	Electronic materials (5)	magnetic materials, PET, silver foils, silicon laminates
	Electronic calculators (5)	Desktop electronic calculators, medium size electronic calculators, card punching machines, automatic program machine tools, fine cutting machines
	Military electronic equipment (1)	all sorts of electronic devices

Source: O (1996:334-335).

In January 1973, the electronics industry was designated as one of the six heavy and chemical industries for promotion, along with steel, non-ferrous metals, machinery, shipbuilding, and petrochemicals. After the oil crisis in October 1973, the electronics and shipbuilding industries received even more spotlight, because they were less energy-intensive than the other heavy and chemical industries. Since financial and tax benefits were provided for the heavy and chemical industries, the electronics industry was able to invest in high-quality equipment for producing electronic components and materials during the HCI drive period (Compilation Committee for a 50-Year History of the Electronics Industry 2009: 172).

In October 1973, the Ministry of Commerce and Industry developed a new plan for promoting electronic products in all sectors: consumer electronic devices (color televisions, etc.), industrial electronic devices (electronic calculators, etc.), electronic components (cathode-ray tubes), and electronic materials. It also set a new export target of $2.5 billion for 1981. This was incorporated into the Second Basic Plan for Electronics Industry Promotion (1974-1981). Promotion objectives were: (1) maximization of electronics exports, (2) localization of components and materials, (3) normalization of production and distribution structure, and (4) development of electronics as a technology-intensive "brain industry."

The Third Basic Plan for Electronics Industry Promotion was drafted in March 1976, prior to the implementation of the Fourth Five-Year Economic Development Plan (1977-1981), and emphasized the upgrading of the electronics industry, focusing on 56 electronic products for promotion (Lee and Yoo 1979: 292-295). In the Fourth Five-Year Economic Development Plan (electronics sector), software was added to the products to be promoted. For each designated product, the following items were specified: (1) development scope, (2) target year, (3) performance and quality goals, (4) standard production facilities, and (5) items related to development objectives and their promotion (FIC 1978: 212-256).[46] During the formative years of Korea's electronics industry (1966-1979), the government maintained the policy stance to pursue export-oriented industrialization and develop domestic capabilities centered on products to be promoted.

46. For example, the basic plan for fabricated wafers set 1977 as the target year of development and established a target for a performance-related failure rate. Standard production facilities for wafer fabrication were to be used for manufacturing, testing, and other functions. The basic plan called for the development of new technologies in large-scale integration and for an improvement in yields, in cooperation with KIST (FIC 1978: 217).

4. Implementation System

After the promulgation of the Electronics Industry Promotion Law, the FIC, NIRI, and KIST were designated as electronics industry promotion organizations on April 12, 1969, providing support for technology development, training and education, and overseas market exploration. However, it took one year to establish inspection facility standards and test regulations, publish the finalized version of the electronics industry promotion plan, and designate products for promotion. It took another year to publish designation guidelines for companies. The administrative process took so long because of lack of manpower. The Director of the Electric Industry Division at the Ministry of Commerce and Industry was changed frequently and was not an expert in the electronics industry. Only one or two government officials took charge of all the tasks related to the electronics industry. In light of these circumstances, the Ministry of Commerce and Industry established a director-level position in charge of the electronics industry and increased the number of personnel to seven in July 1971 (O 1996:356-362). Not until 1978 was the Electronic and Electric Industry Bureau established at the Ministry of Commerce and Industry.[47] In other words, a subdivision- or division-level unit at the Ministry of Commerce and Industry was in charge of promoting the electronics industry for most of its formative years (1966-1979). With a limited number of government officials involved in electronics industry promotion, the Ministry of Commerce and Industry focused on creating incentives for private-sector companies to develop, produce, and export electronic products, rather than engage in large-scale projects or intervene in the details of electronics industry development by establishing new agencies or state-owned enterprises (Yoon 2016).

47. The bureau was composed of four divisions: electronic devices, electronic components, household appliances, and electric industries (EIAK 1980a: 161).

Established in 1966 by a joint industrial agreement between the Korean government and UNESCO, the FIC was in charge of collecting statistics on the electronics industry, registering companies, training technicians and skilled workers, and exploring overseas markets.[48] In addition, the FIC acted as an accredited agency to issue certificates for well-known international technical standards. In 1969, it also launched promotion events such as the Korea Electronics Show (KES) and the National Radio Assembly Contest. Among the FIC's activities, the most prominent was overseas market exploration. The FIC established overseas offices in New York and Tokyo in July 1969 and July 1970, shortly after being designated as an electronics industry promotion agency, and started overseas market research and export promotion activities (Seo 2001:173-175). In November 1969, the FIC organized an electronics industry technology mission, led by the President of the Korea Standards Association, to explore the electronics industry in the U.S., Western Europe, Singapore, Taiwan and Japan over a one-month schedule. The goal of this mission was to attract foreign investment of $200 million and collect data for the establishment of a semiconductor factory with a view to achieve the export target of $ 400 million in 1976 according to the Basic Plan for Electronics Industry Promotion (Korea Electronic Industries Cooperative 1997:113-117).

The NIRI was the only quality control organization for industrial products at that time, and was responsible for electronics technology development, quality inspection and guidance of the companies to be promoted.[49] In 1971, the company purchased quality inspection equipment for a total cost of US $ 250,000, and in the following year, it purchased

48. In 1979, the company registration and industry promotion divisions of the FIC were absorbed into the EIAK, and the research and development division was merged with the Metals Inspection Institute to become the Korea Machinery and Metals Inspection Institute. The Korea Machinery and Metals Inspection Institute was then merged with the Shipbuilding Institute in 1980 to become the Korea Institute of Machinery and Materials.

49. In 1973, the National Industrial Research Institute was renamed as the National Industrial Standards Testing Institute when it was transferred from the Ministry of Commerce and Industry to the Industrial Advancement Administration. It is the predecessor of the Korean Agency for Technology and Standards (KATS).

additional equipment worth $ 100,000 to further solidify its status as a national quality control organization (Seo 2001:176).

Founded in 1966, KIST was the only comprehensive research institute in Korea at that time, covering all industries including machinery, electricity, electronics, metals, and chemicals. KIST provided electronics companies with guidance for technology development and was responsible for quality control, technical training and technical information in special fields beyond the scope of the FIC. KIST's achievements in electronics technology development include: FM portable radios, pocket electronic calculators, transistors, electronic private branch exchanges, remote-control TVs, and semiconductor wafers. Most of these achievements were commercialized and transferred to the private sector (Korea Institute of Science and Technology 1998: 213).

5. Major Policy Instruments

To promote Korea's electronics industry, the government utilized various policy instruments such as strategic domestic market protection, financial and tax benefits, establishment of industrial complexes, and support for education and R&D. The government did not resort to direct intervention, for instance, through state-owned enterprises, because it was felt that encouraging vigorous competition based on commercial principles was an effective promotion policy. In the development of policy instruments to foster the electronics industry, the government actively engaged in public-private consultations. In addition to proposals from individual companies like Goldstar, they included policy recommendations from the Korea Electronic Industries Cooperative and industry representatives at the Monthly Export Promotion Meetings (Korea Development Institute 2013). The fact that the Ministry of Commerce and Industry looked at issues related to international trade and domestic industry together and made government support contingent on export performance also facilitated public-private interaction, while minimizing its adverse side effect.

5.1. Strategic Domestic Market Protection

From the early days of the electronics industry, the government secured breathing space for Korean companies by restricting the imports of foreign products. The government used the Law on the Prohibition of the Sale of Certain Foreign Products (1961) to crack down on smuggled goods and protected the domestic market by imposing tariffs on imported goods or applying quantity restrictions. As shown by the case of Goldstar's black and white TV development, the government imposed import duties and special duties (temporary special duties), and for some time operated the export-import link system. The government also showed flexibility to adjust its policies when tariffs and quantitative restrictions impeded localization and quality improvement.

During the formative years for Korea's electronics industry, the government provided financial and tax incentives and promoted competition in the domestic market to encourage firms to develop their capabilities and increase exports rather than depend indefinitely on protectionist measures. Such policies contributed greatly to the development of the electronics industry by allowing performance-based reward and discipline mechanisms to operate effectively.

However, over the same period, the government also maintained a policy stance that significantly suppressed domestic consumption of electronic products, resulting in the delayed expansion of the domestic market and industry. In addition to fiscal considerations, the government had concerns about the social impact of "conspicuous consumption." Special consumption taxes imposed on electronic products limited consumption of domestic products as well as foreign imports. Furthermore, although Korean companies were producing and exporting color TVs in the mid-1970s, the government postponed color TV broadcasting. These measures were contrary to the objective of strategic domestic market protection in that they impeded the expansion of the domestic market and industry. It also gave the impression that Korea was trying to export its entire production of color TVs while limiting foreign access to its own market. The resulting trade friction with the United States, among others, led to the import restriction of Korean color TVs in 1978.

5.2. Financial and Tax Benefits

As mentioned previously, the Electronics Industry Promotion Law (1969) implied that unlike the Shipbuilding Industry Promotion Law (1967) or the Machinery Industry Promotion Law (1967), promotion funds should be financed out of the general budget rather than a dedicated fund based on the Budget and Accounting Law. To secure the fund needed for the Basic Plan for Electronics Industry Promotion (1969-1976), the Ministry of Commerce and Industry included a year-by-year breakdown of the promotion fund in its briefing to the President and secured his approval, with consent from the budgetary authority (namely, Deputy Prime Minister) who attended the briefing (O 1996: 337-343).

