Korea's S&T Policy English Translation Project: Series 1

The 40-Year History of Science and Technology

Chapter 2. The Birth of S&T Administration in the 1960s

Over the past half century, Korea has achieved remarkable economic growth. Among the major factors that have driven this growth, the development and innovation of science and technology is said to have made greatest contribution. For this reason, developing countries have shown growing interest in learning more about Korea's policy during the early phase of its economic growth.

Science and Technology Policy Institute (STEPI) aims to assist developing countries in their efforts to establish science and technology policy by translating policy materials related to Korea's past development of science and technology. For the first series of this project, we have translated some sections (1960s to 1980s) of The 40-Year History of Science and Technology, published by the Ministry of Science and Technology in 2008.

Ministry of Science, ICT and Future Planning

STEPI SCIENCE AND TECHNOLOGY POLICY INSTITUTE

Section 1. Environment Surrounding Modern S&T Activities in Korea

1. S&T community in the early 1960s

Korean scientists called on the Korean government to lead the promotion of science and technology after the country's reclaiming independence from the Japanese colonial rule in 1945. However, the lack of comprehensive policies or integrated administrative system for promoting science and technology in the 1950s prevented special programs or projects for advancing national science and technology from being developed and executed. Scientists and engineers yearned for the establishment of a government organization specializing in S&T administration and research institutes equipped with quality research facilities. The Office of Atomic Energy (OAE), established in 1959, overseeing research, development, production, utilization and management of nuclear energy can be regarded as the first independent S&T related administrative body of the Korean government. However as its field was limited to nuclear energy, OAE was not able to deal with comprehensive policies to promote national science and technology. The Atomic Energy Research Institute (AERI), established in the same year as an affiliate research institute of OAE, is often regarded as the first effective research institute in Korea, but it took several years for AERI to start its normal operation.

In fact, it was not until the 1950s that "science and technology" became one of the key agenda of the Korean government or the Korean politics. In February 1960, the Liberal Party announced the promotion of science and technology as its official party platform, establishing itself as the first Korean political party to do so. One month before the "Rigged Election of March 15th" which aroused the April 19th Revolution, the Liberal Party leaders and the government cabinet held agreed upon nine policy agenda in a joint meeting, which embraced the "promotion of science and technology" as one of their key agenda. The S&T agenda along with "the promotion of education and culture" was later added to the seven originally adopted policy agenda. It was conceived as a makeshift measure in part of an upcoming election strategy; nevertheless, it was the first time that the Korean politicians put forward the promotion of science and technology as the nation's official policy agenda. However, in two months from the meeting, the April 19th Revolution disintegrated the Liberal Party and the succeeding Democratic Party had to face a similar fate as the May 16th military coupe terminated the Democratic Party before it started full-fledged discussions on the promotion of science and technology.

In the 1960s, the environment for promoting science and technology began to ripe. The establishment of OAE and AERI became a momentum to heighten the interest in science and technology in the government, albeit its limited scale. For seven years from 1956, the Korean government dispatched more than 200 Korean researchers to overseas institutes to receive training. From 1959, the Annual Academic Conference on Atomic Energy had a limited title specific to nuclear energy, but it practically served as a conference for scientists in the all fields of science and pulled all the stakeholders of science and technology nationwide and played a pivotal role in attracting scientists and engineers across all fields of science and technology. On the sidelines of the 1st Academic Conference on Atomic Energy, about 80 leading scientists and engineers held a separate meeting and agreed to work on the promotion of science and technology by launching the "S&T Promotion Committee". Consequently, the Koran Association for Science and Technology Promotion" was established as a national entity covering all scientists and engineers regardless of their specialties in 1960. However, the association remained dormant as the Mary 16th military coupe took place two months from the launching of the association.

The demand for S&T education and research was also growing at universities. The so-called "Minnesota Project" from 1955 to 1961, which was aimed at rebuilding Seoul National University (SNU), transformed S&T educational system at SNU into an American style and promoted science and engineering education. In the process of

implementing the Minnesota Project in part of raising S&T experts and providing educational training, a variety of lab equipment was imported to Korea and a large number of professors of medical, agricultural and engineering colleges of SNU were dispatched to University of Minnesota for training and research. These professors returned in 1959 after their research or training and brought significant changes to education in their academic disciplines. Moreover, studying overseas became more common after the end of Korean War and researchers who had returned from their advanced studies overseas in late 1950s provided new momentum for the Korean S&T community. The passion for science and technology grew gradually, regardless of limited capacity of research and education in the universities, and the country started to recognize the need for policies to promote science and technology.

2. Korean economy in the 1960s

The Korean economy in the 1960s had a typical industrial structure of a developing country and was lagging behind other nations. GNP per capita remained at around US$100 and the country relied heavily on the primary industry. In the country's industrial structure in 1961, the primary industry accounted for 40.2% while the secondary industry was accountable for only 15.2%, contributing only 13% to the overall GNP makeup. This imbalance of economic development was also reflected in industrial technology that serves as a foundation for economic development. A whole range of industrial technologies from factory designing to production technology and quality management were heavily relied upon foreign entities. Development of new product or technology was seldom observed in Korea's industrial sector and the public awareness of R&D was also very low. As a result, the Korean government had to spearhead the promotion of industrial technologies.

In the late of 1950s, the need for autonomous economic development grew significantly as the official development assistance from the U.S. which accounted for a large portion in the Korean economy diminished sharply. In lieu of the diminished foreign aid, the Korean government started to prepare an economic development program and planning and execution of the economic development program was at its full force in 1961. Key industrialization strategies of the First 5-Year Economic Development Plan included the local production of consumer goods, the replacement of imported goods with locally produced goods, and the expansion of exports of light industry products. In line with the key industrialization strategies, industries producing fertilizers, cement, plywood, textile, and electricity were designated as strategic industries. The Korean government recognized the weak industrial foundations at the time and implemented a strategy of first importing technologies crucial to developing strategic industries and later internalizing these imported technologies.

Due to developing countries' weak foundations for technology accumulation and R&D activities, it is inevitable that they place priority in introducing cutting-edge foreign technologies and then internalizing, reforming and utilizing them. The Korean government enacted 'the Act for Promoting Foreign Direct Investment' in 1960 and 'the Special Act on the Introduction of Capital' in 1962 which allowed the long-term settlement method to promote the introduction of foreign capital and technologies to Korea. Furthermore, securing quality S&T experts who serve as the foundation for technology development became an important national agenda. In 1961, the Korean government conducted a survey on S&T human resources; the result showed that S&T human resources comprised 3.7% of the total employment and both employment quantity and quality were in a poor state. As part of the national development strategy, the Korean government had to rely on abundant human resources in lieu of lacking natural resources. Thus it was imperative that the government maximize the utilization of S&T experts including scientists, engineers and technicians to raise core human capital to spearhead the national economic development.

Finally, the implementation of the First 5-Year Economic Development Plan laid down the foundation for Korea to make a giant leap toward an industrialized country. During this period, the primary industry achieved an annual growth rate of 5.1% while that of the secondary industry reached 14.1%, signaling a full-fledged industrialization. In 1966,

the final year of the First 5-Year Plan, the portion of the secondary industry soared to over 20% and that of manufacturing industry to 18.5% as result of industrial restructuring. As manufacturing industry grew and export steadily increased, the will to achieve an economic independence from foreign assistance became stronger and the public awareness of the importance of S&T development was promoted in the process. Instead of simply copying foreign products, it became necessary to reform outdated manufacturing facilities or processes in order to ensure prompt internalizing, absorbing, and improving cutting-edge foreign technologies and strengthening international competitiveness of exporting merchandise. During this process, the role of S&T was given prominence. From the selection of appropriate technologies or manufacturing facilities to the improvement of manufacturing technologies to foster production efficiency and the internalization and tailoring of introduced technologies to the Korean environment, this entire process required a certain level of technological capacity. During this process, the government and industries perceived that S&T is one of the core requirements for the industrial and economic development alongside natural resources, capital, and labor.

In conclusion, importing cutting-edge foreign technologies can be a good starting point for a developing country, but the Korean government required policy measures to hone its research capacity to effectively execute and make a giant leap forward. In response to its needs, the Korean government policy in the early 1960s focused on facilitating the introduction of foreign technologies, fostering high caliber human resources to support imported technologies, and building institutions for industrial technology research.

