The Roles of the United States and Japan in the Development of South Korea's Science and Technology during the Cold War*

Tae Gyun PARK

Abstract

Recently many scholars in the history of science have been trying to illuminate why and how South Korea was able to achieve scientific and technological development simultaneously with economic growth. Scholars have focused on a top-down model led by the South Korean government and the role of technocrats who played crucial roles in the late 1960s. This study, however, focuses on the external conditions rather than on internal factors. U.S. policies towards South Korea became a major determinant of the development of science and technology during the Cold War, which brought about a number of important events such as the reorganization of the scientists' society, the Minnesota Plan of the 1950s, establishment of the Korea Institute for Science and Technology (KIST) in 1966, and launching of the military industry in 1971. Transfers of advanced technology from Japan following the "normalization treaty" in 1965 also played a crucial role in developing both military and heavy chemical industries of South Korea in the 1970s. Ultimately, U.S. and Japanese policies led to rapid scientific and technological progress of South Korea, but at the same time limited the scale and direction of the development.

Keywords: scientific and technological development of South Korea, Minnesota Plan, Korea Institute for Science and Technology (KIST), USAMGIK

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Tae Gyun PARK is Associate Professor at the Graduate School of International Studies, Seoul National University, where he received his Ph.D. in Korean History in 2000. E-mail: tgpark@snu.ac.kr.

Introduction

South Korea's economic growth has often been studied as a model of the developmental state theory. Indeed, the speed and effectiveness of South Korea's case are exceptional compared to those of any other developing countries. Recently many researchers in the history of science have examined why and how South Korea was able to achieve scientific and technological development simultaneously with this economic growth. What triggered such a rapid development of science and technology?

Scholars abroad have focused on several points overall. First, they stress that the development of science and technology was achieved in a top-down manner, under the leadership of the government (Campbell 1991; Yoon 1992). In particular, they point to the Park Chung-hee administration as the first regime to emphasize the significance of science and technology policy, which it promoted through measures such as providing subsidies to the industrialization strategy. In fact, the science and technology policy under the Park government was deeply connected with special development strategies for the heavy chemical industry of the 1970s.[1]

Researchers in the history of science in Korea emphasize the changes that occurred in the late 1960s. They point out that both the Science and Technology Administration and the Korea Institute for Science and Technology (KIST) were established during this period, marking the beginning of concentrated efforts by the government to formulate a science and technology policy. Such changes also illustrate that South Korean scientists' demands for the promotion of science and technology had also gained momentum by the time of the policy implementation (Moon 2007, 69-98). Along with a generational change in science and technology policymakers, President Park

1. This argument created another story of President Park Chung-hee as a pioneer and leader who promoted science and technology. Scholars of this historical interpretation chiefly rely on memoirs of former economic bureaucrats like O Won-Chul and Kim Jeong Ryeom for their evidentiary sources.

intended to use scientific and technological development as a political and economic tool, like another dictatorial leader (G. Kim 2008, 236-261).

The main interest of this study, however, is not in the internal dynamics of South Korea during the period but in the external conditions that had a strong impact on domestic politics. The issue is closely linked to a critical assessment of the developmental state theory. A decisive limitation of the theory is that it overlooks the important role played by the transfer of capital, knowledge, and technology in the economic growth of developing countries (Glassman and Choi 2010; Park 2009a).

The main argument of this study is that external factors played a more decisive role in the development of science and technology than in internal dynamics. It is important to consider that Korea, as a divided country surrounded by superpowers, was at the frontline of the Cold War. In these circumstances, the direction of Korea's development as well as drawback in science and technology was determined by the conditions of the Cold War. In the following sections, I will examine how the Cold War drove the development of Korea's science and technology in a certain direction, from 1945 to the late 1970s.

Reorganization of a Scientists' Society under the USAMGIK

The modern science and technology was imported to Korea in the eighteenth century by intellectuals who were introduced to Western philosophy through their interactions with Qing China. In the late nineteenth century, missionaries had brought to Korea modern scientific knowledge; however, fundamental development of modern science and technology was started through Japan after its colonization of the peninsula. Thus, despite the demise of the Japanese Empire in 1945, Korea's science and technology remained deeply influenced by Japan.

Shortly after independence from Japan, professors Lee Tae-Gyu,

Kim Bong-Jip, An Dong-Hyeok, Kim Dong-Il, and others formed a society of science and technology. Most members of the society, which was led by Lee Tae-Gyu, came from the College of Science and Engineering, Gyeongseong University.[2] They considered science and technology as one of the building blocks in the restoration of the Korean state and submitted to the United States Army Military Government in Korea (USAMGIK) a plan for promoting science education and establishing the Ministry of Science and Education. Their suggestions were partly reflected in the policies adopted by the Education Department of the USAMGIK. USAMGIK received advice from several specialists in science and technology, who were the key figures in devising the policy of promoting science education in 1945-1946 (Table 1).