In the President's declaration of the heavy and chemical industry drive in January 1973, the electronics industry was designated as one of the six strategic industries. The fund to promote the electronics industry could then be financed out of the National Investment Fund, which was established "on the basis of extensive savings and participation of the public to promote the construction of important industries such as heavy and chemical industries and increase exports."[50] The government set up the National Investment Fund by issuing National Investment bonds and exchanging them with some of the public funds and savings deposits. Since public funds such as the government employee pension fund, the industrial accident compensation insurance fund, and the export insurance fund were not able to provide enough funds for promoting "important industries," the financial institutions were required to accept a fixed portion (for example, 20%) of the annual increase in savings deposits (Nam 2009: 110-111).

According to the National Investment Fund Law (1973), the companies eligible to receive loans in the electronics industry were those that produced items designated for promotion or those that moved into the Gumi Electronics Industrial Complex. For each eligible company, the National Investment Fund provided loans up to 70% of its facility investment, but not exceeding 200 million won. The maximum loan period was 8 years, and the interest rate

50. See Article 1 of the National Investment Fund Law (1973).

was set at 13% per annum for the first three years and 14% per annum over the remaining period (Lee and Yoo 1979: 299). At the time, when access to finance was limited, securing loans for facility investment was a great benefit. Moreover, the interest rate on the National Investment Fund loan was 3 to 4 percentage points lower than the long-term lending rate of deposit banks.[51] As the importance of the electronics industry increased, the amount of fund allocation increased from 0.9 billion won (1.2% of the total disbursement) in 1974 to 4 billion won (1.6%) in 1977 and then to 10 billion won (2.6%) in 1979 (Lee and Yoo 1979: 300).

The electronics industry received various tax benefits in addition to financial benefits. Since the electronics industry was designated as an "important industry," electronics companies could choose one of the following tax benefits under the Law on the Regulation of Tax Reduction and Exemption (1966) (Lee and Yoo 1979: 300-301).

Table 4-8 | Tax Reduction and Exemption Benefits for Important Industries

1) Direct reduction and exemption: The income tax and corporate tax shall be exempted in full for three years from the commencement of production of normal products, and the tax amount equivalent to 50/100 of income shall be reduced for the next two years
2) Investment deduction: The amount equivalent to 8/100 of the machinery equipment investment shall be deducted from the income tax and corporate tax of the business year in which the investment or factory transfer is completed (However, when materials or machinery produced or manufactured domestically are used, the amount equivalent to 10/100 of the investment shall apply.)
3) Loss treatment for depreciation: In the case of fixed assets constructed or installed by investment as defined by the Presidential Decree, a depreciation charge equivalent to 100/100 of the depreciation cost established by the tax law shall be treated as a necessary expense or a loss, when calculating the income for each business year.

51. Facility investment support through the National Investment Fund was provided to important industries, while financial support for exports was provided in a sector-neutral manner since the 1960s. Export-related lending rates were about 10 percentage points lower than general lending rates (Cho and Kim 1997: 43).

Tax benefits also included sector-neutral functional support. The government provided Korean companies special tax allowances to facilitate the accumulation of technology development reserves to cover the cost of R&D. The government allowed Korean companies to claim up to 20% of technology development reserves as a necessary expense or a loss when calculating the income for the business year (Lee and Yoo 1979: 301).

Tax benefits also included tariff reductions. In the case of "important industries" designated by the Ministry of Finance, the Customs Law reduced tariffs on investment goods that could not be readily manufactured in Korea: facility machinery, basic equipment, construction materials and structures, and related components and raw materials. The government reduced tariffs on these investment goods by up to 80% for companies engaged in electronics. A customs duty drawback was applied to raw materials that were used for exports. Before the enactment of the Special Law on the Refund of Customs and Related Charges (1975), the government had exempted the customs duty on the condition that companies provide their collateral, but after its enactment, companies had to pay their customs and related charges first and then were refunded later by the government (Lee and Yoo 1979: 302-304).

5.3. Industrial Complexes

In industries where the coordinated procurement of various parts and components and the exchange of ideas are important, the agglomeration economies can be exploited by clustering related companies. The construction of industrial complexes to promote such industries not only facilitates the clustering of related companies, but also makes it easy for the government to provide centralized support of infrastructure and administrative services.

Among major industrial complexes, the Masan Free Export Zone and the Gumi Electronics Industrial Complex were directly related to the government's effort to promote the electronics industry. With the enactment of the Law on the Establishment of Free Export Zones in September 1969, the government designated an area of 83 hectares in Masan City as a free export zone. The Masan Free Export Zone, which began construction in May 1970,

was completed in 1973. From 1973 to 1980, the Masan Free Export was able to attract 99 multinational corporations, including 69 Japanese companies, 3 American companies, 1 German company, 18 Korean-Japanese joint ventures, and 4 Korean-American joint ventures. Since more than 70% of these companies were engaged in electronics and materials business, the Masan Free Export Zone to a large extent served as an industrial complex set up for foreign electronic companies (Compilation Committee for a 50-Year History of the Electronics Industry 2009:145). One of the main objectives for establishing this free zone was to facilitate indirect exports of locally produced parts and components by supplying them to foreign companies in the zone (Korea Electronic Industries Cooperative 1997: 108). Korea thus sought to strengthen the linkages between the free export zone and the domestic market rather than settle for a dual structure with the free export zone cut off from the domestic market.

The Law on the Development and Establishment of Industrial Complexes for Export Industries (1964) provided the formal legal basis for the Gumi Electronic Industrial Complex, and the Electronics Industry Promotion Law (1969) and the Basic Plan for Electronics Industry Promotion (1969-1976) effectively played a facilitating role. The Gumi area had many locational advantages such as the abundant supply of cheap land, water, and workers, as well as convenient transportation. Gumi also had a political significance as Park Chung Hee's hometown. The construction of the industrial complex started on November 3, 1971 and was completed on May 31, 1972. The government asked Goldstar, then the largest electronics company in Korea, to set up operations in the industrial complex so as to encourage other companies to join in, followed by suppliers of various electronic parts and components. In addition, given that the joint venture company Toshiba Korea had already set up in Gumi, the FIC Tokyo branch recruited Japanese companies that were supplying parts and components to Toshiba in Japan. Thanks to this effort, a number of Japanese companies moved into the Gumi Industrial Complex (O 1996: 373).

5.4. Education and R&D

The government used education and R&D as key policy instruments to develop human resources and cultivate technological capabilities necessary for promoting the electronics industry. In August 1968, immediately after Dr. Kim Wan Hee's briefing on electronics industry promotion, the government dealt with the follow-up agenda through a cabinet meeting, and one of the agenda items was the establishment and reinforcement of electronics-related departments at universities (Kim 1968: 52). As a result of consultations among the related ministries, the Ministry of Education increased the university admissions quota for electronical engineering. It also designated Kyungpook National University, near Gumi, as a university specializing in electronical engineering.

The government further recognized the importance of education and R&D for the promotion of heavy and chemical industries, and established the Korea Advanced Institute of Science (KAIS) in 1973 to produce top-quality scientists and engineers (Ministry of Science and Technology 2008: 515). In addition, the government enacted the Law for Promoting Specific Research Institutes, which stipulated the necessary provisions to protect and nurture government-funded research institutes for the development of science and technology and the promotion of industry and economy. This law allowed the government to provide funding to specific research institutes or joint management bodies, which, in turn, had to give priority to research, development and technical support requests from the heads of the central administrative agencies and local governments.

The development of the electronics industry led the government to recognize the need to establish specialized research institutes in electronics. In December 1976, the government established the Korea Institute of Electronics Technology (KIET) under the auspices of the Ministry of Commerce and Industry, and the Korea Electric Research and Testing Institute (KERTI) under the Ministry of Science and Technology. At the same

time, the government established the Korea Electronics and Communications Research Institute (KECRI) at KIST in the Daedeok Science Park under the auspices the Ministry of Science and Technology. KECRI was subsequently transferred to the Ministry of Post and Communications in December 1977 and renamed as the Korea Telecommunications Research Institute (KTRI). In short, specialized research institutes were set up in electronics (KIET), electricity (KERTI), and telecommunications (KTRI) under the auspices of the Ministry of Commerce and Industry, Ministry of Science and Technology, and Ministry of Post and Communications, respectively.[52]

KIET greatly expanded R&D activities in computer and semiconductor fields, which had been previously conducted by the Computer Localization Research Office and Semiconductor Technology Development Center at KIST. KIET had a strong drive to localize computers, including microcomputers (Seo 2001: 236-238).

KECRI / KTRI in the field of telecommunication took over KIST's previous work on the introduction and development of electronic exchanges.[53] KIST, who had experience developing a private branch exchange, conducted an international bidding for the introduction of electronic exchanges in March 1976, commissioned by the Ministry of Post and Communications. KIST set the following conditions for submitting a bid: (1) Bidders shall follow the discretion of the Korean government regarding the result; (2) propose domestic production costs for the next 5 years; and (3) upon winning the bid, transfer technology to an institution designated by KIST. In conjunction with the international bidding, the government planned to establish a state-owned enterprise that would assemble

52. In January 1981, KERTI and KTRI were merged to form the Korea Electrotechnology and Telecommunications Research Institute (KETRI) under the Ministry of Science and Technology. In 1985, the electronics and telecommunications sectors were merged to form the Electronics and Telecommunication Research Institute (ETRI), while the electricity sector was separated to form the Korea Electrotechnology Research Institute (KERI).

53. Goldstar Communications had imported the EMD telephone switching system from Siemens. In the late 1970s, only Pakistan and Korea were using this mechanical system. The Strowger system produced by Dongyang Precision was relatively easy to switch to the electronic type, but it was still limited in that it was fundamentally mechanical in nature. The government had to overcome resistance from these incumbent companies to introduce an electronic switching system in Korea (Nam 2009: 144-149).

and manufacture electronic exchanges, include related domestic companies in the production system, and coordinate the supply of parts and components. Accordingly, the Korea Telecommunications Company (KTC) was established in February 1977 to handle the production of electronic exchanges.