Section 2. Establishment of Economic Development Plan and Birth of Science and Technology Policy

1. Establishment of the First Five-year Technology Development Plan

Having come into power through the May 16 Revolution, the military government showed a far more positive attitude toward science and technology issues than the previous government had. Under the slogan "Let us live well by solving our economic problems and struggling to rise up out of despair and starvation," the military government set the economic growth of the country as its main goal, which naturally led to the increased interest in science and technology development. The Supreme Council for National Reconstruction, the highest government body established by the military government, instructed to review the prospects for a research institute for science and technology, which led the Ministry of Education to form the committee for the establishment of a comprehensive science and technology research institute in September 1961. Chaired by the Vice Minister of Education, the committee was composed of domestic senior scientists and engineers and tasked with drawing up a plan for the establishment of a comprehensive science and technology research institute. As instructed, the committee prepared and reported on the establishment plan for such an institute, which it called the Korea Science and Technology Research Institute (tentative name). Having received the absolute support of the nation, the plan called for the establishment of a private research institute in the form of a special corporation rather than a national or public institute. After reviewing this, the Supreme Council decided to establish the Board of Science and Technology Research Institute under the leadership of a Cabinet member and enacted legislation for the committee responsible for establishing the Board of Science and Technology Research Institute to draw up plans and carry out the preparation of related documents in November 1961. It was then decided that the Board of Science and Technology Research Institute would merge all science and technology organizations scattered throughout various government ministries and take coordination of the research directions of all research institutes through the Science and Technology Review Committee. The government came up with this idea of consolidating or rearranging the existing research institutes because it would have required substantial funds to establish a new research institute, making the idea of establishing an administrative organization—rather than a simple research institute—to consolidate and coordinate the nation's overall science and technology research activities particularly attractive. However, due to the disapproval of such consolidation of existing research institutes expressed by the organizations involved, differences of opinions among science and technology community, and financial issues, the plan failed to make any further progress.

Despite the failure to realize either a new research institute or independent science and technology administration, the establishment of the Five-year Technology Promotion Plan was a notable achievement during this period. While striving to promote economic development by establishing the First Five-year Economic Development Plan in 1961, the military government realized the necessity of science and technology promotion policy, leading it to prepare an additional supplementary plan to accomplish that goal. One event in particular—a question asked by President Park Chung-hee, Chairman of the Supreme Council for National Reconstruction—had a meaningful influence on this plan. At the beginning of January 1962, during the New Year's briefing of the Economic Planning Board that was held in relation to the recently completed First Five-year Economic Development Plan, President Park asked, "Regardless of any problem in terms of technology, we have to build new factories now; is that possible with the technology and engineers currently at our disposal? If not, what are our options?" The Vice Minister of the Economic Planning Board replied that he would establish and report on a separate plan regarding the supply and demand of technology. Soon after the briefing, the Technology Management Department of the Economic Planning Board took charge of drawing up a plan for the supply and demand of technology.

However, the Economic Planning Board had been considering the technology supply and demand issue even before that briefing was held. In 1961, the Board commissioned an affiliated management research institute of Korea University to conduct a nationwide survey on human resources in the technology community; and it submitted the report to the Cabinet meeting in December of the same year. As it showed the numbers of technicians, craftsmen, and technology-related educators that were active across all industries, technology-related government offices, and science and technology educational institutions, the report emphasized in its preface that the results of the survey should be used as the basic data for the development of a plan for the supply and demand of technology. Although technology was essential to the success of the Five-year Economic Development Plan, Korea's technological capability at the time was very low, and the lack of data made it impossible to develop a technology supply and demand. Under such circumstances, where an accurate understanding of the current status of technology in the country was needed, the survey on human resources in the technology field was carried out in order to develop the plans for technology training and the technology supply and demand.

Tasked with drawing up the technology supply and demand plan, the Technology Management Department decided to establish a more comprehensive Five-year Technology Promotion Plan, for which it received support from the United States Operations Mission (USOM) and organized the Science and Technology Policy Council, which consisted of 40 representatives from domestic science and technology societies, including those in the industrial, academic, and research communities. This Council consulted on the development of the plan. With the subtitle, "Supplement to the First Five-year Economic Development Plan," the First Five-year Technology Promotion Plan was officially approved and promulgated in May 1962. The plan focused on three things: namely, the plan for the supply and demand of technology, which aimed to secure human resources in the technology field required for the completion of the First Five-year Economic Development Plan; promotion of the transfer of foreign technology for the sake of industrial technology development; and technology improvement with the aim of building a firm basis for the enhancement of science and technology. This plan forecasted the supply of and demand for human resources in the technology field in order to come up with a human resources development policy and emphasized the importance of devising a plan to increase the ratio of technicians to craftsmen.

The transfer of foreign technology was divided into three categories: namely, the introduction of technology for investment projects, import of technology for foreign loans, and import of technology with the aim of increasing the nation's technological capability. In addition, the building of a firm basis for the enhancement of science and technology included: the dissemination of science and technology, strengthening of science and technology information activities and international exchange, expansion and reorganization of research activities, and improvement of related systems, including the enactment of related laws for the promotion of science and technology, establishment of a comprehensive science and technology administrative system, strengthening of the industrial standardization system, and improvement of patent administration.

The First Five-year Technology Promotion Plan was the first meaningful and comprehensive plan that aimed to promote science and technology in general; furthermore, it showed that science and technology policy had been recognized as a major driving force of national economic development, even over that of the existing education policy. Upon the establishment of this plan, the government set up the foundation for the systematic promotion of science and technology by acknowledging scientific and technological capability as a national agenda and including it as part of its long-term development plan. Unlike this plan, which had been added belatedly to the Second Five-year Economic Development Plan, the plan for the promotion of science and technology was established and included as a separate plan from the beginning. Thus, the mid-term plan for the promotion of science and technology was established under the government leadership along with the economic development plan. The fact that science and technology was recognized and reflected as an essential element of economic development by the government was seen as a significant progress in the process of industrialization and science and technology development in Korea.

2. Establishment of the Technology Administration Bureau

The First Five-year Technology Promotion Plan, the first comprehensive plan for the promotion of science and technology, revived the discussion on establishing a science and technology administration. With the announcement of the plan, national science and technology organizations came together to submit a proposal for the establishment of a government ministry dedicated to science and technology administration to the Supreme Council for National Reconstruction. This proposal requested that a comprehensive science and technology board, chaired by a Cabinet member, be formed at the deputy prime minister level and made responsible for all duties related to science and technology, with an emphasis on science and technology education and research. To realize the importance of such a body, the government decided to first establish an organization attached to the Economic Planning Board, and considered establishing an independent ministry chaired by a Cabinet member during the Second Five-year Economic Development Plan. Accordingly, in June 1962, the existing Technology Management Department was expanded to create the Technology Administration Bureau. It was the first bureau-level administrative organization responsible for the establishment and implementation of a comprehensive policy for the promotion of science and technology. The Technology Administration Bureau originated with the Technology Management Office, a temporary office established under the Ministry of Reconstruction in 1959. This office was responsible for duties related to the training of technicians to be sent overseas based on technical support provided by the United States. When the Ministry of Reconstruction was changed to the Ministry of Construction in 1961, the office was promoted to the Technology Management Department, and again, when the Ministry of Construction was reorganized to form the Economic Planning Board, it became the Technology Management Department under the Materials Mobilization Planning Bureau. The Technology Administration Bureau consisted of the Technology Management Department, Technology Promotion Department, and Technology Survey Department. In particular, the main duties of the Technology Management Department were the establishment of comprehensive policies for science and technology promotion, long-term and annual implementation plans for science and technology promotion, and overall coordination and management concerning the budgets and performance of science and technology research institutes.

After its establishment, the Technology Administration Bureau reviewed the overall status of science and technology in Korea and published the *Science and Technology White Paper* as its first main policy document in 1962. The first white paper on science and technology in Korea identified to date is the *Korean Science and Technology Survey* published by the technology department of the Korea Development Bank in 1959. Published three years later, the *Science and Technology White Paper* was notable as it was the first white paper on science and technology published by the government. Containing details on the current status of, problems in, and forecasts on science and technology in general and also specific fields, this document has been annually published as the *Science and Technology Yearbook* since 1964. In addition to its establishment of the First Five-year Manpower Development Plan (1962 to 1966), based on a survey on human resources in the technology field conducted by an affiliated management research institute of Korea University in 1961, the Technology Administration Bureau conducted a nationwide survey to ascertain the circumstances of science and technology research institutes at the time in 1963. The results of this survey, which included accurate information on the research facilities, researchers, and operating conditions of national, public, university, and private research institutes in Korea, served as important basic data for the establishment of future R&D policies and plans. Thus, after the establishment of the Technology Administration Bureau, basic materials and statistics began to be created and collected in earnest, and the government's science and technology budget began to be handled as an independent budget item.

In addition, after the establishment of the Technology Administration Bureau, efforts were made to enact legislation related to the promotion of science and technology. The regulation on the formation of a basic committee responsible for legislation related to science and technology promotion was passed by an order of the Cabinet in September 1962, and a committee composed of 28 people, including representatives from the science and technology community (societies and associations), officers (director level) of science and technology administrations, and legal experts, was

established. This committee was focused primarily on drafting and reviewing four basic laws—the Science and Technology Promotion Act, Technician Qualification Act, Technician Employment Act, and Vocational Training Act. However, these laws were not immediately passed, due to differences of opinion both inside and outside of the government. Under the new name of the Professional Engineers Act, the Technician Qualification Act was the first to be legislated and promulgated in November 1963. This law was designed to ensure the preferential treatment of highly skilled technicians, define necessary measures for fostering professional engineers in specialized areas of technology, and regulate the qualifications and ranges of professional engineers.