The specialists in scientific technology of the time stressed that education in science and technology would be crucial in building the new state and would lead the construction of all industries. They recognized that there was a shortage of scientists and technicians in South Korea and saw the training of such specialists as an urgent task for the liberated nation. One such argument, as shown by the proposal made by An Dong-Hyeok, is a representative case which scientists conceived at that time.

An's proposal for vocational education is reflective of Japan's policy for mobilization of human resources. For An, education in science and technology meant practical and vocational training for a broad range of people, from low-level technicians to experts (Hong 2010, 21). During the Pacific War period (1941-1945), the Japanese Government General of Korea (Joseon chongdokbu) had decided to reduce the number of liberal arts schools in order to expand vocational schools so that Japanese militarists could mobilize students to work at

2. Lee Tae-Gyu received his doctorate from Kyoto Imperial University in Japan and worked for the university as a professor until 1945. After returning to Korea in November 1945, he was appointed the dean of the College of Science and Engineering at Gyeongseong University, which later became Seoul National University in 1946. Additionally, he served for the USAMGIK as a committee member for higher education.

Table 1. Scientists under the USAMGIK

Name	Education (graduation year)	Activities in colonial period	Activities in 1945-1948
Lee Hi-Jun	Kyoto Imperial University (1926)	Engineer in the Ministry of Home Affairs, the Government-General of Korea; executive director of Samcheok, Inc. in the district of Kanto, Manchuria	Financial officer, Planning and Administration
Jeong Mun-Ki	Department of Fisheries, Tokyo Imperial University (1929)	Principal, Fisheries Experiment Station	Dean, Busan Fisheries College
Jo Baek-Hyeon	Department of Agricultural Chemistry, Kyushu Imperial University (1925)	Engineer, Agricultural Station; professor, Suwon Agriculture and Forestry School for Higher Education	Dean, Suwon Agriculture and Forestry College
Kim No-Su	Machinery Department of Waseda University (1939)	Engineer, Railroads Bureau	Chief, Manufacture Section, Department of Transportation
An Dong-Hyeok	Department of Applied Chemistry, Kyushu Imperial University (1929)	Engineer, Central Test Institute; professor, Keijo Technical College	Director, Central Industrial Research Institute
Yun Il-Seon	Medical College, Kyoto Imperial University (1923)	Professor, Severance Medical College	Head, Department of Medicine, Gyeongseong University

Source: Hong (2010, 17).

factories and workspaces related to the war. The Japanese government issued the decree for this policy in October 1943 and propagated it through slogans such as “Integration of production and education”

and "Bring vocation to classes."

Kim Bong-Jip and Lee Tae-Gyu believed that the development of science and technology was needed to ensure the supply commodities. Both scholars insisted on the importance of an integrated administration for the development of science and technology. But while Kim benchmarked the Soviet's developmental experience, Lee had in mind the Japanese science and technology policy, in particular, the Japanese Academy of Continental Science in Manchuria as the model. The academy was the central organization for science and technology, simultaneously serving both as a research institute and an administrative institution. In a similar vein, Lee called for establishing the Ministry of Science and Technology and argued that all science and industry research institutes should be governed within its jurisdiction. The ideas of Choe Seong-se, a professor at the College of Science and Engineering, Gyeongseong University, however, closely resembled those of Kim Bong-Jip. Choe emphasized that the construction of industry in Joseon should be planned and insisted that a socialist planned economy model be implemented in the construction of the new state. He published his ideas mainly in academic journals such as *Gwahak jeonseon* (Front Line of Science) and *Inmin gwahak* (People's Science), published by leftist scientists' groups.

Despite different political viewpoints, they both agreed that the education of specialists in science and technology had to be carried out under a national plan, and opposed the plan for a national university, believing that the establishment of a national university would channel the resources away from the science and technology education. By setting out to merge educational institutions, the national university plan came to be seen as a move against the promotion of education necessary for increasing the highly qualified specialists in science and technology.

The policy of the USAMGIK, however, posed an obstacle to Korean scientists' desire for the development of science and technology in liberated Korea. U.S. policymakers envisioned the future of South Korea as a nation independent from Japan with a viable economy, but the implementation of concrete policies was difficult in light of

USAMGIK's limited financial resources.[3] Moreover, some staff members of the USAMGIK believed that South Korea was hardly capable of developing advanced science and technology. Instead, they believed that strengthening South Korea's industrial production through the mobilization of labor would be a better solution (Hong 2010, 34).[4] In fact, such policies of the USAMGIK seemed to ignore Korean scientists' proposals and were very different from those of North Korea at the beginning. The North encouraged the training program for scientists and technicians and, as a result, South Korean scientists and technicians defected to the North in large numbers.[5]

In June 1947, the U.S. Educational and Informational Survey Mission was dispatched to South Korea for the purpose of supporting the formulation of general and professional education policies. James R. D. Eddy and Douglas N. Batson, who were in charge of investigating vocational education, recommended training teachers under the guidance of American visiting specialists. Eddy and Batson also stated that there was a need to establish a separate division within the Department of Education, which would oversee the area of vocational education. Consequently, disappointed at the policy focusing on vocational training rather than science and technology education, a large number of professors at Seoul National University (SNU) went