A consortium of ITT of the United States and BTM of Belgium submitted the winning bid. KECRI / KTRI and KTC engineers were promptly dispatched to Belgium to study BTM's advanced technology, and BTM also sent 35 engineers to Korea to transfer their technology. Korean engineers who received training subsequently made significant contributions to the development of electronic communications equipment at government-funded research institutes and private-sector companies (Compilation Committee for a 50-Year History of the Electronics Industry 2009). To sum up, government-funded research institutes contributed greatly to the innovation capacity of the domestic electronics industry through direct R&D and technology acquisition as well as researchers' entry into the private sector.[54]

54. In the mid-1970s, KIST and GTE developed the GTK-500, a 500-line private branch exchange. In December 1977, Samsung Electronics set up Samsung GTE Communications with GTE of the United States, and built on the GTK-500 to produce Korea's first domestic electronic private branch exchange in May 1978. Samsung GTE acquired KTC in 1980, and the high-quality engineers and researchers who came from KTC helped Samsung GTE to forge ahead in telecommunications equipment business (Samsung Electronics 1999).

Chapter 5

Corporate Strategy

1. New Entry vs. Resistance by Incumbents

2. Vigorous Competition and Capacity Development

Corporate Strategy

In the second half of the 1960s, when the government began to formulate comprehensive plans to promote the electronics industry, Korean firms also began to pay attention to the potential of the electronics industry. However, unlike the government, which focused on setting the basic directions of the industrial development strategy and providing incentives for investment, firms had to make a more careful and detailed analysis of the industry than the government, because the success or failure of the new business could influence their survival itself.

In general, a firm needs to consider five factors in order to be competitive in business: (1) the demand condition, such as the market size and the level of customers' sophistication; (2) factors of production that serve as direct inputs managed by the firm, such as labor, capital, and technology; (3) intermediate or complementary inputs, such as goods and services provided by related industries as well as infrastructure; (4) government policy, especially related to competition and regulation; (5) corporate strategy, such the choice between in-house production vs. outsourcing and between concentration vs. diversification. As the criticism raised by Rugman (1992) against Porter (1990) implies, the firm does not

have to confine itself to its home base in considering these factors, but rather can establish an integrated value chain at home and abroad.

Now, consider the situation in the Korean electronics industry in the second half of the 1960s. First, with regard to the demand condition, the domestic market was small, but the market (especially for consumer electronics) was expected to grow rapidly with a rise in per capita income. Also, as Japan and Taiwan had demonstrated, Korea could benefit by exploring foreign markets. Second, with regard to the factors of production, Korea had an abundance of low-wage labor, but capital accumulation was limited and technology was far inferior to the U.S., Japan and Europe. Third, with respect to intermediate or complementary inputs, Korean firms could first import core components from advanced industrial countries and then try to develop capabilities to produce them internally. Fourth, the government policy protected the domestic market to create breathing space, but also emphasized performance-based reward and discipline principles, in conjunction with exports as well as development and production of priority items designated by the government. Fifth, to be effective, a corporate strategy had to take into consideration these factors and choose among alternatives to develop markets, build technological capabilities, and coordinate productive activities and organically link them together.

Among Korea's large business groups, Goldstar entered the electronics industry in 1958, followed by Taihan Electric Wire in 1968 and Samsung in 1969. As a latecomer in the industry, Samsung Electronics was able to study early movers at home and abroad and formulate its corporate strategy in a systematic and comprehensive manner. Therefore, this chapter will focus on the evolution of Samsung Electronics' corporate strategy and discuss other companies' cases when necessary.

1. New Entry vs. Resistance by Incumbents

Having sought advice from Dr. Kim Wan Hee in September 1967 and also kept an eye on the rise of Japanese electronics companies, Lee Byung-Chul, Chairman of the Samsung Group, set up a business development department at Samsung Trading (Samsung Mulsan) in February 1968 and directed them to investigate and study the feasibility of various new businesses. In April, Shin Hoon-Chul, a member of the business development department, recommended the electronics industry as the most promising industry for Samsung. He and his colleagues then closely examined the business conditions for Samsung's entry into the electronics industry.

First, with regard to the demand condition, Samsung saw the limits of the small domestic market and opted to pursue domestic sales and exports concurrently. Second, for factors of production, Samsung realized that the key bottleneck was technology. Rather than trying to accumulate technological capabilities independently from scratch, it felt that acquiring technology through cooperation with foreign capital would be the more effective strategy. Accordingly, Samsung contacted several leading companies in the U.S., Europe and Japan. For securing access to a large market, it would be advantageous to form an alliance with an American company; however, distance and language barriers presented challenges for absorbing technology. In the end, to facilitate technology acquisition, Samsung decided to form joint ventures with Japanese companies. Also, Samsung decided to start with consumer products such as TVs and stereos, accumulate technical knowhow and experience, and then gradually move into industrial products (Samsung Electronics 1999).

As for intermediate or complementary goods, Samsung thought it should produce core components through specialization and vertical integration in due course, even though it would initially have to import them from overseas, mainly from its Japanese partners. Regarding government policy, Samsung understood that the government was encouraging

private-sector firms to enter the electronics industry and form joint ventures. In short, Samsung thought that setting up joint ventures with leading electronics firms would address four problems at once: securing access to foreign markets, acquiring advanced technology, procuring core components in early years, and cooperating with the government on electronics industry promotion. Samsung formulated its corporate strategy by taking these points into account. It set its objective as "complete localization, from materials and components to final products" and laid out three principles: 1) large scale for its electronics complex, 2) vertical integration of the production process, and 3) rapid acquisition of technological capabilities. Its emphasis on vertical integration, in particular, set Samsung apart from incumbents.

After meeting with a number of Japanese companies based on this strategy, Samsung decided to set up a joint venture with Sanyo Electric in final products such as TVs and another joint venture with NEC in major parts and components such as vacuum tubes and cathode-ray tubes as well as telecommunications equipment. In January 1969, the Samsung Group established Samsung Electronics. Its business objectives stated in the articles of association included the manufacture of not only final electronic products but also basic components such as semiconductors and telecommunications equipment as well, clearly demonstrating its intention to pursue vertical integration and diversification in due course. Samsung Electronics formed two joint ventures: Samsung Sanyo Electric and Samsung NEC. In other words, in its early years, Samsung Electronics served as a holding company undertaking joint ventures in electronics.

In May 1969, Samsung Electronics and Sanyo Electric of Japan completed all contracts for their joint venture by signing a bilateral technical cooperation agreement. Samsung Electronics, Sanyo Electric of Japan, and Sumitomo Corporation had an equity share of 50%, 40%, and 10%, respectively, with an initial authorized capital of 1.5 billion won ($5 million). Samsung Sanyo Electric planned to invest $ 12 million (about 3.6 billion won) and

produce 300,000 TVs and 4.1 million radios annually and build a large-scale plant for major parts and components. The joint venture planned to sell only 15% of its TVs and radios in Korea and export the remaining 85% overseas. According to the contracts, Sanyo Electric of Japan would not only participate in the management of the joint venture but also have the right to export its products, exclusively supply its facilities and materials, and put the Sanyo Electric logo on exported products. In addition, products sold in the Korean market would carry Sanyo Electric's logo next to Samsung's and indicate that they were produced with technical cooperation from Sanyo Electric. Negotiating from a weak bargaining position, Samsung Electronics only had the right to sell products in the Korean market. The contract period was three years, and could be renewed based on mutual agreement (Samsung Electronics 1999).

Samsung's entry into the electronics industry precipitated a sharp reaction from the incumbents.[55] They felt threatened by Samsung's move and tried to block Samsung Sanyo Electric's entry into the domestic market by citing the limited size of the domestic market and reverse discrimination against domestic companies.

According to a petition submitted to the government by the Korea Electronic Industries Cooperative, the existing production capacity had already exceeded the domestic demand for electronic products, and Samsung Sanyo Electric's entry would only exacerbate the problem. The incumbents noted that the government continued to designate consumer products such as TV as "consumption repression items." Indeed, the government levied a 50 percent commodity tax on such electronic products as TVs and prohibited their sales based on monthly installments. As the consumer demand was repressed, only 42,000 TVs were

55. Koo In Hoi and Lee Byung-Chul were in-laws, but their relationship soured when Samsung decided to enter the electronics industry, which had been dominated by Goldstar up to that point (Lee 2011: 15-16).

sold in Korea in 1968, but the annual production capacity of the incumbents was 136,800 units. They had to export to survive, and Samsung Sanyo Electric's entry into the domestic market would make their problem even more formidable.

In addition, the petition noted that Korean-owned companies were at a competitive disadvantageous due to various tax and financial benefits given to foreign-owned companies and joint ventures. Foreign investors were exempted from customs duties on the imports of machinery and equipment, as well as corporate income taxes and business taxes-- in proportion to foreigners' equity share in the case of joint ventures. Foreign investors also enjoyed better access to low-cost international financing. Furthermore, the petition argued that the joint venture between Samsung and Sanyo Electric had the features of comprador capital seeking to topple Korean-owned companies.[56] In other words, in addition to raising practical issues such as consumption repression and reverse discrimination, the petition appealed to nationalism, thereby maximizing the pressure on the government.

The incumbents that submitted the petition to the government included not only Korean-owned companies such as Goldstar and Taihan Electric Wire, but also joint ventures such as Komi and 100% foreign-owned companies such as Motorola Korea and Signetics Korea. Korean-owned companies emphasized the problem of repressing domestic consumption and reverse discrimination; whereas, joint ventures and 100% foreign-owned companies, which had to export all their products as a part of their agreement with the Korean government, tried to prevent Samsung Sanyo Electric from receiving more favorable conditions than themselves.

56. See Petition by the Korea Electronic Industries Cooperative regarding the Joint Venture between Samsung Electronics and Japan's Sanyo Electric, June 1968 (Korea Electronic Industries Cooperative 1997: 103-106).

