STI in History* :

Choi, Hyung Sup (1920-2004): A Metallurgist Who Founded Modern Korean Science and Technology

Editorial Summary**

As a scientist, manager, and policymaker, Dr. Choi, Hyung Sup is remembered for a leading contribution in institutionalizing contemporary Korean science and technology.

BRIEF BIOGRAPHY

Dr. Choi, Hyung Sup (Nov. 2, 1920 - May 29, 2004) was born in Jinju, a small city in Kyungnam Province of Korea in 1920. After graduating Daejeon middle school, he moved to Japan to study mining and metallurgy at Waseda University. After independence from Japanese Colonialism, he returned to Korea and taught mining and metallurgy for some years at Kyungsung University, the predecessor of Seoul National University. He went to the United States to further study metallurgy. He earned a master's degree from the University of Norte Dame in 1954 and doctoral degree from Minnesota University in 1958 (both in metallurgy). He started his research career in the Department of the Interior before his return to Korea.

In 1961, Dr. Choi returned to Korea to join the Atomic Energy Research Institute (AERI), which was established in 1959 as an affiliate of the Office of Atomic Energy (OAE) that later became the Korea Atomic Energy Research Institute (KAERI)[1]. A year after he joined the AERI, he was appointed as the director of AERI in 1962. He was also concurrently appointed the director-general of the mining division in the Ministry of Trade and Industry of Korea. In 1966, he was invited to

* The 'STI in History' is reserved for (series of) articles, essays, or editorial summaries that highlight events, individuals, or STI policies from a historical perspective.

** This editorial is based on various books, articles, and materials written by and for Dr. Choi, Hyung Sup. Credit goes to Ms. Choi, Eunjung, the managing assistant, for her excellent job in creating the initial investigation and draft for this summary. And "Dr. Choi Hyung Sup's Exhibition Center" in KIST (Korea Institute of Science and Technology) has provided a number of valuable references.

[1] The Atomic Energy Research Institute (AERI), Radiological Research Institute (RRI), and Radiation Research Institute in Agriculture (RRIA) merged to become the present KAERI. Refer to KAERI's website at http://www.kaeri.re.kr/english.

become the first president of the Korea Institute of Science and Technology (KIST), the first Korean government-sponsored research institute (GRI) that covered diverse scientific research areas. He showed outstanding leadership in founding and managing the institute. President Park Chung-hee appointed him as the Minister of Science and Technology in recognition of his excellent achievements. During his term of seven and a half years, he founded and dramatically strengthened the basis of Korean science and technology. Even after his retirement, he actively contributed to systemizing the Korean S&T developments and to diffusing this successful model for domestic S&T policies to the international community through consultations with developing countries. He passed away on May 29, 2004.

AT AERI: *The Start of Modern Science and Technology in Korea*

- Opening Ceremony of the MFRI
- Opening Ceremony of the SMW Research Reactor of AERI

Dr. Choi returned to Korea during the 516 Revolution and the new administration demanded that he take an important role in the creation of the Korean foundation for industrial technology. One of them was to assist the establishment of the Metal Fuel Research Institute (MFRI), which has carried out outstanding research and contributed to producing high value-added metals for diverse industrial use.

Another important role was to participate in drafting the first and second 5-Year Economic Development Plan. He successfully included a plan for building an integrated iron and steel mill, which later developed into POSCO[2].

In 1962, Dr. Choi was appointed President of the Atomic Energy Research Institute (AERI). As the President of AERI, he established robust foundations for Korean S&T as well as for the institute. First, he attracted and provided remarkable incentives for competent researchers. At that time, only the Department of Nuclear Energy at Seoul National University had an undergraduate program. Nuclear energy was regarded as a cutting-edge study area; however, there was no place for graduates to continue the focus of their studies. As a result, he decided to hire all atomic energy graduates to the AERI. He also improved the salary and living conditions for researchers and staff at the institute. Second, he tried to build a high-quality research capability by initiating many important research projects. One of the projects that he led resulted in an internationally influential paper[3] published in the Journal of Applied Physics in 1968. Receiving much recognition for his accomplishments at the AERI, he was appointed as the first President of the KIST in 1966.

[2] For further information on POSCO, refer to http://www.posco.com

[3] "Hardening of Ionic Crystals by Neutron and Gamma Irradiation: Study of the NaCl and KCI Single Crystals," Journal of Applied Physics, Vol.39, No.9, 1968.

- Greeting Dr. Hornig, the Science Advisor to the U.S. President in 1965
- Groundbreaking Ceremony of the KIST in 1966
- President Park appointed Dr. Choi as the first President of KIST in 1966

Korea in the early 1960s was primarily an agricultural state that focused most national investment on agricultural development. However, Korea was seeking other revolutionary strategies to develop its economy since this strategy had limited effect on economic development. The limited natural resources and abundant human resources of Korea led to a strategy of industrialization. Problems were caused by the lack of available funds for investment in industrial technology. Dr. Choi argued that Korea should encourage education that could contribute to the needs of industry and establish integrated research institutes independent from bureaucracy that could develop the necessary industrial technology. In 1965, President Park visited the U.S. to acquire the necessary funds for industrialization in return for the dispatch of Korean troops to the Vietnam War. Korea and the U.S. declared a joint statement that included an agreement to establish an integrated research institute in Korea.

In order to realize this agreement for a Korean research institute, a group of the U.S. advisors[4] that included Dr. Hornig (the Science Advisor to the U.S. President) visited Korea and examined the feasibility of the plan by examining Korean industrial firms, universities, and research institutes such as the Atomic Energy Research Institute (AERI), and the Metal Fuel Research Institute (MFRI). With economic aid from the U.S., the Korea Institute for Science and Technology (KIST) was finally established February 10, 1966.