3. "The achievement of this objective will require the progressive elimination of all vestiges of Japanese control over Korean economic and political life and the eventual substitution of independent Korean governmental, economic, and social institutions" ("Basic Initial Directive to the Commander in Chief, United States Armed Forces in the Pacific for the Administration of Civil Affairs in Those Areas of Korea Occupied by United States Forces," SWNCC 176/8, October 17, 1945, in *Foreign Relations of the United States*, vol. VI, pp. 1071-1091). There were other policy papers on the financial policy in South Korea. However, there was no mention about U.S. assistance to USAMGIK for that purpose.
4. This idea is very similar to that of Robert Komer, a staff member at National Security Council (NSC) in the early 1960s. He recommended to the Park government that labor-intensive light industries would be much better for Korea's industrialization strategy (Memorandum to Rostow, March 15, 1961, National Security Files (NSF), box 127, John F. Kennedy Library).
5. Twenty-two professors in science and engineering college of Gyeongseong University went to North Korea in 1946. http://online.kotst.or.kr/Board/?acts=BoardView&bbid=1021&nums=1679 (accessed on March 29, 2012).

to North Korea. Moreover, Lee Tae-Gyu left for the Unite States in 1949, and Choe Gyu-Nam, who was appointed chief of the Bureau of Science and Education in early 1948 under the USAMGIK, became a new leader representing scholars in science and technology (D. Kim 2006, 98-118).

Officials of the Ministry of Culture and Education under the USAMGIK appointed Raymond W. Phipps as an advisor in vocational training. After three months of investigation, Phipps recommended the establishment of the Bureau of Vocational and Technological Education, which would supervise five subdivisions: Agricultural Education, Industrial-technical Education, Business and Marketing Education, Girls' and Women's Vocation, and Advancement of Technological Science. The USAMGIK followed Phipps' recommendation but shortly thereafter had to turn over its administrative functions and property to the new government of the Republic of Korea (ROK).

Due to the problems of the USAMGIK policy, which was different from the policy that Korean scientists were conceiving of, the ROK government could not have sufficient sources in science and technology at the beginning. There were neither fund nor scientists to lay the cornerstone to build modern science and technology when the ROK government was established in 1948. For Korean scientists, the USAMGIK policy seemed to be a very myopic one rather than one based on a long-term perspective (Park 2011).

The Minnesota Plan

After the establishment of the ROK government, the Ministry of Culture and Education concentrated its efforts in developing and expanding institutions of vocational training. Such policies were justified by the government's stated purpose of increasing the productive population. However, due to the incessant industrial stagnation of the 1950s, they came under the severe criticism by the end of the decade for being unreflective of changes in social and industrial conditions.

The Korean government set up the Bureau of Science Education

under the Ministry of Culture and Education and appointed Choe Gyu-Nam as its chief in late 1948. The bureau eliminated the Department of Girls' and Women's Vocation and added the Department of Fisheries Education. Enacted in late 1949, the Education Act stated that "education in citizenship, science, vocation, and teacher training deserve special attention" *(Dong-A Ilbo*, November 27, 1949). Soon afterwards, the government announced a policy that sought to adjust the ratio of students in vocational school to those studying the humanities to 6:4 in secondary education, and 7:3 in higher education (*Chosun Ilbo*, October 28, 1948). This policy remained in effect after the appointment of Choe as president of SNU. In fact, his appointment to the position in the first-rank national university demonstrates the prioritization of science and technology by the Korean government. In 1950, the Ministry of Culture and Education restructured a 6-year secondary education into 3 years of junior high and 3 years of high school. The 248 secondary education institutions that existed at the time of liberation—183 academic and 65 vocational schools—were reformed into 256 academic high schools and 213 vocational high schools in 1954.

In higher education, four national universities opened colleges of agriculture and engineering, and medical schools and business schools were established in three universities. In addition, several universities expanded existing departments of agriculture and of engineering to the size of colleges, as in the case of Korea University and Dongguk University establishing their respective College of Agriculture and College of Forestry in 1951. Chosun University opened its College of Engineering in 1952. As a result of these changes, by December 1954, the number of vocational students, approximately 16,000, in national and public colleges surpassed that of students in the humanities, approximately 13,000.

A plan aimed at strengthening vocational education can also be seen in the character of aid by the United Nations Korean Reconstruction Agency (UNKRA). UNKRA clearly stated that the aid was intended for promoting technical education. Sixty percent of its funds were used for recovery from the devastation of the Korean War and the

rest was spent on purchasing equipment for vocational institutes and supporting vocational education. However, a change in the U.S. policy toward Korea could be seen in the mid-1950s. And the Minnesota Plan was a representative case. The plan was devised by the U.S. Foreign Operation Administration (FOA) to support the reconstruction of SNU through a partnership with the University of Minnesota, primarily targeting the College of Engineering, College of Agriculture and Forestry, Medical School, and College of Natural Sciences. From 1954 to 1962, US$ 9.5 million were invested in the plan, and 218 professors of natural sciences and engineering went to the United States for training. This amount accounted for 78 percent of all aid that the United States allocated to South Korea's higher education during this period (M. Kim 2009).