Despite the Technology Administration Bureau's emphasis on the promotion of science and technology, a new science and technology promotion plan was sought even after the bureau's establishment. However, the formation of the Economy and Science Council was the only substantial result. Established as an organization to advise the President on important policies regarding the promotion of science and technology for the sake of national economic development prior to the Cabinet council, the Economy and Science Council was proposed at the final stage of the constitutional amendment at the end of 1962. At the time, the press pointed out that, although the establishment of the Economy and Science Council had never been discussed during the three months of deliberation over the constitutional amendment, the agreement to establish the Economy and Science Council as an advisory council to the President was made just before the confirmation of the constitutional amendment, and the Council was established in early 1964, after the new constitution was passed. However, among the seven members of the Council, only one was involved in science and technology. In fact, because the large majority of committee members were involved in the fields related to economics, the committee was unable to serve as an effective advisory body in the area of science and technology.

3. Effort to Reorganize National and Public Research Institutes

One of the main tasks regarding the science and technology policies that was promoted by the Technology Administration Bureau was the reorganization of national and public research institutes. At the time, most research institutes were national or public institutes, and the majority of researchers worked at such institutes; furthermore, nearly the entire budget for science and technology research went to these institutes. However, except for a few, most national and public research institutes were very small. The large institutes, including the Central Meteorological Service, Office of National Geological Survey, Korea National Institute of Health, and National Fisheries Promotion Institute, whose primary functions were not research, accounted for more than half. In fact, since the majority of national and public research institutes primarily carried out testing and survey activities under poor conditions and with limited budgets, their research activities accounted for only a small portion of the total, except for two or three institutes. Furthermore, the majority of researchers at national and public research institutes were government officials, and their numbers were fixed. In addition, as the treatment of researchers was regulated by the Government Officials Act, hiring good researchers was very difficult. Governed by the Budget and Accounts Act, research institutes did not have fiscal autonomy over their operations; therefore, it was almost impossible to begin new and creative research activities. Accordingly, the government continued its attempts to improve national and public research institutes in hopes of creating new and different types of research institutes.

In 1963, the Technology Administration Bureau began conducting an extensive survey in an effort to gather more accurate data on the actual conditions of science and technology research institutes in Korea, and promoted plans to reorganize national and public research institutes to create private research institutes. The goal of this plan was to transform and integrate national and public research institutes to establish a comprehensive science and technology research institute in the form of a special corporation. With the agreement of the Budget Bureau, which was responsible for the national budget, the final draft of the Korea Institute of Science and Technology Act (proposal) was prepared and submitted to the council of economy ministers in the name of the minister of commerce and industry in the summer of 1963. The primary purpose of this law was to establish the Korea Institute of Science and Technology,

a special corporation, and promote its growth as a technology center for industrial development. However, the proposal for this law faced considerable opposition both inside and outside of the government. In particular, the employees of research institutes were very hostile toward the privatization of research institutes. As a result, the law was put on hold; and as all outstanding laws proposed under the military government were automatically abolished with the inauguration of the Third Republic of South Korea in December 1963, the proposal to reorganize national and public research institutes disappeared. Even though the proposal failed, the attempt to overcome the problems of national and public research institutes by establishing a special corporation gave momentum to the dissemination of the idea of establishing research institutes in the form of private organizations. At the same time, the perception that research institutes for technology development were needed in order to achieve industrial development spread among economy-related government departments.

This effort to reorganize research institutes, which was interrupted with the abolishment of the Korea Institute of Science and Technology Act (proposal), was revived when the controversy over the issue became known to the President. After being briefed on the reorganization efforts that had been made, the President instructed the Minister of Economic Planning Board to review and report on the feasibility of establishing a comprehensive science and technology research institute through the consolidation and reorganization of the National Industry Research Institute, Atomic Energy Research Institute, and Metal and Fuel Research Institute. These three were the research institutes with the best conditions and researchers at the time. In particular, the Metal and Fuel Research Institute, an incorporated foundation, was a private research institute operated based on contributions from crown corporations, unlike other national and public research institutes, and employed researchers of a much higher caliber than those of other institutes, which was confirmed through the survey of research institutes conducted by the Technology Administration Bureau. Following the review, the Technology Administration Bureau reported that instead of consolidating the three different organizations, it would be more practical to establish a new research institute in the form of an incorporated foundation led by the Metal and Fuel Research Institute. The Bureau's report forecasted that it would be possible to promote R&D directly related to industrial production through financial assistance from private corporations and the expansion of contributions from the crown corporations that were providing financial support for the operation of the Metal and Fuel Research Institute. With the agreement of the responsible officials of related government ministries and relevant organizations, the plan to establish a new comprehensive science and technology research institute began to take shape. Although financial issues had slowed the process, in early 1965, the Technology Administration Bureau set the basic direction for the establishment of such a research institute and promoted the reorganization of national and public research institutes.

Section 3. Establishment of Modern Science and Technology Research Institutes

1. Background of the establishment of the Korea Institute of Science and Technology (KIST)

The Korean government's efforts to overcome the limitations of national and public research institutes and establish a comprehensive science and technology research institute responsible for supporting the development of industrial technology were accelerated by the United States' proposal to support the establishment of research institutes in Korea at the Korea-U.S. summit in May 1965. Of course, not all of the research institutes that the government was seeking to establish were related to industrial technology development. However, the main purpose of the research institutes was industrial technology research, as the efforts to achieve economic and industrial development in the 1960s set the stage for the heightened interest in the issue of establishing research institutes. In addition, at the core of the discussion regarding the establishment of research institutes was the idea that such institutes needed to be established as private organizations in order to ensure their autonomy and independence. Moreover, the President was aware of the purpose and direction of the reorganization that needed to be carried out to set the stage for the emergence of such research institutes. Under these circumstances, when the issue regarding the establishment of research institutes was raised at the Korea-U.S. summit, President Park Chung-hee immediately expressed his strong agreement, and the Technology Administration Bureau began drawing up plans for the establishment of research institutes shortly after the joint statement was made.

The United States' proposal to support the establishment of research institutes in Korea was devised by the U.S. President's Special Advisor on Science and Technology, in accordance with the instructions of U.S. President Johnson, as a meaningful gift for President Park Chung-hee ahead of his visit to the United States. In particular, the United States drew up plans to offer technical assistance to Korea in exchange for Korea's decision to send troops to the Vietnam War, as well as to counteract the brain drain that the United States had been dealing with at the time. At the same time, the proposal was meant to appease those in Korea who were opposed to the Korea-Japan Treaty, which had reached the final stages of negotiation, and offer reassurance that the United States would continue to support Korea after the establishment of diplomatic relations between Korea and Japan. Both Korea and the United States sought to ensure the desired benefits of Korea's dispatch of troops to Vietnam, and the United States pursued the establishment of diplomatic relations between Korea and Japan by indicating that it would provide continuous economic and technical assistance to Korea and back the Park Chung-hee regime by supporting the establishment of research institutes and granting a development loan of USD 150 million. In fact, these three issues—the dispatch of Korean troops to Vietnam, the conclusion of the Korea-Japan Treaty, and the economic development of Korea—were interconnected, giving the United States no choice but to engage aggressively with Korea based on its substantial interests in each of the three issues. The support of the United States could help the new regime strengthen its political power, and support for the development of science and technology was unlikely to attract controversy, as it had no direct connection to politics. The establishment of research institutes had the potential to not only promote economic development and modernization, but also contribute to the creation of a more positive public perception of the regime. Recognizing this, President Park Chung-hee engaged aggressively in the effort to establish research institutes.

With a team from the U.S. government expected to visit Korea to conduct a feasibility study on the establishment of research institutes in July 1965, the media and science and technology community sought to heighten people's interest in Korea's international status in terms of science and technology. The media raised various questions about the overall domestic situation surrounding science and technology, including the administrative and support systems for science and technology, manpower problems such as brain drain, and the research environment. Scientists and engineers hoped that the team's visit would serve as an opportunity to make improvements in these areas. Prior to Hornig's visit to

Korea, the Korean government prepared a comprehensive science and technology and R&D plan with the aim of promoting domestic research activities in general and supporting the establishment of research institutes. The major goals of this plan were the establishment of a comprehensive science and technology research institute, the creation of the Special Account for the Science and Technology Research Fund, and the legislation of the Science and Technology Promotion Act. The plan also provided for the establishment of a science and technology administration system, based on the logic that, in order to facilitate R&D activities efficiently at the national level, it was necessary to reorganize the science and technology administration system in addition to establishing research institutes. In this way, the government pursued not only the establishment of new research institutes, but also the implementation of new policies to promote the nation's science and technology in general.

2. Establishment of KIST and Its Management Principles

KIST was established in February 1966, and its first president was Choi Hyung Sup, former president of the Korea Atomic Energy Research Institute. Even though KIST was established with the financial support of the Korean and U.S. governments, it was an incorporated foundation with autonomy over its own operations, and President Park Chung-hee was named as its founder. The fact that the President was the founder of KIST was considered to be a factor that could facilitate government support while emphasizing the autonomy and independence of KIST as a private foundation. President Park showed his strong support for KIST and played a role in mediating and resolving some of the problems that arose in the early stage of its establishment. The President's support for KIST raised the social status of KIST researchers, and gave them special responsibilities as well as burdens. Especially, President Park's support contributed to KIST's rapid growth under the strong support of the government, and the government's aggressive support and preferential treatment for KIST researchers gave numerous scientists and engineers an opportunity to demonstrate professional competence in their fields and achieve greater recognition and higher social status.