After much deliberation, the government proposed to approve of the new joint venture on the condition that it export all its products. Sanyo Electric of Japan had wanted to move early into the Korean market in view of its rising prospects. Now faced with the Korean government's decision, some people in the company called for the nullification of the joint venture. However, after consulting with Samsung Electronics, Sanyo Electric decided to proceed with the joint venture but at a reduced scale. Finally, on September 2, 1969, the government approved of the joint venture and Samsung Sanyo Electric was established on December 4 (Samsung Electronics 1999).

At the same time, Samsung Electronics established Samsung NEC to increase value added and raise its technological capabilities in a short period by producing basic materials and components in mass quantities. On September 13, 1969, Samsung Electronics signed a joint venture agreement of $ 3.5 million, with an equity share of 50% for Samsung Electronics, 40% for NEC, and 10% for Sumitomo. The government approved of the joint venture on December 19, and Samsung NEC was established on January 20, 1970. [57]

Ironically, having seen the usefulness of joint ventures through Samsung's cases, other companies actively pursued joint ventures of their own. For example, after consultations with Alps Electric, Japan's largest manufacturer of electronic components, Goldstar established Goldstar Alps Electronics in August 1970 (LG Electronics 2008). Anam Industry, which was the first Korean-owned company to enter the semiconductor assembly field in 1968 under the leadership of Chairman Kim Hyang-Soo, established Korea National Electric in June 1973, as a 50-50 joint venture with Matsushita Electric of Japan.[58]

57. Samsung NEC changed its name to Samsung Electronic Tubes in 1974, and then to Samsung SDI in 1999.

58. Anam Industry was the first Korean-owned company to export $ 40 million of electronic products. Korea National Electric produced and exported Korea's first color TVs in 1974. In 1980, the Anam Group bought out Matsushita's shares in Korea National Electric and changed its name to Anam Electric. The company was changed to Anam Electronics in 1990. Anam Industry changed its name to Anam Semiconductor in March 1998, but after a workout, it was taken over by the Dongbu Group in 2002.

2. Vigorous Competition and Capacity Development

Samsung's entry into the electronics industry in 1969 triggered major changes in Korea's electronics industry, which had been dominated by Goldstar up to that point. At the time, there were other Korean-owned companies such as Taihan Electric Wire, and foreign-owned or joint-venture companies such as Motorola Korea in the electronics industry. However, Samsung, as Korea's largest business group, posed a competitive threat that was on a different level. In fact, in 1969, companies in the Korean electronics industry could be divided into two groups: Korean-owned enterprises that were much smaller than Goldstar producing various electronic products and foreign-owned or joint-venture companies focused on assembling and exporting electronic components. Goldstar had more than 40 percent of the consumer electronics market, three times the market share of its closest competitor. Since foreign-owned and joint-venture companies focused on electronic components such as transistors and exported all their products, Goldstar did not have to worry about facing them in the domestic market. In contrast to other Korean-owned companies, however, Samsung formed joint ventures with major Japanese companies and sought to produce electronic components and materials as well as final goods and move into the domestic market as well as the international market. Samsung quickly built up its own capabilities through R&D and increased its market share, triggering vigorous competition in the electronics industry. In fact, based on shipments, Goldstar's market share declined from 12.6% in 1969 to 7.1% in 1971. By contrast, Taihan Electric Wire's market share increased from 2.9% to 4.6% over the same period, and Samsung Sanyo Electric had a market share of 4.0% in 1971, barely one year after starting its production.[59]

59. The combined market share of electronic companies outside the top ten also increased from 27.4% in 1969 to 41.2% in 1971.

Table 5-1 | Market Shares by Firm in the Electronics Industry: 1969 vs. 1971

	Company	Products	Shipments (mil. won)	Share (%)
1	Motorola Korea	Components	3,581	15.0
2	Goldstar	Consumer Devices	3,001	12.6
3	Goldstar Communications	Industrial Devices	2,094	8.8
4	Fairchild Korea	Components	1,787	7.5
5	Signetics Korea	Components	1,653	6.9
6	Dongyang Precision	Industrial Devices	1,303	5.5
7	Control Data Korea	Components	1,203	5.0
8	IMEC	Components	784	3.3
9	Taihan Electric Wire	Consumer Devices	693	2.9
10	Dongnam Electric	Consumer Devices	688	2.9
11	Others	-	6,549	27.4
Total		-	23,859	100.0

Source: KDB (1970)

	Company	Products	Shipments (mil. won)	Share (%)
1	Motorola Korea	Components	7,039	13.8
2	Goldstar	Various Devices	3,613	7.1
3	Signetics Korea	Components	3,524	6.9
4	Daehan Micro	Components	3,276	6.4
5	Goldstar Communications	Industrial Devices	2,488	4.9
6	Taihan Electric Wire	Various Devices	2,331	4.6
7	Honam Electric	Components	2,108	4.1
8	Samsung Sanyo Electric	Various Devices	2,070	4.0
9	Dongnam Electric	Consumer Devices	1,891	3.7
10	Fairchild Korea	Components	1,720	3.3
11	Others	-	21,033	41.2
Total		-	51,093	100.0

Source: Editorial Board, Journal of the Korea Electric Association (1972: 16)

Goldstar had imported capital and technology mainly from West Germany and Japan through loans and licensing arrangements; whereas, Samsung Electronics imported capital and technology mainly from Japan and the United States through joint ventures. In addition, Goldstar and Goldstar Communications had imported core components and produced from their early years a wide range of products including electric cables and telephone switching systems as well as consumer electronic products; whereas, Samsung Electronics focused on consumer electronic products but tried to produce key parts and components from the outset (Seo 2001: 222). In other words, Goldstar emphasized product diversification; whereas, Samsung Electronics pursued vertical integration focused on a small range of products.

The first product produced by Samsung Sanyo Electric in November 1970 was a 12-inch black-and-white TV based on vacuum tubes. Within two months, the joint-venture company exported 500 units to Panama. At the same time, to overcome the 100% export requirement for Samsung Sanyo Electric and gain experience in the domestic market, Samsung Electronics signed contract manufacturing and sales contracts with other companies. In December 1969, Samsung Electronics signed a sales contract with Orion Electronics to launch Prince, a Samsung-brand TV set, and followed it up with similar sales contracts for stoves, desktop fans, and refrigerators manufactured by Hanil Electric and Shinhanil Electric. The sales of these products helped to build a brand image for Samsung Electronics (Samsung Electronics 1999).[60]

In 1971, Samsung Electronics signed technology licensing or training contracts for desktop electronic calculators, audio devices, TVs and TV components to develop its own production technology, and dispatched 25 technical trainees to Japan in 1972. In addition, to build its own production base, Samsung Electronics established a production system in 1971 that could turn out 480,000 TVs per year. Based on its experience accumulated through R&D, production and overseas training, Samsung Electronics began to manufacture and sell 20-inch black-and-white TVs in July 1972. Furthermore, in December 1972, Samsung

60. In 1972, the government relaxed the requirement to export all electronic products produced by foreign-owned companies and joint ventures. As a result, Samsung Sanyo Electric was able to sell some of its products in the domestic market (O 1996:395-400).

Electronics established a new technology development center to improve its R&D system and to acquire advanced foreign technology (Samsung Electronics 1999).

This independent move by Samsung Electronics caused friction with Sanyo Electric of Japan. Samsung Electronics could argue that it had to develop its own capabilities in case its three-year contract with Sanyo Electric might not be renewed. However, from Sanyo Electric's viewpoint, Samsung Electronics was charting an independent course and competing with Samsung Sanyo Electric while the joint-venture contract was in effect. In addition to Samsung Electronics' independent move, Sanyo Electric's uncooperative attitude toward providing technical information data,[61] and high supply prices of Sanyo Electric's components and materials escalated tension between the two sides.

After a series of consultations, the two sides agreed to resolve their problems and exchanged a Memorandum of Understanding to normalize relations in February 1973. Rather than going ahead with a plan to establish its own electronic parts factory in Gumi, Sanyo Electric agreed with Samsung Electronics to locate it in Samsung Electronics' complex in Suwon and set it up as a joint venture, named Samsung Sanyo Parts. In addition, the two sides renewed their technology alliance agreement for another three years, and adjusted the items subject to a royalty payment. For instance, TV sets for exports were exempted from a royalty payment (Samsung Electronics 1999). Samsung Electronics' improved capabilities had strengthened its bargaining position.[62]

Samsung Electronics actively pursued vertical integration to become an integrated manufacturer of consumer electronics products. Established in August 1973, Samsung Sanyo Parts produced such core parts and components as VHF-tuners, deflection coils, high-voltage transformers and electrolytic capacitors, which had all been imported from

61. In the end, Samsung Electronics did not so much acquire technology through its partnership with Sanyo Electronics as address its technological challenge by starting with reverse engineering and building its own capabilities through R&D. In fact, as foreign firms were extremely concerned about the "leakage" of technology, it was not realistic to promote technological development by attracting foreign direct investment (Noh 1977, Lee and You 1979: 259-260).

62. In 1977, Samsung Electronics acquired all of Sanyo Electric's shares in Samsung Sanyo Electric and absorbed the company into Samsung Electronics.

overseas. In July 1974, the company established a laboratory to develop technology. In 1976, its own engineers developed color TV components, raising the localization rate of color TVs to over 70% by 1979 (Samsung Electronics 1999).[63]

In addition, in December 1973, Samsung Electronics set up a 50-50 joint venture, Samsung Corning, with Corning Glass Works of the United States to produce bulb glass for TVs. In 1975, the company completed the production line for black and white bulb glass fusion, and in 1977, it built its own melting production line. As a result, Samsung Corning was able to achieve complete localization (Samsung Electronics 1999).