An important characteristic of the Minnesota Plan is that it intended to concentrate on the development of science and technology. In contrast to the establishment of International Christian University in Japan and the Free Berlin University in West Germany for the purpose of dissemination of American educational philosophy and pedagogical methods to the respective countries by founding new universities, the Minnesota Plan focused on providing aid for science and technology to existing colleges.

Secondly, the primary focus of the project was on providing faculty training. In a broader sense, it was designed not only to help reconstruct SNU, but also to cultivate scholars and technical specialists who would lead the reconstruction of the nation. The number of SNU faculty members dispatched to the United States between January 1, 1955 and June 30 stood at 218: 57 specialists in agriculture, 64 in engineering, and 78 in medicine (the remaining 27 were recruited from the Department of Public Administration, including 8 public government officials) (M. Kim 2009, 58). With respect to the positions of the dispatched personnel at SNU, 54 people were senior faculty members—professors and associate professors—62 full-time assistant professors and lecturers, 73 teaching assistants, and 20 part-time lecturers (the remaining 16 people were not academic staff, consisting of 8 employees of the College of Nursing and the university hospital and 8

public officers).

The majority of the participants in this training program attended or audited courses. Out of the 226 participants, 170 were registered full time and 86 of them received an academic degree, including 15 doctorates and 71 master's degrees. Of the academic degrees, 23 were from the College of Agriculture, 4 from the College of Veterinary Science, 21 from the College of Engineering, 11 from medical school, and 12 from the Graduate School of Public Administration.

In terms of distribution of the participants by department, 8 faculty members were dispatched by the department of chemical engineering; 7 each by the departments of electric engineering and mechanical engineering; 6 each by the departments of civil engineering and textile engineering; and 5 each by the departments of aeronautics and marine engineering, optical engineering, and metal engineering. According to a survey conducted in June 1961 among the recipients of the Minnesota Plan training, 11 professors, 16 associate professors, 16 assistant professors, 9 full-time lecturers, and 5 teaching assistants remained at SNU by that time, and one official was still holding office in the university. Those who left SNU obtained tenure positions at other schools such as Hanyang University and KIST, thus continuing their academic career. Upon returning from training in the University of Minnesota, numerous professors of science and technology attempted to introduce new courses and teaching methods. Their endeavors often led to conflict with faculty members who were educated during the colonial period, or after liberation without the opportunity to study abroad. On the other hand, students had great expectations for the Minnesota-trained professors (M. Kim 2009, 85-89).

Overall, since the establishment of SNU in 1946, approximately 86 percent of full-time professors at the College of Engineering gained an opportunity to travel abroad for study or as a field trip, and 75 percent of them went to the United States with the assistance of the U.S. International Cooperation Administration (ICA), which succeeded the FOA in 1955. Along with faculty training, the Minnesota Plan also supplied new equipment to educational facilities at SNU, playing an important role in the overall Americanization of the structure and

culture within the College of Engineering. In the period between 1955 and 1959, a total of US$ 2.7 million were spent on the provision of equipment. The largest portion—US$ 1.38 million—was allocated for the College of Engineering, whereas US$ 0.34 and 0.74 million, respectively, were used for the College of Agriculture and the College of Medicine.

The Americanization of teaching and research methods at the College of Engineering was further facilitated by the American professors who were dispatched by the University of Minnesota to serve as advisors. Particularly prominent among them was Clarence Weems, an MIT graduate who spoke fluent Korean.[6] Most of the American professors focused more on the practical connections between school and industry rather than on theoretical knowledge, and valued experimenting and other forms of practice over lectures. In sum, the Minnesota Plan made a major contribution to converting education at the College of Engineering into a more American system. As a result of the plan, the number of students who continued their studies for M.A. and Ph.D. degrees in the United States rapidly increased.

The Minnesota Plan was supported by the U.S. government within the framework of American technological aid to South Korea. The plan for technological aid to South Korea became concrete during the second half of the Eisenhower administration, with the formulation of policies towards South Korea in the National Security Council Report of 1957.[7] The chronology of events illustrates that the Minnesota Plan started prior to materialized technological aid, and points to a close connection between the plan and U.S. aid for the reconstruction and economic development of South Korea.