With the U.S. President's proposal leading directly to the establishment of KIST, the United States played an active role in the establishment of research institutes in Korea. The U.S. government provided a grant of USD 7.188 million (USD 2.562 million for construction materials, USD 170,000 for books, USD 1.28 million for research equipment, and USD 3.176 million for the technical service fees of the Battelle Memorial Institute) and a loan of USD 1.856 million (USD 175,000 for books and USD 1.681 million for research equipment). In addition, the Battelle Memorial Institute of the United States, upon which KIST was modeled, signed a contract with the U.S. government regarding its participation in the establishment of KIST, which it supported in several ways, including the selection of researchers, purchase of equipment, and preparation of a research operation system. Of course, the advice and counsel of Battelle were not always accepted outright; they had to be modified to suit Korea's circumstances. As one of KIST's main objectives was the assimilation and improvement of newly imported technology, the systems and principles introduced by Battelle were subjected to a similar process of assimilation and improvement.

KIST announced that, in order to contribute to the economic development of Korea, it would focus on research activities for industrial technology. Since an accurate understanding of the status of the domestic industry had to first be achieved in order to select appropriate research areas, the investigation team, consisting of 57 experts from industry, universities, and government bodies and 23 experts from the Battelle Memorial Institute, conducted a survey of 16 industrial areas. Based on the results of the survey, KIST selected five key research areas—materials and metals, food, chemicals and chemical engineering, electronics, and machinery. These selections reflected the key R&D areas selected for the Second Five-year Economic Development Plan, which was established in July 1966. With the government's selection of the design and production of industrial machinery, chemicals processing and production, and metal and nonferrous metal materials as priority areas in which R&D needed to be conducted, KIST chose machinery, chemicals, and metals as its core research areas. Also included among KIST's research areas were the

food industry, at a time when the nation was facing numerous problems in this regard, and the electronics industry, which was beginning to emerge as a major industry. In addition to these five areas, the study of industrial economics was emphasized as well, as gaining a clear understanding of the market through such means as economic analyses was considered to be an important function of KIST, as an industrial research institute advocating market-based research.

As proposed by the United States, KIST adopted a contract research system as its main operating principle. Based on this principle, which was also the operating principle of the Battelle Memorial Institute, KIST made contracts with research consignors, including industries, to accept requests to conduct research activities on specific issues and disclose the results. This was a rather unorthodox method in Korea at the time. However, as the government believed that it was an opportunity to reform the country's research environment, it accepted the contract research system. In this way, the government sought to encourage researchers to conduct the research that corporations desperately needed, to have corporations recognize that R&D was an investment essential to their businesses, and to apply the research results to their production sites. In addition, it was thought that once KIST achieved financial independence through such research contracts with corporations, the government's burden would be reduced.

The basic principle of covering operating costs through research contracts was expected to help the government reduce its fiscal burden by allowing the research institute to operate without heavily relying on the government for support. Moreover, the contract research system was emphasized as one of the key factors in allowing KIST to maintain its autonomy and independence. In order to maintain the contract research system, KIST adopted a responsible accounting system oriented around individual labs and based on a thorough research cost calculation system. When there was sufficient demand for a particular research activity, and a capable researcher was available, a research lab was established and operated as a self-supporting system under the responsibility of the chief researcher. This chief researcher was responsible for the research results, instead of merely the management of the research funds, without external constraints. As such, the chief researcher was responsible for the management as well as the results of research activities.

KIST attracted Korean scientists and engineers from overseas as key researchers, and guaranteed them preferential treatment, including substantial salaries, good housing, and sufficient research leave, as a means of encouraging them to focus on their research. The fact that KIST, in order to ensure the success of its operation, brought back to Korea talented researcher who had gone to work overseas was particularly meaningful to the government. Such a return of competent scientists and engineers was an indicator of how Korea's status, both at home and abroad, was changing. In fact, KIST helped ensure the legitimacy of the regime by serving as a symbol of the "modernization of Korea," which had been emphasized by President Park Chung-hee. With the best facilities and the top researchers from Korea and abroad and based on the fact that it was operated autonomously, without the direct control of the government, KIST possessed considerable political value leading up to the presidential election in 1967. In order to maximize such political value, President Park Chung-hee set out to make KIST "the best research institute in Asia," which resulted in the scale of KIST being expanded much more than was initially planned.

KIST was a part of the effort to promote the development of science and technology in Korea. However, as its scale had been expanded, and the fiscal support from the Korean government increased, the political support that the government had planned to provide for other sectors was decreased accordingly. For example, the Science and Technology Research Fund that had been announced during the establishment of the plans for the research institute in June 1965, and launched with the legislation of the fund management regulations in August 1967, struggled to raise funds. The government's fiscal support for universities and other research institutes increased, but fell short of researchers' initial expectations. In particular, the government provided relatively little support for basic science. The entire government budget for science and technology between 1966 and 1970 was about KRW 35.2 billion, of which KRW 5.44 billion, accounting for 16 percent of the total budget, was provided to KIST, while national and public science and engineering universities received only KRW 4.36 billion over the same period to cover their research and

facility costs. As a result, even though KIST was established as a research institute with the best facilities and working conditions for its scientists and technicians, and promoted massive government investment in science and technology R&D, at the same time, it first gave rise to the imbalance in supporting policies for science and technology.

3. Early Research Activities of KIST

In order for KIST to be operated stably as a contract research institute, demand for research from industries should have been sufficient. However, the domestic situation at the time made it difficult. Since corporations considered the lack of equipment and funds and the purchasing of raw materials to be the most urgent problems at the time, they had little interest in developing of new products or process technologies. Therefore, KIST made considerable efforts to contact industries, and turn their attention to R&D, and carried out promotional activities in order to secure research contracts. The institute contacted industries first and then sought out research projects through which it could enter into contracts. KIST also pursued a strategy by which it entered into research contracts with relatively small amounts of research funds in order to convince industries of the importance of R&D and increase their willingness to enter into research contracts. In an effort to promote the research projects by industries, the government even passed legislation that allowed individuals or corporations who had made donations or research contracts to KIST to report such expenses as deductible expenses on their income taxes.

Most of the industrial research projects carried out by KIST in the early stage of its establishment aimed to solve problems at production sites by providing technical guidance rather than conducting R&D on new technologies or processes. Their role was to assist the technical matters that were being encountered in the process of applying technologies imported from overseas and participate in the contracting process involved in the import of such technologies, thereby providing economic and technical assistance. It is often said that one of the most important roles of research institutes in developing countries is to support the private sector in its adoption of foreign technologies, thereby ensuring the success of technology transfers. In this regard, KIST has served as a technology transfer center, driven by the goal of promoting technological capability.

Despite KIST's efforts, research contracts with industry accounted for only 34 percent of all research contracts during the period from its establishment to 1972; the rest were research projects financed by the government through such means as subsidies. In fact, most of the projects from the government in the early stage of KIST's establishment were considered to be industrial research activities rather than laboratory research work. Working as a kind of government think tank in the areas of science and technology, KIST also carried out research activities for government policy on industry, science and technology, including a research project on long-term energy supply and demand, a development plan for the machinery industry from the Economic Planning Board, and the establishment of a comprehensive, long-term plan for the promotion of science and technology from the Ministry of Science and Technology. In addition, KIST produced a number of R&D results through specific projects that were requested by various government ministries, including defense-related research projects such as the design and construction of high-speed boats from the Navy Headquarters, a research project on the desiccation of red ginseng and red ginseng extract from the Office of Monopoly, and a project for the construction of greenhouses from the Rural Development Administration. The research funds provided for these projects were much larger than those granted for research by institutional funding. Also, the projects for the computerization of government tasks, including research on EDPS (Electronic Data Processing System) for budgeting tasks and the development of EDPS for the management of telephone charges, accounted for a significant share of government research projects. By carrying out such research projects, KIST promoted greater awareness of the value and necessity of R&D, both inside and outside the government.

Section 4. Establishment of an Administrative Organization for Science and Technology

1. Background of the Establishment of an Administrative Organization Dedicated to Science and Technology

Having concluded that the modern research system had been thoroughly established with the inauguration of the Korea Institute of Science and Technology (KIST), the government decided to establish a comprehensive administrative organization for science and technology. Since the Liberation of Korea, the establishment of an independent ministry had been a great hope of the science and technology community. The launch of the Technology Administration Bureau in 1962 was a step in the right direction, but the science and technology community still wanted an independent ministry.

The plan to restructure the administrative organization for science and technology, which was submitted as the agenda of the fifth Economy and Science Council in February 1965, embodied the desire to establish such an independent ministry. This restructuring plan suggested that the Board of Science and Technology be established as an independent ministry for science and technology, with a Cabinet member serving as its president. The plan also pointed out the irrationality of the situation that, although atomic energy was only one area of science and technology, the Atomic Energy Agency was the only independent science and technology administration, and emphasized the urgency of establishing and operating an influential, unified administrative organization for science and technology to promote science and technology.