Samsung Electronics' vertical integration strategy culminated with its entry into the semiconductor business. In December 1974, Samsung Electronics acquired the Korean stake in a joint-venture company named Korea Semiconductor. Originally, Korea Engineering & Manufacturing Co. (KEMCO) and Integrated Circuit International Inc. (ICII) of the United States had invested $500,000 each to establish Korea Semiconductor in wafer processing business.[64] However, its management was in serious trouble due to aggressive investment and price spikes in raw materials in the wake of the 1973 oil shock. Driven by its strategy to localize core components, Samsung Electronics decided to take over the Korean stake in Korea Semiconductor.

Korea Semiconductor successfully produced the standard C-MOS Logic 4000 series for the first time in Korea on December 20, 1974. In September 1975, the company produced KS-5001, an LED (Light Emitting Diode) semiconductor for wristwatches, making Korea the fourth country in the world to produce C-MOS / LSI. In June 1977, a team of Korean engineers succeeded in developing more than 10 types of transistors for black-and-white TVs and audio products. As a result, the component localization rate of black-and-white

63. Samsung Sanyo Parts changed its name to Samsung Electric Parts in 1974 and then to Samsung Electronics Parts in 1977. Samsung Electronics acquired Sanyo Electric's shares in the joint venture in 1983. Samsung Electronics Parts changed its name to Samsung Electro-Mechanics in 1987. Unlike Samsung Electronics, Sanyo Electric did not evolve into a vertically integrated and diversified electronics company, and was eventually acquired by Panasonic in 2008.

64. Dr. Kang Ki-dong, who had worked at Motorola in the U.S., led the establishment of Korea Semiconductor.

TVs increased from 40-60% to over 90% (Samsung Electronics 1999).

Samsung Electronics acquired the remaining 50% in Korea Semiconductor in December 1977 and made it an affiliate of the Samsung Group, changing its name to Samsung Semiconductor. In the following year, Samsung Semiconductor acquired a semiconductor assembly factory from Fairchild Korea, when it decided to sell the factory due to labor disputes. Samsung Electronics thus completed the semiconductor production system from wafer processing to assembly production. When Samsung Semiconductor increasingly needed a stable source of funding to cover its large investment, Samsung Electronics absorbed the company in January 1980 and started building stronger linkages between semiconductors and consumer electronic products (Samsung Electronics 1999). In short, Samsung Electronics steadily pursued vertical integration in the 1970s and laid the groundwork for its do-or-die investment in semiconductors, as Chiarman Lee Byung-Chul would announce in 1983.

Thanks to the rapid development of its capabilities, Samsung Electronics began to produce new products ahead of the incumbents. In particular, Econo TV, released by Samsung in April 1975, was very popular because it came on instantly. Consumers did not have to wait several seconds for it to warm up and thus could save time and money. In June 1974, Samsung signed a patent licensing agreement with RCA, which held fundamental patents for color TVs. In cooperation with KIST, Samsung started full-fledged development of color TVs, and successfully produced the first prototypes in Korea in June 1976. Instead of collaborating with foreign companies, Samsung developed its own models by working with the electronic circuit lab at KIST.[65] Although color TV broadcasting was not allowed in Korea, Samsung managed to export its color TVs, starting with Panama in April

65. See the transcript of an interview with Chun Bak-Mi, who led color TV development at Samsung Electronics (Chun 2016). He had originally worked at KIST, doing research on color TVs for four years. At Samsung's request for color TV development, he produced a prototype in a year and transferred technology to Samsung. He himself joined Samsung as well. RCA, which had the fundamental patent on color TVs provided what was in effect quality control support by pointing out problems that needed to be resolved when Samsung brought color TVs for testing, to abide by RCA's quality standards as part of its terms of the contract.

1977. Furthermore, Samsung Electronics developed the first microwave oven in Korea in November 1978 through a reverse engineering process to disassemble and reassemble foreign products.[66] Soon Samsung Electronics started working on the video cassette recorder (VCR), and in May 1979, it succeeded in developing the VCR, making Korea the fourth country to develop VCRs, after Japan, West Germany and the Netherlands. Japan had maintained strict confidentiality regarding VCR technology, but Samsung Electronics succeeded in developing its own VCR by reverse engineering new products introduced by Japan Victor Company (JVC).

In 1970, Samsung Electronics' sales revenue had amounted to only 320 million won, or 4.5% of Goldstar's sales revenue in the same year. By 1979, however, Samsung Electronics' sales revenue had increased to 231 billion won, nearly equal to Goldstar's 262 billion won. Moreover, Samsung Electronics' net profit in 1979 was 10.5 billion won, or 84% higher than Goldstar's 5.7 billion won (Samsung Electronics 1999, LG Electronics 2008).

Samsung Electronics' breakthroughs inspired other companies to come up with their own innovations. Goldstar established the Central Research Laboratory in July 1973 to conduct research on production technology for special processing, material testing, and welding. In December 1975, it established the Central Research Institute to develop high-precision instruments, the first of its kind for a private-sector company in Korea. In August 1979, LG Electronics acquired Daehan Semiconductor and changed its name to establish Goldstar Semiconductor, laying the groundwork for semiconductor production (LG Electronics 2008). Since the 1970s, Goldstar (today's LG Electronics) and Samsung Electronics have competed intensely against each other and developed their capabilities to become world-class electronics companies.

66. For more information on developing microwave ovens through reverse engineering, see Kim (1997: 136-140).

Chapter 6

Assessment and Conclusion

1. Assessment

2. Conclusion

Assessment and Conclusion

Starting with assembly operations and relying on imports for core components, the Korean electronics industry produced its first radio model in 1959, black-and-white TV in 1966, color TV in 1976, and VCR in 1979.[67] By increasing the localization rate of major electronic products such as TVs and securing circuit design technology during its formative years (1966-1979), the Korean electronics industry was able to develop to the point where it could think seriously about producing core parts and materials on its own. As a result, the Korean electronics industry was ranked as a leader among developing countries in the late 1970s.[68] This chapter first analyzes the development of the Korean electronics industry using statistics on production, trade, employment, and R&D, and then assesses government policies and corporate strategies. It concludes by drawing implications for the ongoing industrial policy debate and providing lessons for today's developing countries.

67. The level of Korea's semiconductor technology that had started with the assembly of transistors in the late 1950s was estimated to be 20 years or more behind advanced industrial countries in the early 1970s, based on the prototype development year. However, after successfully developing 64K DRAM in 1983 and 4M DRAM in 1989, Korea reached the world top level by developing a 64M DRAM prototype in 1993. In addition, by introducing digital technology and convergence technology into consumer electronics, Korea became No. 1 in digital TV production (Ministry of Science and Technology 2008: 487).
68. See Mike Tharp, "South Korea Seeks Electronics Rebound," The New York Times, March 24, 1981.

1. Assessment

During its formative years, the Korean electronics industry experienced remarkable growth in production, trade, employment, and R&D. As a result, the status of the Korean electronics industry in the world market and the national economy was greatly improved.

Korea's share in the global electronics production and exports was only 0.2% and 1.1% in 1972, respectively, but increased to 1.3% and 1.9% in 1977. As a result, Korea was ranked 11th in the world in terms of production in 1977 and 11th in terms of exports. The United States, Japan, West Germany, France, the United Kingdom, Italy, Taiwan, the Netherlands, Belgium and Sweden were ahead of Korea in the ranking. In 1977, Korea's electronics industry output was $ 1.7 billion, compared with Taiwan's $ 2.1 billion and Japan's $ 24.8 billion. In the same year, Korea's electronics exports amounted to $ 1.1 billion, compared with $ 1.3 billion for Taiwan and $ 11 billion for Japan (Lee and Yoo 1979: 102). Korea still lagged behind Taiwan and Japan, but it had made great strides since 1967, when Korea's electronics production amounted to $ 55 million, far less than Taiwan's $ 192 million or Japan's $ 3.6 billion (Kim 1968: 39).

The status of the Korean electronics industry in the national economy had also improved. The share of electrical and electronic device manufacturing in the GDP had been only 0.19% in 1965, but nearly tripled to 0.54% by 1979. The share of the electronics industry in Korea's exports increased from 1.4% ($3.6 million out of $ 250 million) in 1966 to 12.3% ($ 1.85 billion out of $ 15.06 billion) in 1979. In terms of exports by industry, electronic products had ranked fifth after textiles, plywood, wigs, and mining products in 1970, but became second after textiles in 1975. Although there was some fluctuation in its ranking in subsequent years, the electronics industry remained one of the top four export industries with textiles, shipbuilding, and steel. The electronics industry maintained its position as one of the four largest export industries until the early 1980s (Electronic Times 1985: 105).

There had been only 70 electronics companies in 1966, or 0.3% of the total number of companies in the manufacturing industry. However, the number of electronics companies increased to 241 (0.9%) in 1971, 482 (2.0%) in 1976, and 810 (2.4%) in 1981 (O 1996: 360). In 1975 prices, facility investment made by the electronics industry in 1968 was 1.43 billion won, which was only 0.4% of the total investment of 168.2 billion won in the manufacturing industry. However, in 1969, it soared to 7.3 billion won (2.5%) and reached 44.8 billion won (4.0%) (Lee and Yoo 1979: 198-199). In terms of the nationality of financing sources over the 1968-1977 period, Korean investors accounted for 92.1% and foreign investors, the remaining 7.9%. This implies that foreign investors basically made minimal investments necessary to utilize Korea's low-wage labor to produce and export labor-intensive products (Lee and Yoo 1979: 204-205).