However, the Eisenhower Administration generally did not prioritize providing economic and technical aid to developing countries, including South Korea (Kunz 1994, 15-18). As the provision of aid

6. Clarence Weems was the son of a missionary, William Weems, who had served in Korea during the colonial period. He was as fluent in Korean as a native speaker.
7. "National Security Council Report," NSC 5702, January 14, 1957, in *Foreign Relations of the United States*, vol. XXIII, part 2, pp. 374-384.

was stipulated by the Military Security Act, which focused more on security rather than economic and technical assistance, reducing the size of foreign aid was a key objective of the administration's New Look policy (Park 1999, 93-120). Therefore, the U.S. aid for the development of science and technology in South Korea cannot be considered as a plan with a long-term vision as shown in U.S. assistance to construct thermal power plants in the 1950s (Park 2011). In fact, the Minnesota Plan was originally envisioned as a three- or four-year program, but only later extended until 1962.

In addition, there were a number of negative responses to the effect of technological aid under the Minnesota Plan. The criticism targeted not only the Minnesota Plan, but also the work of the Oregon Advisory Group, which was dispatched to South Korea to support its economic development plan. Most of the complaints were derived from communication issues and the unilateral decision-making by American advisors, as there existed few reciprocal processes between the American and Korean scholars as well as the administrators involved.

Nevertheless, the Minnesota Plan is critical to understanding the history of Korean science and technology. In spite of the conflicts that arose from the methodological changes, the Minnesota Plan initiated reliance of Korean science and technology on the American academia of science and technology. It should be noted that there were no other alternatives to the U.S.-oriented transformation, given the ultimate importance of the United States to the national security of South Korea—the frontline under the Cold War system.

The Vietnam War, the Establishment of KIST, and the Heavy Chemical Industrialization Policy

No development policy for science and technology was actually implemented during the 1950s at the national level except the establishment of the Institute of Atomic Energy Research (Koh 1991). Rather, the starting point of such a policy can be traced to the first

Five-Year Plan for the Promotion of Technology in 1962 (Moon 2008, 76-82). There was also a plan to found an institute, tentatively named Korea Institute of Science and Technology, in early 1962, as well as a proposal to establish an integrated science and technology research center under the Ministry of Commerce and Industry in 1963, but neither was implemented due to fundraising difficulties. In fact, the United States at that time was focused on the development of labor-intensive light industries in South Korea and discounted the idea of building high-technology or heavy chemical industries. Such a stance sheds light on the difficulty of allocating resources for building steel mills and machinery factories under the first Five-Year Economic Development Plan (Song 2002, 7-9). Rather, during the military government and beginning of civilian government under Park Chung-hee, scientific and technological policies were scaled back as the Bureau of Science and Technology was downsized within the Ministry of Culture and Education, and the activities of the Institute of Atomic Energy Research had to be decreased. The prioritization of simple industrial training over science led to a further decline in the promotion of basic sciences (G. Kim 2008, 240-243).

The promotion of science and technology finally kicked into gear in the mid-1960s when South Korea sent combat units to the Vietnam War. During the Johnson-Park summit in 1965, it was announced that the United States would provide South Korea with US$ 150 million as a developmental loan and would consider supporting a research center for applied sciences. To this end, President Johnson also offered to dispatch scientific advisors to assist the development of industrial technology and the establishment of the research center.

Such a shift was enabled by both the popular view that foreign aid was crucial for the modernization of developing countries and emerging nations—as best articulated by Walt Whitman Rostow, a key foreign policy advisor for President Kennedy and President Johnson—as well as by the Johnson administration's attention to technological aid (Park 2006). Yet the primary recipients of this technological aid consisted of major U.S. allies in the Cold War, such as Japan, Israel, and the European nations, while less economically developed

countries, such as South Korea, were hardly seen as targets of such policies. South Korea, therefore, could not count on the U.S. technological grants until the Vietnam War, which became the turning point in the U.S. provision of technological aid to South Korea.

In addition, Rostow's rise within the Johnson administration allowed the American government to change its policy toward Korea. Rostow had not occupied a decisive position during the Kennedy administration in spite of the fact that his view of foreign assistance was widespread within the government. After the assassination of President Kennedy, Rostow was appointed as Special Assistant for National Security Affairs. Since Rostow was a strong proponent of increased involvement in Vietnam and mobilization of allied forces, he advocated the policy of increased aid for countries that sent troops to Vietnam. South Korea, in particular, dispatched the second largest group of combat troops during the Vietnam War.

The United States focused its provisions of technological aid to applied research centers rather than to universities and other educational institutions. The Korean government requested additional aid for the establishment of research institutes and was prepared to allocate more resources from its own budget, but the United States maintained that funding had to be based on industrial demands from the private sector. American policymakers at the time believed that scientists should deliver faster results as remuneration of private-sector investment, which was very different from ideas of Korean officials and scientists who stressed government's leading role in stimulating developing science and technology. They also expected that students who were pursuing degrees in the United States at the time would return to their homeland and contribute to the development of Korea's science and technology.

Following Johnson's proposal, the two governments carried forward the plan for a science and technology research center. The plan materialized into the Agreement on the U.S.-Korea Collaboration in Establishing and Operating the Korea Institute of Science and Technology (KIST), signed by both parties on February 4, 1966. The agreement stated that "the affiliated research institute will support

the organization and operation of this institute, train researchers and administrators to enhance its capacity, and strive to open the door and contribute to international exchange of technology," making it clear that the institute had to be open to international exchange and linked to the United States. In other words, interconnections with both the private business sector and the U.S. government were preconditions for the establishment of KIST.