On May 19, 1966, three months after the establishment of KIST, the first National Scientists and Engineers Convention was held, where scientists and engineers drafted a recommendation for the government concerning the promotion of science and technology. This recommendation comprised four specific actions: enact the Science and Technology Promotion Act as soon as possible, improve the status of scientists and engineers, establish the Science and Technology Complex, and create an independent ministry that is dedicated to science and technology and headed by a Cabinet member. During the preparations for the convention, it had been agreed that a nationwide administrative organization inclusive of all scientists and engineers needed to be established in order to strengthen relationships among science and technology organizations, contribute to national development through the systematic planning and implementation of measures for the promotion of science and technology, and improve the status of scientists and engineers. Accordingly, the National Scientists and Engineers Convention was combined with the inaugural general meeting of the Korean Federation of Science and Technology Societies (KOFST), which was officially launched in September of the same year. Shortly afterward, KOFST requested that the government address the four issues that had been brought up at the convention, including the establishment of a comprehensive science and technology ministry. At around this time, the Administrative Reform Committee also pointed out the poor state of science and technology in the country, and argued that the government needed to enact a basic law concerning the promotion of science and technology and establish a comprehensive ministry.

In response to KOFST's request, the government urged the ruling party to enact the Science and Technology Promotion Act as quickly as possible, and announced that discussions regarding the establishment of a ministry dedicated to science and technology were being held with the ruling party. The first draft of the Science and Technology Promotion Act, which was the first recommendation, was completed by the Technology Administration Bureau in June 1966 and submitted to the National Assembly through the legislation of the Assembly. However, it remained in limbo for several months. The Science and Technology Promotion Act, the basic legal instrument for the promotion of science and technology, was finally passed by the National Assembly in January 1967, providing the

basis for improving the status of scientists and engineers and establishing the Science and Technology Complex. As the first comprehensive legislation on the promotion of science and technology, the act clearly outlined the national responsibility for science and technology and provided the basic framework for the promotion of science and technology in terms of the administrative organization and financial issues by defining matters related to the establishment of basic policies and plans for the promotion of science and technology, as well as the systematic implementation and financial measures needed to carry out such policies and plans.

Although the Science and Technology Promotion Act had been passed, the issue of the establishment of a ministry dedicated to science and technology remained, prompting the government to continue its work on the issue. In 1966, in its preparations for the second Five-year Science and Technology Administration Promotion Plan, the Technology Bureau emphasized that the promotion of science and technology itself was the goal of the administration, and that it was necessary to establish a comprehensive, independent science and technology ministry with a Cabinet member serving as President. The Technology Administration Bureau planned to establish such an administrative organization by around 1971, the final year of the second Five-year Plan. However, ahead of the presidential election on May 3, 1967, the government and ruling party pushed back the timeline.

After returning home in August 1966, Kim Gi-hyeong, the first minister of science and technology, strongly supported the establishment of a science and technology ministry, as well as the British vice president system, when advising the President on science and technology matters. After his appointment as a standing member of the Economy and Science Council, Kim submitted a report on the establishment of a science and technology ministry. After reviewing this report, President Park Chung-hee gave instructions, during the 10th enlarged Cheongwadae meeting for export promotion on November 21, regarding the establishment of a science and technology ministry. He said, “Now that we have a proper science and technology research institute (KIST), we need a government organization dedicated to the promotion of science and technology to manage it,” and gave orders for a study to be done and report submitted, on the governmental science and technology organizations of advanced countries. Accordingly, after Kim Gi-hyeong visited India, Pakistan, the Philippines, Japan, and Western countries, including the United States, the United Kingdom, and Italy, to study their administrative systems for science and technology, he prepared a proposal for the establishment of the Board of Science and Technology (tentative name) and reported to the President on January 5, 1967.

Amid the heightened interest in the promotion of science and technology following the establishment of KIST, which Korean science and technology community had longed hoped for, the establishment of a ministry dedicated to science and technology was finally realized with the decision of the government and the ruling party ahead of the presidential election. Thus, Korea’s science and technology policy, which began with the Technology Administration Bureau, was given an opportunity to move forward.

2. Process of Establishing the Ministry of Science and Technology

Going into 1967, the process of establishing a ministry dedicated to science and technology was accelerated. After reviewing the proposal for the establishment of the Board of Science and Technology, President Park Chung-hee issued instructions for the establishment of a science and technology ministry during his New Year inspection tour of the Ministry of Education on January 11, and made the official announcement at the State of the Union Address in the National Assembly on January 17. From then on, according to the president’s instructions, the office of the minister without portfolio started drawing up a plan for the establishment of the new administrative organization. The Technology Administration Bureau of the Economic Planning Board, upon receiving a request for advice from the office of the minister without portfolio, drafted the plan for the establishment of the Board of Science and Technology, based on internal discussions. Unlike the Ministry of Commerce and Industry or Ministry of Internal Affairs, the

science and technology ministry had no inherent duties; therefore, it was decided that it should not be established as a ministry (line ministry), but as a ministry (staff ministry) or board. Having concluded that the organization needed the authority of the deputy prime minister in order to promote science and technology effectively at the national level, the Technology Administration Bureau decided to call it the Board of Science and Technology. Based on opinions collected from scholars and experts in various fields of science and technology, the office of the minister without portfolio drew up the plan for establishment of the Board of Science and Technology, and reported it to the President on February 8, 1967. The main goals of this plan were to: first, establish a new science and technology ministry led by the Technology Administration Bureau of the Economic Planning Board; second, name it the Board of Science and Technology, task it with advisory and planning duties only, not execution, and place it under the direct supervision of the prime minister, much the same as the Economic Planning Board yet smaller in scale; and, third, enable the Board of Science and Technology to merge related science and technology administrative organizations—only research institutes and testing labs not directly related to the inherent duties of individual departments—scattered throughout various government ministries, and downgrade the Atomic Energy Agency to a government agency under the chairman of the Board of Science and Technology. Cheongwadae sent this plan to the Ministry of Government Administration, which was the ministry in charge of the establishment of government administrative structure and organs, and instructed it to carry out more specific tasks for the establishment of the organization.

Based on the results of independent research studies and professional consultations with outside organizations, the Ministry of Government Administration finalized the establishment plan for the Board of Science and Technology. According to the plan, the duties of the new organization were to establish comprehensive basic policy for the promotion of science and technology, make comprehensive changes to how research works are carried out and research facilities are operated, engage in international cooperation in relation to the promotion of science and technology, and establish and execute atomic energy R&D and a related utilization plan. What was notable in the Ministry of Government Administration's plan was that the new administrative organization was not referred to as the Board of Science and Technology, but the Ministry of Science and Technology. According to this plan, since the board or ministry (staff ministry), which serves as an advisor or coordinator, needed to be established directly under the prime minister, as specified in the fundamental principles of the government structure, it was appropriate to establish the comprehensive science and technology ministry as a body under the authority of the prime minister. Since the policy on government structure at the time called for the concept of a "board" to be applied to the areas of education, research, and health, the concept of a "ministry (staff ministry)" to advisory and coordinating organizations; and the concept of a "ministry (line ministry)" to administrative enforcement organizations, it was more appropriate to establish a science and technology administrative organization as a ministry (staff ministry) rather than a board or ministry (line ministry). In fact, the decision to establish the ministry as either a ministry (staff ministry) or board was the biggest issue in the establishment process. The Technology Administration Bureau and most members of Korean science and technology community said that the government needed a board of science and technology established at the deputy prime minister level in order to promote science and technology effectively. However, the proposal for such a board faced strong opposition within the government. In an effort to resolve this situation, the President proposed the establishment of a ministry (line ministry) of science and technology; however, due to concerns that the comprehensive coordination rights over science and technology might be lost if the organization was established as a ministry (line ministry), it was determined that the organization would be formed as a ministry (staff ministry) of science and technology.

Since the administration duties of science and technology involved comprehensive coordination among various related ministries, the organization was planned to be a board or ministry (staff ministry). At the time in Korea, there were several administrative organizations for science and technology: the Technology Administration Bureau of the Economic Planning Board, administrative organizations responsible administrative duties in certain areas of science and technology whose main pursuit was science and technology itself; the Atomic Energy Agency; the National Bureau of Standards; the Patent Bureau; and technology-related organizations, including the Higher Education Bureau,

General Education Bureau, National Science Museum under the Ministry of Education, Rural Development Administration under the Ministry of Agriculture and Forestry, Ministry of Commerce and Industry, Ministry of Transportation, Ministry of Communication, and Ministry of Construction. In addition, the Economy and Science Council served as the presidential advisory council. Even though various ministries were involved in science and technology, there was no cooperation or institutional connections between them. Therefore, it was inevitable that a comprehensive science and technology ministry would be established, either as a board or a ministry (처).

However, the establishment of the Board of Science and Technology as a deputy-prime-minister-level was no easy task. In fact, the deputy prime minister was not designated as a part of the administrative machinery under the Constitution, and the Economic Planning Board was the only deputy-prime-minister-level organization at the time. Despite constitutional controversy, the military government established the deputy prime minister system in order to ensure the strong leadership of the minister of the Economic Planning Board, which was necessary because the government had to lead economic development. Therefore, the placement of an additional deputy prime minister in the area of science and technology, which is closely related to the economy, was a great risk that had the potential to provoke conflicts with the other ministries as well as with the Economic Planning Board. In addition, the board was not expected to always serve as a deputy-prime-minister-level organization. In fact, neither the proposal to establish the Board of Science and Technology made at the Economy and Science Council in February 1965 nor the proposal to establish the board made by the office of the minister without portfolio explicitly stated that the minister of the Board of Science and Technology needed to be a deputy prime minister. The reason behind this was that the decision to name a deputy prime minister as the minister of the Board of Science and Technology was to be made by the president or via a political agreement among politicians.