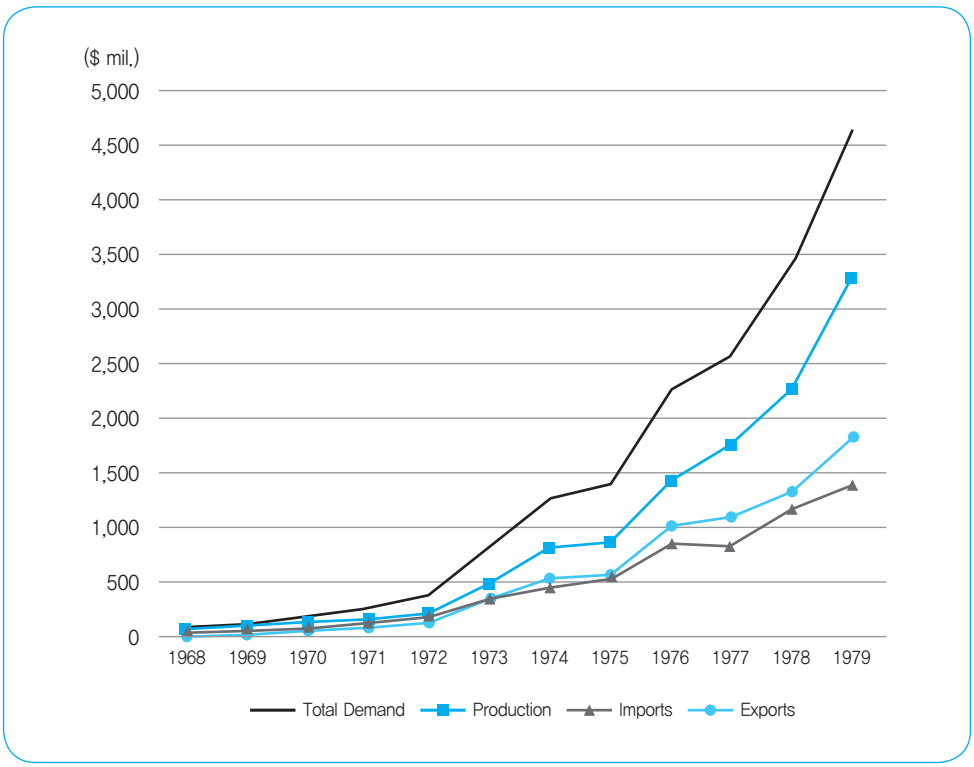
The share of the electronics industry in manufacturing employment had been only 0.6% in 1966, but increased to 8.1% by 1976 (Lee and Yoo 1979: 111). The number of workers in the electronics industry surged from 52,500 in 1972 to 103,200 in 1975 and then to 183,635 in 1978. By the end of the 1970s, however, labor-intensive assembly and production operations had begun to move from Korea to countries with lower wages. In 1979, employment in the Korean electronics industry declined to 179,784 (Electronic Industries Association of Korea 1980b: 232). Indeed, the number and amount of foreign investment in the electrical and electronics industry between 1972 and 1976 had been 121 cases (26.9% of the total) and $ 93.0 million (16.5%). In 1979, however, foreign investment in the electronics industry involved only three cases (7.1%) but amounted to $23.7 million (22.0%), indicating that foreign investors were interested in larger-scale projects (Electronic Times 1985: 112).

The ratio of R&D investment to sales for the electronics industry in 1979 was 1.52%, which was much higher than the average of 0.62% for all industries, and trailed only the precision equipment industry's 1.58% (Electronic Times 1985: 119). In terms of technology

licensing payments, the electronic and electric industries accounted for $ 10.75 million, or 11.1% of the total amount, over the 1972-1976 period. Technology licensing payments by the electronic and electric industries soared $ 24.96 million, accounting for 26.6% of the total, in 1979 (Electronic Times 1985: 120).

A closer look at the development of the Korean electronics industry is as follows. According to FIC's annual statistics, electronics production, imports, and exports increased by an annual average of 39.2%, 32.3%, and 41.4%, respectively, over the 1968-1979 period. Domestic demand grew at an annual average rate of 34.4% over the same period, somewhat slower than exports or production.

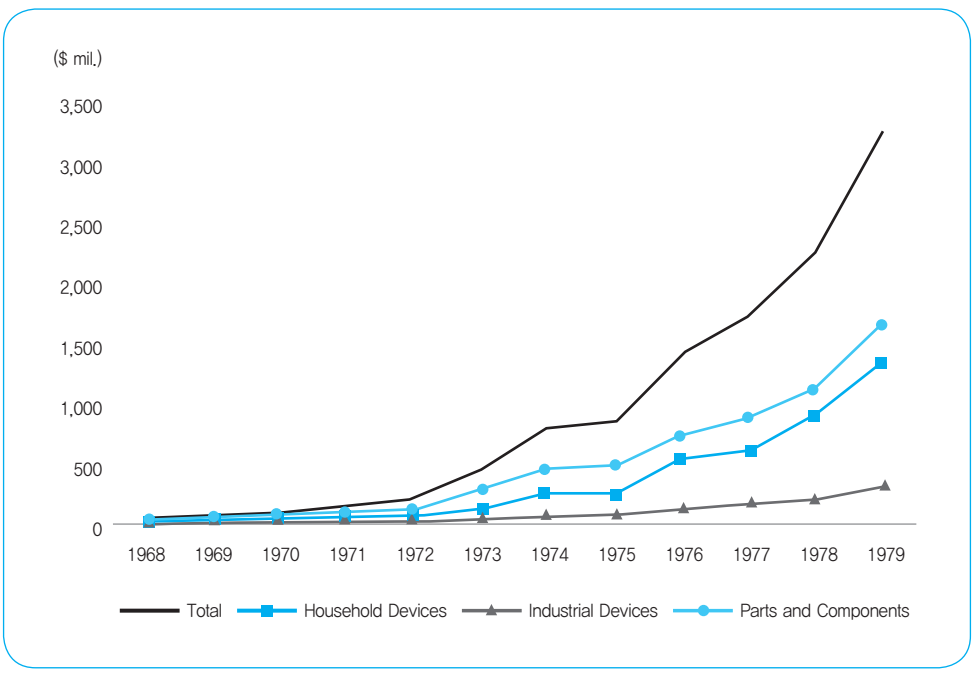
Figure 6-1 | Total Demand, Production, Imports, and Exports for the Electronics Industry (1968-1979)



Source: Lee and Yoo (1979:122), Electronic Times (1985:93-94)

Over the 1968-1979 period, production trends by sector showed the fastest growth for household electronic devices and the slowest for industrial devices. In 1968, the share of production by sector was in the order of parts and components (55.3%), household devices (29.4%) and industrial devices (15.3%). There was no change in ranking in 1979, but the share of production by sector had changed to parts and components (51.6%), household devices (41.9%), and industrial devices (9.8%), showing the rapid growth of household devices. Among household devices, black and white TVs maintained the top position during this period, but the production of amplifiers increased rapidly in the mid-1970s, surpassing radios in 1976, and the production of color TVs showed solid growth as well (Lee and Yoo 1979: 131).

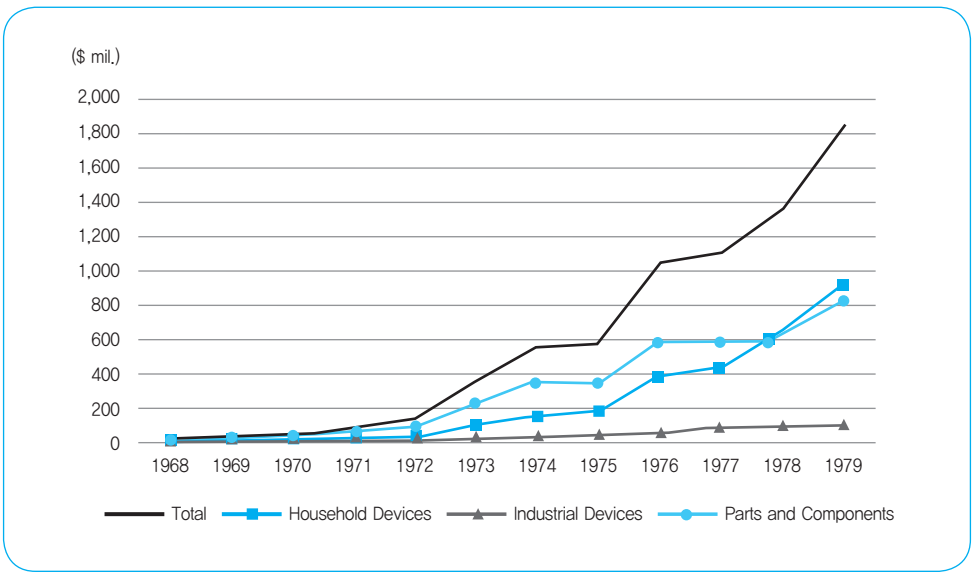
Figure 6-2 | Production by Sector in the Electronics Industry (1968-1979)



Source: Lee and Yoo (1979:125), Electronic Times (1985:93-94)

The rapid growth of household devices was even more noteworthy in exports. The share of exports by sector was in the order of parts and components (81.1%), household devices (18.4%), and industrial devices (0.5%) in 1968. However, by 1979, parts and components (44.4%) had been surpassed by household devices (49.6%), with industrial devices still far behind (6.0%).

Figure 6-3 | Exports by Sector in the Electronics Industry (1968-1979)



Source: Source: Lee and Yoo (1979:140), Electronic Times (1985:93-94)

As shown by production, trade, employment, and R&D statistics, the growth of Korea's electronics industry during its formative years was remarkable. However, it is not easy to establish a rigorous causal relationship by linking industry growth to government policy and corporate strategy, because it is difficult to posit a counterfactual situation that shows how Korea's electronics industry would have developed in the absence of government policy and corporate strategy that prevailed during the 1966-1979 period. Nevertheless,

the fact that Korea's electronics industry grew much faster than its foreign counterparts as well as other domestic industries in Korea suggests that Korea's government policy and corporate strategy in the electronics industry during this period was highly effective. Of course, one could draw other conclusions if something other than the government policy and corporate strategy led to the rapid growth of Korea's electronics industry, but it is difficult to specify what such other factors might be. For example, the expansion of international trade during the 1966-1979 period created more opportunities for exporting electronic products, but not all countries were able to take advantage of these opportunities like Korea. Effective government policy and corporate strategy were needed to exploit these opportunities. It is also plausible that rapid improvement in Korea's human capital contributed to the industry growth during this period, but this improvement did not take place automatically and required effective government policy and corporate strategy. In short, the omitted variable bias is unlikely in the context of Korea's government policy and corporate strategy in the electronics industry during the 1966-1979 period. Therefore, given that Korea's electronics industry grew much faster than its foreign counterparts as well as other domestic industries in Korea and that the omitted variable bias is unlikely, this section considers Korea's government policy and corporate strategy to be highly effective during the 1966-1979 period and summarizes their main points.