In accordance with the U.S. plan for the research institute in South Korea, the Battelle Memorial Institute played an important role in the process of establishing KIST. Battelle's support took place in two stages: the first occurred from 1966 to 1967, and the second continued until June 1971. In the first stage, it not only provided overall advice but was also directly involved in devising the specific contents of KIST's activities—e.g., helping find and select scientists and technicians, cooperating and advising on technological development, conducting applied research, and supporting the installation of information channels for science, technology, and industry. Through this process, it was decided by the Korean government and scientists that the priorities for KIST would be material engineering, mechanical engineering, electrical engineering, chemistry, and food engineering (G. Kim 1989).

As the majority of scholars point out, the establishment of KIST was the critical turning point in the development of Korea's science and technology. Each step in the process of the institute's foundation—the U.S. support, links with the United States, and the recruitment of U.S.-educated researchers—determined the future direction of Korea's scientific and technological development. Although the U.S. aid fostered South Korea's achieving a rapid growth in the way of technology, specified priorities for the received aid resulted in an imbalanced development of basic sciences.

Along with the establishment of KIST, the Vietnam War also led the Park administration to develop the idea for its own military industry. Even though the Johnson administration was reluctant to allow South Korea to build its own military industry, President Park and his staff relentlessly persisted in discussing the possibility with

the U.S. government. The idea in fact originated from the Brown Memorandum of 1966, which promised the "modernization of firepower, communication and maneuverability of the South Korean Army."[8] There was not much progress during the war, however, until the Nixon Doctrine and the following withdrawal of a division of the United States Forces Korea (USFK) with the accompanying pledge that the United States would "modernize the equipment of the South Korean Army and provide long-term military aid" (Oh 2009).

Since 1948, the United States had adhered to a policy of restricting the development of South Korea's defense industry. There were two reasons for this policy. First, there was a risk that such a development would provoke North Korea, specifically given that President Rhee Syngman's insistence on unification by way of "marching North" and his objections to signing the armistice agreement was a source of conflict between the two Koreas. The development of a military industry in South Korea would create a security dilemma for the Korean peninsula. As a result, beginning with the National Security Council Report 8 of 1949 and until the late 1960s, the U.S. policy towards South Korea was to restrict the increase of South Korea's military power and to control its military industry. Furthermore, the U.S. government was particularly concerned about the security crises of 1967 and 1968, partially triggered by the Park government's active retaliation strategy (Park 2009b). The second reason was that developing South Korea's defense industry could aggravate the security situation in the region at large. Since South Korea was competing not only with North Korea, China, and the U.S.S.R., but also with Japan, the development of South Korea's defense industry could lead to an accelerated arms race among the neighboring countries. The consideration of such a possibility was clearly reflected in the U.S. efforts to

8. The Brown Memorandum, which defined the special assistance to Korea for the sending of Korean combat troops to Vietnam, was signed between the Johnson administration and the South Korean government in March 1966. It stipulated more than US$ 300 million dollars for economic and technical assistance as well as military aid. The memorandum was named after the American ambassador in Seoul at the time.

prevent South Korea from developing a nuclear bomb and missiles as well as enhancing the capacity of its navy and air force.

Nevertheless, the Vietnam War paved the way for the South Korean government's vision of building a new country with its own military capacity. In addition to South Korea, other countries involved in the Vietnam War, such as Taiwan and the Philippines, simultaneously started to develop their own military industries in the late 1960s and early 1970s. In this respect, the Vietnam War brought about significant changes to the region. Since South Korea participated in the war at the request of the United States, the American government could not easily reject the demands of South Korea. In the words of William J. Porter, the then U.S. ambassador to South Korea, the dispatch of South Korean troops to Vietnam was like an "Aladdin's Lamp" for the South Korean government.[9]

The Nixon Doctrine: Another Turning Point

Ironically, an important factor that facilitated the transfer of military technology was the Nixon Doctrine, which weakened America's engagement in Asia by stressing the "Asianization" of regional defense issues. Even though the Johnson administration allowed special aid to South Korea due to its contribution to the Vietnam War, the administration had been reluctant to promote military industry in South Korea. But the Nixon Doctrine, which caused a reduction of U.S. forces in South Korea, inevitably brought change President Park's industrial policies. President Park strongly protested the downsizing of U.S. forces in South Korea and requested a transfer of military technology that had been prohibited until the late 1960s. The Nixon administration allowed the building of a military industry in limited ways, beginning in 1970, not only for the sake of maintaining a balance of power on the Korean peninsula after the withdrawal of

9. "Additional ROK Troop Contribution to Vietnam," Telegram from the Embassy in Korea to the Department of State, Seoul, November 25, 1967, in *Foreign Relations of the United States*, vol. 29.