Eventually, on April 21, 1967, the Ministry of Science and Technology was established as a comprehensive ministry dedicated to science and technology, 10 days ahead of the sixth presidential election. Even though it was not a deputy-prime-minister-level organization, as hoped by Korean science and technology community, the ministry was headed by a Cabinet member, and represented the realization of the science and technology administration that the science and technology community had longed for. At the time, Korea was the only developing country with a cabinet-member-level organization dedicated to science and technology. Even though the ministry's position within the government was not that high, its establishment was the turning point in the advancement of science and technology policy. Since 1968, Science Day has been celebrated on April 21, the date on which the Ministry of Science and Technology was established, and science and technology community and educational circles have hosted various events related to science and technology in April, which is recognized as Science Month.

3. Organization and Functions of the Ministry of Science and Technology

Located in the former Atomic Energy Research Institute building in Jeong-dong, Seoul, the Ministry of Science and Technology began as an organization with a total of 240 employees and two offices (Office of Research and Coordination & office of Planning and Management), two bureaus (Promotion Bureau & International Cooperation Bureau), and 10 departments and affiliated organizations, including the Atomic Energy Agency and Central Meteorological Service. With 20 or fewer higher government officials and ordinary government officials, the Office of Research and Coordination, which was responsible for the selection and management of science and technology R&D projects, was a very unique organization within the central government in that it was possible to hire outside professionals. The Office of Planning and Management was in charge of planning, budget, and the management of the Ministry of Science and Technology, while the Promotion Bureau established comprehensive basic plans for the promotion of science and technology, carried out manpower and resource development plans, and collected

information related to science and technology. The International Cooperation Bureau was wholly responsible for technological cooperation with foreign partners.

The Government Organization Act stipulated that the Ministry of Science and Technology was responsible for the establishment of comprehensive basic plans for the promotion of science and technology, comprehensive coordination concerning the plans, technology cooperation, and other duties related to the promotion of science and technology. Since its establishment, the Ministry of Science and Technology had set the basic direction of science and technology promotion policy; reorganized the system, including the administrative, legal, and comprehensive coordination system; and established a long-term plan for the promotion of science and technology. At the request of the Minister of Science and Technology, the President supported the development of science and technology policy by granting an exception to the budget guideline that stipulated a 10-percent year-on-year increase in funding and instructing that the ministry's budget be reassigned. However, due to the limitation on budget increases under the government's financial scale, the Science and Technology Fund of KRW 1.5 billion, to be used to support science and technology research, was completely removed from the 1968 budget. The fundraising that then needed to be carried out was going very slowly. So, to jumpstart the process, the officials of the Ministry of Science and Technology, including the minister and vice minister, each collected KRW 400,000, and set up an account at the Science and Technology Fund with the Bank of Korea.

With the establishment of the Ministry of Science and Technology, the Atomic Energy Agency became an agency under the Ministry, and the Central Meteorological Service and Office of National Geological Survey were merged and placed under the jurisdiction of the Ministry of Science and Technology. And the Ministry later took charge of the National Science Museum and National Astronomical Observatory. In addition, the Science Education Bureau was established under the Ministry of Education and tasked with providing effective mediation between science and technology policies and science education policies;

The Central Meteorological Service started out in 1904 as temporary weather stations installed in five regions— Busan, Mokpo, Incheon, Wonsan, and Yongampo. In 1949, after the Liberation of Korea, the Education and Management Bureau of the U.S. military government office reorganized the weather stations, which had been set up by the Japanese Government General of Korea, to form a meteorological organization called the Central Meteorological Service, and placed it under the Ministry of Education. Consisting of several departments, including the observation department, forecast department, statistics department, astronomical department (responsible for the publication of an almanac), and the general affairs department (responsible for administrative duties), the Central Meteorological Service developed the framework for a meteorological administrative organization through the establishment of 14 regional stations and two branches and provided training for the necessary meteorological manpower at its meteorological technology training center. In 1962, the Central Meteorological Service was transferred from the Ministry of Education to the Ministry of Transportation. Following the establishment of the Ministry of Science and Technology, however, it was transferred to the new ministry, where it was tasked solely with carrying out meteorological observations and training meteorological manpower.

The Office of National Geological Survey began with the Office of Geological Survey, which was established in 1918 to explore, develop, and research mineral, energy, and groundwater resources, as well as the Fuel Dressing Research Institute, established in 1924. These two organizations were merged after the Liberation of Korea to form the Central Geological and Mine Research Institute, under the Department of Commerce and Industry of the U.S. military government office. With the establishment of the Korean government in 1948, the institute was renamed the National Geological and Mineral Research Institute. After merging with the Daejeon Mineral Test Lab in 1961, which was established with the support of the UN Korean Reconstruction Agency (UNCRA) in 1956, the National Geological and Mineral Research Institute was renamed the Office of National Geological Survey. Following the establishment of the Ministry of Science and Technology, the institute was placed under the jurisdiction of the new ministry. With its transfer of the institute to the Ministry of Science and Technology, its mining and dressing research functions were

separated and transferred to the National Mining Research Institute, under the Ministry of Commerce and Industry. The Office of National Geological Survey was later reorganized to form the Geoscience and Mineral Resources Research Institute, an incorporated foundation, in 1976.

The National Science Museum has its origins in the Eunsa Memorial Science Museum, established in 1927 and renamed the National Science Museum following Korea's Liberation. The National Science Museum was reorganized to establish the new National Science Museum in 1949. However, its building and facilities were destroyed during the Korean War. With the completion of the first phase of its restoration, the National Science Museum resumed service in 1962. In 1969, two years after the establishment of the Ministry of Science and Technology, the National Science Museum was transferred from the Ministry of Education to the new science and technology ministry, giving it the opportunity to achieve new development. With the completion of a five-story main building in 1970, the National Science Museum was able to aggressively promote the improvement of the science and technology culture and served as the main organization for the national science movement in the 1970s. Immediately following the establishment of the Ministry of Science and Technology, the establishment of the National Astronomical Observatory was promoted as part of the Five-year Plan, including the enactment of establishment committee regulations for the National Astronomical Observatory, appointment of committee members, and procurement of related facilities. After five years of preparation, the organization of the National Astronomical Observatory was promulgated, and the establishment of the astronomical observatory was finally realized. The National Astronomical Observatory was responsible for conducting astronomical research, making celestial observations, publishing an almanac, determining standard time, and carrying out time-signal-related duties.

Section 5. Building Foundations for Science and Technology Promotion

1. Science and Technology Promotion Policy of the Ministry of Science and Technology

The creation of the Ministry of Science and Technology has expanded and deepened the government's science and technology promotion policy. Upon its establishment, the ministry began preliminary work on legislation aimed at forming a basis for science and technology administration and enacted about 50 laws, including the Enforcement Decree of the Science and Technology Act, Korea Institute of Science and Technology Act, and Korea Science and Technology Information Center Act. In addition, 14 committees tasked with advising the Ministry of Science and Technology on policy matters, including the Science and Technology Promotion Committee, Human Resources Development Committee, and Atomic Energy Committee, were established. On the other hand, the Ministry of Science and Technology took control over the National Science Museum and Korea Science and Technology Information Center, under the Ministry of Education, and reorganized the Korea Science and Technology Information Center to form an incorporated foundation. In addition, in order to ensure that science and technology research projects could be carried out in a stable and efficient manner, free of the constraints of government budget accounting, the Ministry of Science and Technology established the Science and Technology Fund, in accordance with Article 11 of the Science and Technology Promotion Act, and went on to secure the necessary funds on an annual basis.

After its establishment, the Ministry of Science and Technology promoted and prioritized the creation of a comprehensive, long-term development plan for science and technology (1967 to 1986) to guide the nation's science and technology development efforts. During the first phase of the plan (August to December of 1967), the ministry composed the Planning Committee and established long-term goals and a comprehensive basic plan for science and technology based on the results of a research conducted, through an academic research contract, on the status and development direction of the nation's science and industrial technology by KIST, the Korea Productivity Center, and the Korea Engineering Corporation. The study results were presented to the Economic Cabinet Council at the end of 1967 and reported to the President early the following year. During the second phase (January to November of 1968), this basic policy was divided into a comprehensive plan and sectoral plan, and around 400 experts from 30 sectors participated in the verification and coordination process. The proposal for a comprehensive, long-term development plan for science and technology was reported and confirmed at the Cabinet Meeting in December 1968.