In order to promote Korea's electronics industry, the government used various policy instruments. To draw lessons for developing countries, it would be more useful to highlight how a set of policy instruments worked effectively together to promote the industry rather than list all instruments employed by the government. In fact, many countries have used policy instruments such as domestic market protection, financial and tax benefits, establishment of industrial complexes, and support for education and R&D to promote promising industries including the electronics industry. It would be important to understand why only some of them have succeeded, despite the employment of the apparently same policy instruments.

In Korea's case, the government provided breathing space for Korean companies by restricting the inflow of foreign products in the early stage of electronics industry development; however, to ensure that Korean firms develop their own capabilities instead of depending on protectionist measures indefinitely, the government provided incentives for them to develop, produce, and export electronic products and compete vigorously both in the domestic and global market. These measures were broadly in line with the policies that the Western latecomers such as the United States and Germany had adopted to catch up with Britain, the leader of the Industrial Revolution (Cohen and DeLong 2016). By externally imposing high tariffs on imports of manufactured goods, they had provided breathing space for their infant industries to reduce their gap with Britain. Internally, they had provided support to education and R&D to develop their own capabilities and promoted competition in the domestic market. As Korea had a much smaller domestic market than the United States and Germany and a bigger gap with advanced industrial countries, Korea emphasized exports to a greater extent and adopted a more proactive government role in promoting promising industries.

If the Korean government had not initially restricted the import of foreign products, the Korean electronics industry would have lost the opportunity to accumulate localization experience, and likely have become only a subcontracting assembly base for multinational corporations. If the government had focused only on blocking imports and provided no incentives for Korean companies to compete in the domestic and international markets by cultivating their own capabilities, performance-based reward and discipline mechanisms could not have operated in the Korean electronics industry. Given that it was not difficult to secure effective competition based on commercial principles in the electronics industry at the time, it was probably wise for the government to encourage private-sector companies, exposed to vigorous competition, to appreciate the importance of innovation and develop their capabilities in R&D through marketing, instead of setting up a state-owned monopoly

to undertake these functions. Also, it was useful to link tax and financial benefits to performance while considering positive externalities, by designating "important industries" (e.g., heavy and chemical industries) or opting for sector-neutral functional support (e.g., export financing and tax benefits for R&D).

Although the Korean government's policy to promote the electronics industry was generally successful, it also had some problems as well. Most importantly, the anti-consumption bias that the government maintained over the 1966-1979 period impeded the expansion of the domestic electronics market and industry. In particular, despite the fact that Korean companies started exporting color TVs in 1974, the government's decision to maintain its ban on color TV broadcasting led to two adverse side effects. First, due to the limited expansion of the domestic market, Korean companies found it difficult to realize economies of scale to the full extent and exploit opportunities to diversify and upgrade their products by relying on domestic consumers' relatively rapid market response. As a result, Korean companies found it more challenging to break away from original equipment manufacturing (OEM) and produce own-brand models and products. Second, starting around 1978, foreign import regulations were applied to Korean electronic products, especially color TVs. As a result, Korean companies found it more challenging to diversify risks by considering both domestic and overseas demand.

In addition to the adverse effects of the anti-consumption bias, the government policy to designate products for promotion was beginning to show limitations as well, as it could hinder the development of alternative products or processes. Instead of designating products for promotion, the government could have removed its anti-consumption bias and allowed companies to utilize the domestic market to the full extent. They could have then made their investments in products or processes based on market response (Lee and Yoo 1979: 323-328). Last but not least, the government's ineffective response to pressure from

the incumbent companies delayed the introduction of electronic switching systems and impeded the development of the telecommunications industry. These policy issues were resolved in the next phase of development for Korea's electronics industry (1980-1993).

As for corporate strategy during the 1966-1979 period, it was critical for firms to make effective choices regarding market development, technological capacity building, and coordination of productive activities, given Korea's demand conditions, factors of production, intermediate and complementary inputs, and government policies at the time. First, with regard to market development, it was reasonable to pursue domestic sales and exports concurrently. The domestic market was small, but the demand for consumer electronic products was expected to grow rapidly with a rise in per capita income. Also, beyond its scale, the domestic market was important for its rapid consumer response and feedback, which would help Korean companies to diversify and upgrade their products. In addition to the domestic market, they could explore overseas markets for scale economies and learning effects. Second, with regard technological capacity building, Korean companies had to find ways to acquire technology from advanced industrial countries instead of trying to accumulate technological capabilities independently from scratch. Although some felt that acquiring technology through cooperation with foreign capital would be the most effective strategy, it was, in practice, unrealistic to promote technological development by attracting foreign direct investment, because foreign firms were extremely concerned about the leakage of their technology. Starting with reverse engineering, supplemented by technology licensing and training arrangements, Korean firms had to develop their own capabilities to address this problem. Third, with regard to the coordination of productive activities, it was useful to take a step-by-step approach, starting with the production of basic consumer devices and then moving on to more sophisticated products. In the electronics industry, it was important to pursue vertical integration because the value-added share of

core components and materials in final products was high. Also, for risk diversification and technology convergence, it was useful to develop a range of products from household devices to communications equipment. Over the long run, firms that proved successful were those that managed to develop capabilities to produce final products, components, and materials through R&D and vertical integration and to generate synergies from product diversification. By contrast, firms that stuck with labor-intensive assembly or only household appliances had to move their operations to low-wage countries or face a decline in performance.

2. Conclusion

The development of Korea's electronics industry during the 1966-1979 period provides useful lessons not only for the academic community engaged in the industrial policy debate, but also for developing countries seeking promising industries after garments and footwear. This section discusses these lessons from two angles: the identification and promotion of promising industries.

Theoretically, in order to select promising industries, it is necessary to identify those industries that can play a leading role in the structural transformation of the economy due to their high income elasticity of demand and potential for rapid productivity growth. At the same time, it is necessary to assess current capabilities and their potential for improvement. In this process, it is important to identify trends in global markets and technologies, and analyze the industrial development and growth trajectory of countries that started out with similar endowments as one's own. In addition to international benchmarking prescribed by New Structural Economics, the search and experimentation process emphasized by the self-discovery theory and the analysis of international trade statistics highlighted by the product space theory could play a useful role in identifying promising industries.

In the case of the electronics industry, positive assessments of its prospects began to gain support in the late 1950s in Korea. The assembly segment of the electronics value chain seemed to provide a relatively easy point of entry because it was labor-intensive, but compared with other labor-intensive industries, the electronics industry had a high income elasticity of demand and a rapid pace of productivity improvement and could provide significant spillover effects for other industries. Electronics thus attracted attention because it could play a dual role by not only creating jobs but also facilitating structural transformation. Although most people agreed that the electronics industry was an important industry for the future, many voiced reservations about Korea's prospects for success in this industry, as demonstrated by Lak Hee Chemical's internal debate regarding its entry into the electronics industry. It was not clear whether the electronics industry was a realistically promising industry for Korea, given Korea's capabilities and prospects for improvement at the time.

International benchmarking played a critical role in resolving this problem. In particular, Japan, with similar natural endowments as Korea's, seemed to show that it was possible for Korea to have success in the electronics industry. Within a decade of launching its policy to promote the industry in 1957, Japan had become the world's second largest producer of electronic goods. Specifically, government officials and business leaders who were tracking Japan's industrial production and trade performance through MITI and JETRO publications came to believe that given Korea's human capital, Korea too could develop its capabilities to become a major player in electronics. This belief was reinforced by Taiwan's success in the electronics industry in the mid-1960s.

In identifying electronics as a realistically promising industry for Korea, there was a great deal of information exchange between the government and the private sector. The government certainly did not pick the electronics industry out of the blue. It studied

industrial policy in Japan and other countries and consulted with business leaders and experts such as Dr. Kim Wan Hee. This is in line with the identification process envisioned for a developmental state.

As for industry promotion, the Korean case holds interesting policy implications from technical and political economy perspectives. From a technical angle, Korea's policy to promote the electronics industry combined international benchmarking to find effective measures and public support to encourage activities that generate positive externalities. Japan's Law on Provisional Measures for Electronics Industry Promotion (1957) had a direct impact on Korea's Electronics Industry Promotion Law (1969). In Korea, as in Japan, the government designated products for promotion and provided support to companies that made investment in the development and production of these designated products. However, unlike in Japan, the Korean government did not abide by the three-stage approach (development research → volume production → rationalization). Instead, as a latecomer, it tried to reduce catch-up time by attracting foreign companies and forming technology alliances, given the wide knowledge gap between Korea and advanced industrial countries at the time. Also, from the outset, Korea emphasized exports to a greater extent than Japan, given Korea's domestic market was much smaller than Japan's.

The government policy to designate products for promotion and provide support to companies is in line with the self-discovery theory, which recommends that the government provide support to companies that discover promising industries or activities, given the positive externalities generated by successful search and experimentation. In Korea's case, as a latecomer in electronics, it was initially relatively easy for the government to designate products for promotion because information on what needed to be discovered was readily available. However, by the late 1970s, instead of designating products for promotion, it might have been better for the government to remove its anti-consumption bias and allow companies to make their investments in products or processes based on market response.