American forces, but also to appease Park's anger. In July 1970, President Park began to consider the possibility of manufacturing the M16 gun and several kinds of small canons.[10]

Using the opportunity provided under the Nixon Doctrine, the Park administration was able to set up research facilities for national defense in the 1970s. The Agency for Defense Development (ADD) was established in August 1970, which later became a corporation. The location of the ADD, which was situated adjacent to KIST, hints at the link between South Korean science and technology and national defense. ADD, along with KIST, became the leading center of the development of Korean science and technology in the mid-1970s and was commonly referred as the "place where all great brains in science gathered" (Moon 2008, 80).

Another transition resulted from the change in the role played by Japan in Northeast Asia. According to Rostow's plan, Japan, instead of the United States, would broaden its role in Asia. In order to expand economic aid to developing countries, the participation of other developed countries such as Japan and those in Western Europe would be needed (Rostow 1957, 84). Normalization between South Korea and Japan was one of the significant objectives for both the Kennedy and the Johnson administrations because the United States sought to transfer a heavy portion of the burden of the Korean peninsula onto Japan. This purpose was strengthened during the Nixon administration due to the economic problems caused by the Vietnam War. Although the transfer was delayed due to the prominence of South Korean combat troops at the frontline in Vietnam, shortly after inauguration of President Nixon, the United States began to encourage Japan to play a greater role in Northeast Asia. The U.S. intention became apparent during the summit between President Nixon and the Japanese Prime Minister Sato Eisaku in late 1969.

From the perspective of the South Korean government, the nor-

10. Many documents produced in the Blue House during 1969-1970 showing the Park government's intention to build military industry are now declassified. They show heated debates between the Nixon and the Park administrations regarding the military industry.

malization of relations with Japan in 1965 stood for another chance to revive its original plans. It is a well-known fact that the funds obtained through claims from Japan during the normalization talks greatly contributed to South Korea's economic development. In particular, the Pohang Steelworks Project benefited greatly from the normalization. Since the beginning of the administration and until the late 1960s, steel mill construction had been one of President Park's main ambitions, but the realization of the project had continued to be delayed due to the shortage of funds and necessary technology (Song 2002, 6-12). Park considered the steel industry to be a key to building a self-sufficient nation and to serve as a foundation for heavy and military industries. He once said to Kim Jeong-Ryeom, the then Minister of Commerce and Industry, that "the power of Japan to initiate the Pacific war came from steel mills. They had steel mills, and thus made tanks, cannons, and warships." For Park, Japan—and specifically, its Kawasaki Steel Mill—was a model for his vision of South Korea.

At the end of 1966, soon after Kim Hak-Ryeol was appointed vice premier, the Research Committee of Overall Planning for Steel Business was organized with the participation of KIST scholars, like Kim Jae-Gwan and Yun Yeo-Gyeong. But a more important task was acquiring financial and technological assistance from Japan. In September 1965, the Japanese Ministry of Industry, in cooperation with Japan Steel Federation and the six largest steel companies in Japan, dispatched a group of 9 specialists to South Korea. Japan provided approximately 60 percent of the construction costs and most of the equipment during the first stage of the project (1970-1973). In the construction process, a coalition of Japanese steel companies, called Japan Group, advised their South Korean counterparts in sectors of skills and equipments.

The usage of funds obtained through claims filed through normalization talks was originally restricted to the agricultural sector and was to be spent evenly each year for a period of ten years. If South Korea wanted to use the funds within a short period of time and for a different purpose, it first had to seek Japan's agreement.

For this reason, KIST prepared a specific plan for steel mill construction and presented it to the Japanese government. Japan approved the plan at the first South Korea-Japan Ministerial Meeting in August 1969. A month later, a 13-member group consisting of Japanese government officials from the Ministries of Economy, Defense, Finance, and Foreign Affairs and experts from the private companies such as Fuji Steel, was dispatched to South Korea to verify the feasibility of the project.

In November 1969, a negotiation team led by Jeong Mun-Do, the then Assistant Secretary of the Economic Planning Board, visited Japan. Here, a controversy between South Korea and Japan arose in relation to the type of casting and rolling facilities to be constructed. The Japanese argued that the facilities proposed by the South Korean side were too advanced and not yet available even in Japan. Eventually, Korea agreed to reduce some of their proposals for the facilities and change the casting method to be employed.

Negotiations on the terms of financing the project resulted in a pledge by Japan to provide US$ 73.7 million out of the claim funds during the three-year period and an additional 50 million in the form of a commercial loan. Subsequently, on December 3, 1969, Kim Hak-Ryeol, the then Deputy Prime Minister of Korean Economic Planning Board, and Masahide Kaneyama, the then Japanese Ambassador to South Korea, signed the Agreement between South Korea and Japan on the construction of Pohang Iron and Steel Co., Ltd. From this point, the cooperation proceeded mostly in relation to the technological aspect. In December 1969, Pohang Steel made a preparatory technological contract with Japanese companies, Yawata Steel, Fuji Steel, and Nihon Steel Pipe (Song 2002, 10-23).