The objective of the comprehensive, long-term development plan for science and technology was to surpass the leading industrialized nations by enhancing Korea's capability to achieve the self-reliance in science and technology development by the 1980s. Several key tasks were set to achieve this goal, including promoting the import of advanced technologies, developing and maximizing the utilization of science and technology manpower, enhancing technological capability in the private sector, and promoting the technology development toward internationally competitive one with its unique features. Specifically, the objectives were to first increase R&D investment to over KRW 180 billion, or 2.5 percent of the GNP, in 1986 by maximizing R&D investment through the joint efforts of the government and private sector; raise the capabilities of active science and technology manpower to levels comparable to those of their counterparts in advanced countries; produce the highest caliber scientists by promoting basic research; fully localize technological consulting services in the light industry sector; raise industrial standards to a level on par with those of major industrial countries through enhancing indigenous technological capability and promote technology exports and the overseas expansion of national patents; become firmly self-reliant and establish a foundation for rapid growth by maximizing the utilization of the nation's natural resources and land space backed by technology development; and foster a creative culture among the people as a means of promoting science and the establishment of an environment conducive to scientific development. Although many doubted the feasibility of this

20-year, comprehensive, long-term plan linked to economic development, having an independent ministry dedicated to science and technology was what made it possible to establish it in the first place.

One of the policies that the Ministry of Science and Technology focused on following its establishment was the policy for fostering a favorable environment for science and technology. Despite the substantial role of science and technology in Korea's process of rapid modernization since the 1960s, the majority of people at the time still lacked sufficient awareness of science and technology—even in the education system, it was not considered an important subject. Accordingly, the Ministry of Science and Technology began to devise specific policies with the aim of creating a favorable environment for science and technology based on its recognition that the promotion of science and technology was a prerequisite for national economic development and socio-cultural modernization as well as an important factor in making science and technology a part of the people's everyday lives and improving their understanding of science and technology for the sake of national scientific and technological development. In other words, the objective of this policy was to encourage people to incorporate science into the way they think and live, and create an environment where science and technology were respected and utilized in everyday life.

In December 1967, a few months after its establishment, the Ministry of Science and Technology formed the Association for Supporting Science and Technology, an incorporated foundation tasked with ensuring the welfare of retired scientists and engineers, yet the main purpose of this organization was to create a favorable environment for science and technology development. Named as the founder, President Park Chung-hee empowered the association by designating the purpose of its establishment himself. Recognizing that the promotion of science and technology was crucial to achieving the country's urgent goals at the time, which were to achieve rapid economic growth and realize the modernization of the nation, President Park established the Association for Supporting Science and Technology with the goal of fostering the growth and development of highly skilled scientists and engineers nationwide, thereby putting science and technology at the center of the people's lives and the prosperity of the nation. As its key tasks, the Association for Supporting Science and Technology adopted the fostering of a social atmosphere under which science and technology would be able to become a major part of our lives and the promotion of the welfare of retired scientists and engineers. With the help of the Federation of Korean Industries, the Association for Supporting Science and Technology secured funding of around KRW 50 million from large corporations, and President Park penned the phrase "Making Science a Way of Life" to assist the association in its fund-raising efforts. In 1968, the Association for Supporting Science and Technology started paying a monthly lifetime subsidy of KRW 20,000 to nine retired scientists and engineers who had been selected as individuals of national merit. The following year, it started carrying out projects with the goal of spreading greater social awareness of science and technology, including the publication and supply of books on science. The National Science Museum and Institute of Science Education, an affiliated organization of the Ministry of Education, along with the Association for Supporting Science and Technology, actively engaged in activities to support the creation of an environment conducive to science and technology, and the Ministry of Science and Technology promoted the popularization of science and technology through related youth organizations and social and cultural organizations at all levels.

2. Human Resources Development Policy

The human resources policy for scientists and engineers was one of the most important of the science and technology policies implemented in the 1960s. With the promotion of the Five-year Economic Development Plan during the same decade, Korean industries needed more technicians and craftsmen, and the human resources policy for scientists and engineers was aimed at cultivating and utilizing sufficient numbers of such skilled manpower. As the country's industrialization policy first focused on the development of the light industries, and the science and technology standards of such industries were not so high, the training of technicians and craftsmen capable of entering the workforce immediately was emphasized as the top priority.

In order to identify the status of science and technology manpower, the government conducted a human resources survey of scientists and engineers in 1961 and 1962, and used the data as the basis for the establishment of policy related to workforce training; it continued to conduct similar surveys from then on. Policy for the development of human resources based on the status and supply and demand trends of manpower working in technology fields was first presented in the first Five-year Technology Promotion Plan, which emphasized the establishment of a technical education and vocational training system and the quantitative expansion and quality improvement of vocational high schools focused on the cultivation of technicians capable of leading the development of the light industries.

The second Five-year Technology Promotion Plan continued this emphasis on human resources development in order to expand and ensure the internal stability of technical education and vocational training, the goal of which was to reorganize and establish the foundation necessary for the development of a technical workforce capable of satisfying the needs of industry. It was of particular importance to efficiently cultivate and train manpower, including technicians and craftsmen, capable of manufacturing products using newly imported technology and facilities. The details of the second plan included: increasing the admissions quotas of natural science and engineering universities and the number of schools and classrooms of industrial, fisheries, and marine schools; establishing appropriate industrial majors at agricultural schools located in industrial parks so as to meet the industrial requirements of local communities; improving the operation of teacher training institutions in order to ensure a sufficient supply of high-quality instructors, enhancing in-service teacher training programs, and improving the working conditions of teachers; improving and developing curriculum and educational content tailored to industrial development; fostering and developing audio-visual-based institutes at all levels; establishing standards for experimentation and application and pursuing effective facility investment through industrial educational cooperation; and increasing government subsidies on an annual basis in order to cover half or more of all experiment expenditures and support private vocational high schools.

As a result of this second plan, natural science and engineering colleges responsible for training engineers underwent significant expansion. Also, in order to train technicians capable of working in different fields, the establishment of a large number of five-year vocational schools for middle school graduates was planned. Great progress was made particularly in terms of quality improvement, including the expansion of vocational high schools, mainly technical high schools, expansion of facilities for improving students' practical skills, reorganization of curriculum, and expansion of practical experiment. Through the Vocational Education and Training Promotion Act, which was enacted during the second five-year plan, a vocational training system was established, and public vocational training programs operated by the government or public organizations and vocational training programs accredited by the government were expanded substantially. In addition, military vocational training projects aiming to produce highly skilled workers by linking military occupational specialties with industrial occupations were actively developed.

While establishing the comprehensive long-term plan for the development of science and technology, the Ministry of Science and Technology also drew up a long-term plan for the demand and supply of science and technology manpower, spanning a 20-year period, in order to emphasize the importance of such manpower. Based on this, the ministry established the human resources development plan that was needed for the economic development of the country. At the time, there was an argument that, if the technology-intensive development trend of the industrial structure were to continue, in accordance with the economic development plan, it would be necessary to train master's and doctoral level manpower in strategic areas in preparation for the inevitable increase in demand for experienced science and technology manpower and skilled workers. Such training was realized through the establishment of the Korean Advanced Institute of Science and Technology in 1971. In addition, the Institute of Human Resources Development, an incorporated foundation installed under the Ministry of Science and Technology immediately following its establishment, conducted researches on the demand and supply, training, procurement, utilization, and preservation of human resources.

Meanwhile, the Ministry of Science and Technology began to transition away from its passive policy of controlling study abroad toward more aggressive policy aimed at encouraging overseas Korean scientists and engineers to return

to their home country. Even though Korea had been experiencing one of the worst brain drains in the world, until the establishment of KIST, it had failed to collect accurate data on this phenomenon, not to mention implement countermeasures against it. However, with the proposal for the establishment of KIST, the government carried out a survey on international students, and in 1968, the Ministry of Science and Technology began leveraging the nation's financial resources to attract Korean scientists and engineers working overseas. As a result, many such scientists and engineers agreed to return home, including five permanent commitments and two temporary commitments in the first year. Providing these scientists with financial support, such as travel and lodging expenses and employment services, the project was divided into permanent commitments, where scientists worked at least two years in Korea, and temporary commitments, where scientists lectured or provided consultation services for short periods of time. These policies highlighted the government's determination and considerable efforts to address Korea's brain drain, which was considered one of the worst in the world at the time.

3. Promotion of the "Science and Technology Boom"

Since the establishment of the Ministry of Science and Technology, science and technology associations have become increasingly active. Until the 1950s, however, such associations had been unable to conduct effective academic activities, such as publishing journals or giving research presentations, due to insufficient financial and human resources. However, from the early 1960s, as more and more researchers who had gone abroad to study or receive education returned home, their desire to engage in such academic activities grew. In addition, as the Atomic Energy Research Institute began funding some researchers as a means of promoting the progress of science and technology, research activities began gradually expanding. By the mid-1960s, natural science and engineering associations were publishing 21 periodical journals, and the number of papers published through these journals exceeded 300 annually. Including agricultural science, medicine, and pharmacy, the number of regular journals reached a total of 60. With the government's provision of financial support for each association following the establishment of the Ministry of Science and Technology, the academic activities of the associations stabilized. Although the government's limited support helped only with such activities as publishing journals, joining academic conferences, and participating in or subscribing to international science and technology societies, the associations in fields that had been selected as major support beneficiaries, including physics and chemistry, were able to make excellent progress in terms of the number of journals and research papers published, the latter having increased two- to three-fold.