From a political economy angle, it could be argued that Korean politicians provided benefits to economic agents in exchange for their assistance in helping them achieve their goals, as posited in the basic model. The key is how much the pursuit of their private interest was aligned with the public interest. Interesting examples are provided by Goldstar, which called for a crackdown on smuggled electronic products and advocated a campaign to send radios to farming and fishing villages; and the incumbents that tried to block Samsung Sanyo Electric's entry into the domestic market. If these companies had only sought to restrain competition and secure procurement demand, with no regard for localization and quality improvement, and if the government had simply accommodated their requests, the pursuit of their private interest would have amounted to a typical rent-seeking activity. However, in Korea's case, the incentive system was set up so that performance-based reward and discipline mechanisms could operate effectively in a competitive environment, and it helped to ensure that companies' pursuit of private interest was in alignment with the public interest. In the case of Korea's electronics industry, what proved critical was a performance-based reward and discipline system that was consistent with the notion that the policy objective was localization with international competitiveness (or import substitution through export promotion), not localization per se.

The government provided breathing space for Korean companies by restricting the inflow of foreign products in the early stage of electronics industry development; however, to ensure that Korean firms develop their own capabilities instead of depending on protectionist measures indefinitely, the government provided incentives for them to develop, produce, and export electronic products. If the government had not initially restricted the import of foreign products, the Korean electronics industry would have lost the opportunity to accumulate localization experience. If the government had focused only on blocking imports and provided no incentives for Korean companies to develop their own capabilities, Korea likely would have become only a subcontracting assembly base for multinational

corporations—and only for a limited time. The development of Korea's electronics industry during the 1966-1979 period shows that although it is necessary to provide protection and support in the early stages of industry promotion, far more important is the role of innovation and competition based on economic incentives.

(Korean-Language References)

Chun, Bak-Mi. 2016. "Interview Transcript."

Compilation Committee for a 50-Year History of the Electronics Industry. 2009. *Miraculous Time 50: A 50-Year History of Korea's Electronics Industry* (Seoul: Electronic Times).

Editorial Board, Journal of the Korea Electric Association. 1972. "The Current Status of Korea's Electronics Industry," *Journal of the Korea Electric Association* (October 1972):12-27.

Electronic Industries Association of Korea (EIAK). 1980a. *Electronics Industry Handbook 1979-80*.

Electronic Industries Association of Korea (EIAK). 1980b. *Electronics Industry Statistics 1980*.

Electronic Times. 1985. *Korean Electronics Yearbook 1985*.

Fine Instruments Center (FIC). 1978. *Korean Electronics Industry Statistical Yearbook 1978*.

Kim, Si-Youn. 1996. "Industrial Policy in the Electronics Sector and Meso-Corporatism, 1960s-1980s." *Korean Political Science Review* 29(3): 123-140.

Kim, Wan Hee. 1967. "Policy Recommendation for Electronics Industry Promotion," Journal of the Korean Electrical Science Association 16(3): 78-81.

Kim, Wan Hee. 1968. *Background Report for Electronics Industry Promotion: A Korean-Language Summary.*

Kim, Wan Hee. 1999. *Embracing Two Suns* (Seoul: Dong-Ah Ilbo).

Kim, Chung-yum. 1990. *A 30-Year History of Korea's Economic Policy* (Seoul: Joong-Ang Ilbo).

Korea Development Institute. 1998. *Transcripts of Export Promotion Meetings, Volumes I, II, and III*.

Korea Electronic Industries Cooperative. 1968. "Petition on the Joint Venture between Samsung Electronics and Japan Sanyo Electric," reproduced in A *30-Year History of the Electronics Cooperative*, pp.103-106.

Korea Electronic Industries Cooperative. 1997. A *30-Year History of the Electronics Cooperative*.

Korea Institute for Advancement of Technology. 2012. "How Did the First Radio Look?", *Technology and Future* 8:68-72.

Korea Institute of Science and Technology (KIST). 1998. *A 30-Year History of KIST.*

KOTRA. 2002. *40 Years of KOTRA, 40 Years of the Korean Economy.*

Lee, Chae-Yoon. 2001. *Samsung Electronics 3.0 Story* (Seoul: Book Ocean).

Lee, Jong-Wook and Jong-Gu Yoo. 1979. *The Current Status and Problems of Korea's Electronics Industry* (Seoul: Korea Development Institute).

Lee, Kie-Hong. 1999. *Hidden Stories behind Economic Modernization* (Seoul: Voice Press).

Lee, Won-Kyung. 1975. "The Current Status of Korea's Electronics Industry," *Electricity Journal* (March 1975):22-26.

LG Electronics. 2008. *A 50-Year History of LG Electronics*.

Lim, Wonhyuk and Minha Lee. 2010. *Promotion Policy for the Information and Communications Industry* (Seoul: Korea Development Institute).

Ministry of Science and Technology. 2008. *A 40-Year History of Science and Technology.*

Nam, Duck-Woo. 2009. *At the Strategic Point of Economic Development* (Seoul: Samsung Economic Research Institute).

Noh, Jung-Ik. 1977. *An Empirical Study on the Technological Level and Development of Korea's Electronics Industry*. Master's Thesis. KAIS.

O, Won-Chul. 1996. *Korean-Style Economic Development: An Engineering Approach*. Vol. 3 (Seoul: Kia Economic Research Institute).

Park, Young-Gu. 2010. "Production and Export Plans for the Electronics Industry in the 1970s," *Social Science Research* 49(2):221-250.

Samsung Electronics. 1999. *A 30-Year History of Samsung Electronics*.

Seo, Hyun-Jin. 2001. *Endless Revolution: Forty-Year Footsteps of Korea's Electronics Industry* (Seoul: EB Com)

Yoon, Chungwoo. 2016. "Interview Transcript."

(English-Language References)

Aghion, Philippe, Mathias Dewatripont, L. Du, Ann Harrison, and Patrick Legros. 2012. "Industrial Policy and Competition." NBER Working Paper 18048.

Amsden, Alice H. 1989. *Asia's Next Giant: South Korea and Late Industrialization*. New York: Oxford University Press.

Cohen, Stephen S., and J. Bradford DeLong. 2016. *Concrete Economics: The Hamilton Approach to Economic Growth and Policy*. Boston, Mass.: Harvard Business Review Press.

Cho, Yoon-Je, and Joon-Kyung Kim. 1997. *Credit Policies and the Industrialization of Korea*. Seoul: Korea Development Institute.

Cyhn, Jin W. 2002. Technology Transfer and International Production: The Development of the Electronics Industry in Korea. Cheltenham, UK: Edward Elgar.

Evans, Peter. 1995. *Embedded Autonomy: States & Industrial Transformation*. Princeton: Princeton University Press.

Grossman, Gene M., and Elhanan Helpman. 1991. *Innovation and Growth in the Global Economy*. Cambridge, MA: MIT Press.

Hidalgo, Cesar A., B. Klinger, A-L. Barbasi A.-L & R. Hausmann. 2007. "The Product Space Conditions the Development of Nations." *Science*. July 27. Vol. 317: 482-487.

Johnson, Chalmers. 1982. *The MITI and the Japanese Miracle: The Growth of Industrial Policy, 1925-1975*. Stanford: Stanford University Press.

Khan, Mushtaq H., and Jomo K.S.(eds.). 2000. Rents, Rent-Seeking and Economic Development: Theory and Evidence in Asia. Cambridge: Cambridge University Press.

Kim, Linsu. 1997. Imitation to Innovation: The Dynamics of Korea's Technological Learning. Boston, Massachusetts: Harvard Business School Press.

Lederman, Daniel, and William F. Maloney. 2012. *Does What You Export Matter?: In Search of Empirical Guidance for Industrial Policies*. Washington, DC: The World Bank.

Lim, Wonhyuk. 2012. "Chaebol and Industrial Policy in Korea," *Asian Economic Policy Review* (2012) 7: 69-86.

Lin, Justin Yifu, and Celestin Monga. 2010. "Growth Identification and Facilitation: The Role of the State in the Dynamics of Structural Change," Policy Research Working Paper 5313. Washington, DC: The World Bank.

Matsuyama, Kiminori. 1992. "Agricultural Productivity, Comparative Advantage, and Economic Growth." Journal of Economic Theory 58: 317-334.

North, Douglass C., John Joseph Wallis, and Barry R. Weingast. 2009. *Violence and Social Orders: A Conceptual Framework for Interpreting Recorded Human History*. Cambridge: Cambridge University Press.

Nunn, Nathan, and Daniel Trefler. 2010. "The Structure of Tariffs and Long-Term Growth." *American Economic Journal: Macroeconomics* 2(4)(October): 158–194. doi:10.1257/mac.2.4.158.

Porter, Michael E. 1990. *The Competitive Advantage of Nations*. New York: Free Press.

Rodrik, Dani. 2007. *One Economics Many Recipes: Globalization, Institutions, and Economic Growth*. Princeton and Oxford: Princeton University Press.

Rugman, Alan M. 1992. "Porter takes the wrong turn." *Business Quarterly* 56(3), 59–64.

Wade, Robert. 1990. *Governing the Market: Economic Theory and the Role of Government in East Asian Industrialization*. Princeton: Princeton University Press.

Woo-Cumings, Meredith (ed.). 1999. The Developmental State. Ithaca and London: Cornell University Press.

www.ksp.go.kr

Ministry of Strategy and Finance, Republic of Korea

30109, Sejong Government Complex, 477, Galmae-ro, Sejong Special Self-Governing City, Korea Tel. 82-44-215-2114 www.mosf.go.kr

KDI School of Public Policy and Management

30149, 263 (Bangok-dong, Korea Development Institute), Namsejong-ro, Sejong-si, Korea Tel. 82-44-550-1114 www.kdischool.ac.kr

9 791155 451861 95320

ISBN 979-11-5545-186-1

Knowledge Sharing Program
Development Research and Learning Network

- 339-007, 263 (Bangok-dong, Korea Development Institute), Namsejong-ro, Sejong-si, Korea
- Tel. 82-44-550-1172
- www.kdischool.ac.kr