The technological transfers and advice from Japan, as well as its collaboration, appear to have been as important as the funding. In September 1966, the first television set was made in South Korea by Kumsung Company. It was an assembly achieved by a technological cooperation with the Japanese company Hitachi, with 75 percent of components imported from Japan. Since then, South Korean exports in electronics as a percentage of total exports surged from 1 percent

in 1965 to 6.7 percent in 1969. A visit by Doko Toshio, the president of Toshiba, to the Blue House in 1966 appears to have played an important role as well (Oh 2009, 312). Doko pointed out that the world was entering an age of electronics industry and advised South Korea to build factories for electronics and electronic components.

The Korea Electronic Industries Cooperative (KEIC) was formed on January 12, 1967, and, on May 30, 1967, released a draft bill entitled the Promotion of Electronics Industry Bill. The bill was a rehashing of a Japanese legislation of the same title that was enacted on May 11, 1957 (Nishino 2004, 141). In October 1967, KEIC dispatched an observation team to Japan and, in July 1970, established an office in Tokyo. The city of Gumi in Korea was designated as a location for electronics industrial complex, and in September 1969, a Japanese businessman of Korean origin, Gwak Tae-Seok, founded Toshiba Korea in Gumi.

South Koreans also borrowed the Japanese model of industrial restructuring, which had allowed Japanese heavy chemical industry to achieve a US$ 10 billion mark in exports within ten years after the beginning of production in 1957. The government's plan for restructuring South Korean industries, presented in late 1972, was based on the strong belief that South Korea needed to adopt a similar model. On January 12, 1973, President Park announced the beginning of heavy chemical industrialization at the New Year's press conference.

The plan for heavy chemical industrialization envisioned an intensive fostering of the machine industry during the period of 1973-1981, and particularly emphasized the growth of the defense industry. The role model for the mechanization of the defense industry was the Japanese company Hitachi (Oh 2009, 570). A machine manufacturer, Hitachi produced all kinds of mechanical products, from large-size engines to be used in power plants and warships, to trains and weapons.[11] At a routine ministerial meeting between South Korea

11. The South Korean government sent mission teams to Japan several times to benchmark weapons technology, according to declassified documents found in the Presidential Library of Korea. Another document shows that the South Korean government invited Japanese technicians to stay for longer than a year in South Korea.

and Japan, the South Korean government requested assistance from the Japanese government and proposed an organization of non-governmental economic exchanges for the process of heavy chemical industrialization (Nishino 2004, 212-220).

Conclusion

This paper examined the reorientation of South Korean science and technology from a system linked predominantly to Japan during the colonial period to one dominated by U.S. standards and priorities after liberation. U.S. policies during the Cold War era became a major determinant of the scientific and technological development of South Korea, bringing about key aspects such as science and technology policies following the country's liberation, the Minnesota Plan of the 1950s, the establishment of KIST in 1966, transfers of advanced technology from Japan in the 1960s and 1970s, the correlation between the dispatch of Korean troops to Vietnam, and the development of the defense and heavy chemical industries in the 1970s. Such policies led to rapid scientific and technological progress, but at the same time limited the scale and direction of the development.

Although it is indisputable that U.S. policies initiated the development of South Korea's science and technology in the late 1960s, it is also necessary to note that U.S. policies had hindered such a development in an earlier period. U.S. policies and the circumstances of the Cold War did not always promote growth within South Korea, as clearly apparent in the content of the agreements reached between South Korea and the United States regarding technology and science. Both the 1956 Agreement for Cooperation Concerning Civil Use of Atomic Energy and the 1961 Comprehensive Agreement Regarding Economic Technical Assistance between the Government of ROK and the Government of the United States entail the provision of technical and scientific assistance by the United States, while simultaneously stipulating U.S. control over the technological development.

Even with American aid, the development of science and tech-

nology in South Korea ultimately would have been impossible without the enthusiastic efforts of the South Korean government officials, scientists, and technicians of the era. In fact, considering the restraints imposed on South Korea by the United States, the role of Korean stakeholders in Korea's development cannot be underestimated. Moreover, it is not difficult to find conflicts between Korean scientists' intentions and American policy. This paper does not refute the model of scientific and technological development under the theory of the developmental state. Rather, it aims to clarify the facts that, given the circumstances of the Cold War and Korea's strategic location, science and technology of Korea could not avoid the effect of geopolitics and the U.S. Cold War strategy, in both positive and negative ways.

A limitation of this study is that it did not closely examine the issues related to the theories and substantive elements of science and technology. A closer scrutiny of the process of choosing a particular direction of development among several options would strengthen the argument of this paper. To this end, a specialized understanding of science and technology in the United States and Japan, as well as in the communist and Western European countries, is needed. This task requires an integrated effort of specialists in science and technology as well as those in the humanities and social sciences. A potential area of future research includes comparative approaches examining the differences and similarities between the case of South Korea and that of other countries.

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