In addition, the Korea Science and Technology Information Center, which had been transferred from the Ministry of Education to the Ministry of Science and Technology and launched as an incorporated foundation following the establishment of the Ministry of Science and Technology, underwent considerable change. The center was first established as the Korea Science Literature Center in 1962, serving as a department of the UNESCO Korea Committee, and became independent with its establishment as the Korea Science and Technology Information Center under the Ministry of Education in 1964. However, due to a lack of budgets, it could not adequately fulfill its fundamental role of copying and translating scientific and technical literature requested by researchers and collecting and organizing domestic and foreign scientific and technological information. However, after becoming an incorporated foundation, the Korea Science and Technology Information Center was able to commence the construction of a new headquarters building in Hongneung in 1968, and with the enactment of the Korea Science and Technology Information Center Promotion Act in the following year, its scale and responsibilities began to grow.

As outlined above, numerous science and technology organizations and institutions were established or reorganized at around the time of the establishment of the Ministry of Science and Technology in 1967. One newspaper at the time referred to 1967 as the year in which a "Science and Technology Boom" occurred in Korea. That term was used to refer to the establishment and implementation of comprehensive science and technology promotion policies by a new government ministry dedicated to science and technology, the institutionalization of an R&D system through the

establishment of KIST with the best facilities and researchers, and the full-scale activities of the science and technology associations. In addition, the Korea Federation of Science and Technology Societies, Association for Supporting Science and Technology, and Korea Science and Technology Information Center supported science and technology activities, and the growth of an institutional base for the support of science and technology development, including the Science and Technology Promotion Act, was prepared. That expression, it turns out, was not an exaggeration at all, as a substantial part of Korea's modern science and technology system was built at that time.

Section 6. Performances and Achievements of Science and Technology Promotion

When Korea started promoting economic development in earnest in the 1960s, when the core of the industrial structure was labor-intensive industries based on low wages, the role of science and technology and R&D was modest. Industries acquired skills through their operation of factories constructed under turnkey contracts and use of equipment and materials imported from foreign countries, and concentrated on the typical processing-trade-type industrial structure, through which they manufactured and shipped light industrial finished goods based on the import of intermediate and capital goods and use of low-wage, unskilled labor. Therefore, the importance of technology development received little recognition. However, as industries came to understand that a certain level of technological capability was required in order to select appropriate technologies and assimilate and improve upon imported technologies and recognized the production value of the industrial technology research conducted by research institutes such as KIST, the necessity of R&D promotion gradually increased. In addition, with the increase in the level of technology required for the expansion of the chemicals, steel, and machinery industries and enhancement of the industrial structure after the late 1960s, the need for science and technology promotion grew even more. In terms of science and technology development at the time, the gradual change in the awareness of society at large toward the promotion of science and technology and R&D was particularly noteworthy.

Prior to the establishment of the Ministry of Science and Technology, Korea's R&D environment was in a very poor state. In 1968, a year after the establishment of the ministry, a nationwide survey was conducted R&D activities in order to obtain basic data for the establishment of a long-term comprehensive science and technology development plan. The results of the survey, which included data from 223 research institutions across Korea, showed that the total number of research workers was 6,698, or an average of 30 R&D personnel per institution, and the total amount of research funds was KRW 5.357 billion, accounting for a mere 0.43 percent of GNP. Of the research institutions engaged in R&D activities, 67 were national and public research institutions, and seven were private research institutions. Among the national and public research institutions, the largest proportion, or 40 institutions, was active in the field of agricultural sector. The reason behind this was the industrial structure at the time, which was heavily dependent on primary industries. In addition, it reflected the fact that industrial and natural science R&D had not been yet been materialized. In 1967, the total research funds of 51 university-affiliated research institutions amounted to KRW 130 million, or only KRW 2.6 million per institution, while the total research funds of 98 corporations was KRW 690 million, less than KRW 7 million per corporation. Therefore, it can be concluded that the majority of investments in R&D until the 1960s were used to cover the expenses necessary to operate the national and public research institutions. It can be said that, in the 1960s, the government led R&D investment. In 1965, in particular, the government and public sector accounted for 90 percent of all R&D investment; in 1970, that percentage decreased, but it was still quite high at 76 percent.

The inauguration of KIST and the establishment of the Ministry of Science and Technology are considered to have served as the catalyst for the major change that was to sweep Korea's science and technology community at the time. Established in 1966, KIST entered into 91 research contracts and applied for 31 patents at home and abroad between 1968 and 1969, even before the institute was fully completed. In 1970, when KIST began its research activities in earnest following the completion of the research institute, it entered into 160 research contracts valued at KRW 470 million, playing a major role in changing the national R&D environment. Through the contract research system that KIST adopted, researchers had to meet the requirements of industry, rather than pursue their own curiosity, with industry confirming the necessity and value of R&D investment by applying the R&D results in which they had invested to their actual production processes.

In addition, the launch of the Ministry of Science and Technology enabled the establishment and implementation of comprehensive national science and technology policies, and the consistent R&D support contributed to the

vitalization of R&D activities, even though the amount of support was not substantial. Since the establishment of the Ministry of Science and Technology in 1967, the absolute amount of science and technology related budget increased steadily; however, the percentage of the total government budget remained at the two- to three-percent level. Under such circumstances, the Ministry of Science and Technology sought to expand nationwide R&D investment in order to stimulate a favorable research environment by providing KRW 130 million annually to major research institutes, through service contracts, to cover the expenses of research activities. The Ministry of Science and Technology selected research projects of national urgency and paid research expenses totaling KRW 810.8 million through 536 contracts over a period of five years from 1967. Of these R&D investments, 70 percent were paid to secondary and tertiary industries for projects that resulted in six patent acquisitions and 27 patent applications. Unlike the situation prior to 1967, when the majority of R&D was focused on the agricultural sector, the Ministry of Science and Technology began putting more emphasis on industrial technology development. Despite the modest scale and results of this R&D investment, the fact that approximately 3,000 researchers from the academia, industry, and research institute sectors participated, giving a much needed boost to science and technology development, was especially meaningful.

After the establishment of the Ministry of Science and Technology, science and technology associations became increasingly active. Despite the modest nature of the support for these associations, it served to promote academic activities, leading to an increase in the number of papers and journals published. Along with the birth of government science and technology policies, science and technology development was accelerated.

In the 1960s, the most notable achievement in science and technology was in the area of atomic energy. The TRIGA Mark-II, Korea's first nuclear reactor, entered operation in 1962, enabling Korea to carry out basic research autonomously using radioactive isotopes and radiation, engage in nuclear and neutron physics research using neutrons emitted from the nuclear reactor, and conduct research on the characteristics of nuclear reactors. In 1963, the Atomic Energy Agency separated the Radiological and Medical Sciences Research from the Atomic Energy Research Institute to establish the Research Institute of Radiological and Medical Sciences, an independent institute under the immediate authority of the Atomic Energy Agency, and tasked with carrying out research on the medical use of radioactive isotopes and radiation. In addition, in 1965, the agricultural section of the Biological Research, under the Atomic Energy Research Institute, was separated and established as the Research Institute of Radiological and Agricultural Sciences, an independent research institute under the immediate authority of the Atomic Energy Agency, in order to carry out research on the agricultural use of radioactive isotopes and radiation, including improving the breeding of rice, beans, and peppers.

Following its establishment, the Atomic Energy Research Institute started providing research grants to and paying the research expenses of organizations and scientists and technicians that were studying the development, production, and use of atomic energy. With such research support, 247 research projects were carried out between 1959 and 1969 in various fields of physics, chemistry, biology, engineering science, agricultural science, and medical science, of which research on the use of radioactive isotopes in the life sciences, including biology, agricultural science, and medical science, accounted for 65 percent of all research projects. In addition, the Atomic Energy Conference, held every year from 1959 to 1966 and which was considered to be a general science and technology conference in which related manpower from all areas of domestic science and technology participated, played an important role in uniting senior scientists and engineers.

In the field of industrial technology, the accumulation of production and operation capabilities based on the operation of factories and import of new technologies was a major achievement. In particular, for the construction of a fertilizer factory, which was done in an effort to substitute the import of fertilizer, one of the key strategic industries at the time, the turnkey method was adopted, where all necessary materials were imported in bulk from the United States. For several years after the construction of the factory, those involved learned operation and management skills through

the assistance and training provided by technology service companies. Based on the experience it accumulated through the construction and operation of several fertilizer factories, including the Chungju Fertilizer Factory, Korea was able to build its own fertilizer factories from the late 1960s. To a certain extent, such technological skills were extended to other chemical engineering industries, including the oil refining industry, and were applied to the operation of Korea National Oil Corporation's refinery in Ulsan in 1964 and Honam Oil's refinery in Yeosu in 1969.

Korean industries that focused on the imitation of manufacturing simple products in the 1950s were able to gradually acquire technological skills through their experiences operating turnkey factories and gained systematic skills training with the import of facilities from advanced countries. Based on such skills, along with the country's reverse engineering efforts and transfer of core technologies, Korea was able to construct factories independently and manufacture products for which it had previously been dependent on imports. Up until that time, labor-intensive products, including shoes, plywood, and wigs, had been Korea's main export goods. However, by the late 1960s, about a decade later, Korean industries had undergone a drastic change, leading them to start producing and exporting home electronics, including small transistor radios and black-and-white televisions, and assembling integrated circuits.