Dr. Choi was appointed as the first President of KIST. As soon as he took office, he devoted his energy to attract high-quality researchers (mostly Korean scientists and engineers who studied and lived in the U.S.) to identify practical research themes that focused on the needs of industry. He has also tried to benchmark several advanced research institutes in the creation of the institutional framework. For example, he benchmarked the National Research Council (NRC) of Canada for its research autonomy, even though it was state-sponsored organization. The Commonwealth Scientific and Industrial Research Organization (CSIRO) of Australia was benchmarked for its authority in research priority-setting, according to national demands. While the Marx-Planck-Gesellschaft (MPG) of Germany was adopted as a standard for its balanced focus between basic and applied research along with the close relationship between research institutes and universities. The RIKEN(Rikagaku Kenkyūsho) of Japan was benchmarked for its unit laboratories management style and emphasis on the commercialization of the research results. The Battelle Memorial Institute (BMI) of the U.S. was referred to for its unique research contract-out system.

Dr. Choi commented that his endeavor to establish and make the KIST a success had been accomplished largely through the support by President Park. President Park stood in favor of the decisions

[4] In addition to, Dr. Hornig, Dr. James B. Fisk, the President of Bell Telephone Laboratories, Dr. Bertram D. Thomas, the President of Battelle Memorial Institute, Dr. Albert H. Moseman, an expert in agriculture in Rockefeller Foundation, and Dr. Lilli S. Hornig, a professor of chemistry in Trinity College were also included in this visiting group.

by Dr. Choi whenever there were critics and opposing arguments from other ministries. President Park also visited the KIST at least once or twice a month for the first three years to talk with the staff and provide financial rewards for outstanding achievements. The President's visit has raised the reputation of the institute and the morale of researchers.

Dr. Choi extended his role to the national level. He actively contributed to forming the industrial policies of Korea by participating in many policy projects for long-term industrial plans. The following three projects (in which he had played key role) are considered as ones having a profound impact on Korean success; "Long-term Plan for Energy Supply" (1967), "Basic Direction for Industrialization of the Machine Industry" (1969), and "A Feasibility Study for an Integrated Steel and Iron Mill" (1969-1975).

AT MOST: *Success and Goal Setting*

Long-term Plan for Korean S&T

President Park requested Dr. Choi to become the Minister of Science of Technology in acknowledgement of his excellent achievements at KIST. However, Dr. Choi refused this request because he thought the KIST was not yet self-sufficient. Dr. Choi finally accepted the request to be appointed as the second Minister of Science and Technology in 1971, after the promise by the president to let him return to KIST after two or three years of service. However, President Park did not keep his promise to preserve policy consistency in the S&T arena and Dr. Choi served as a minister for seven and a half years (the longest term in Korean history) until 1978.

As soon as Dr. Choi took office, he realized that there were no systematic policies or activities for the Ministry of Science. He set up the three basic directions and principles for Korean S&T policy with a long-term view. They were: i) building a robust foundation for science and technology development, ii) the development of strategic industrial technology, and iii) the promotion of public awareness in science and technology. With the first direction, he tried to build a system to develop S&T human resources. The second direction was proposed in order to make S&T available to support economic development. For this principle, he tried to select some strategic industrial technology and give them the highest priorities in development. The third principle was introduced because he thought it was important to create circumstances favorable to S&T for obtaining wide public support for S&T. The Confucian society of Korea was dominated by excessive idealism. This cultural environment made it difficult to encourage Koreans to have practical and quantitative thinking based on science and technology.

He initiated and accomplished many projects that produce a grand framework for S&T development and a national innovation system. He first tried to establish a sound legal framework by proposing new laws and regulations and revising outdated statutes. A major achievement was the creation of the 'Coordinating Committee for Science and Technology (CCST).' It was too difficult to coordinate other ministries to conduct many S&T projects; as a result, he promoted the establishment of a basic law on S&T to establish the CCST. This committee became a central place for the discussion and coordination of national projects to develop science and technology.

In recognition of the importance of international cooperation in supplying needed industrial technology from advanced countries, he produced the '5-Year Plan for International Technology Cooperation: 1972-1976' as a part of the 'Third Economic Development Plan.' As its initial effort of

the plan, he first visited France, the U.K., and Germany in 1972 and received their promise of cooperation for the transfer of advanced technology to Korea. He later expanded and accelerated international cooperation with other advanced countries such as Japan, Canada, and European countries for S&T and economic development.

To enforce the capability to absorb imported technology and develop endogenous technology, he strengthened the national R&D system as well as established many additional government-supported research institutes (GRIs) in various technological areas. One of the most successful achievements was the proposal of the Daedeok Science Town, where leading S&T research institutes are located to produce a synergy effect in research and development. This research complex (present Daedeok Innopolis[5]) is known as a successful regional innovation cluster. All his achievements provided the groundwork for current Korean S&T.

Technical Colleges

Dr. Choi asserted that human resources are the core component in developing science and technology. As soon as he took his office as a minister, he established a national analytical survey on the supply and demand of human resources for successful industrialization. That survey concluded that the proper composition of human resources for S&T would be 5% high-quality researchers, 10-15% technicians, and 80-85% as low-skilled craftsmen. According to this conclusion, he made a long-term 15-year plan for educating and training the necessary S&T human resources for industrialization.

Technicians and low-skilled craftsmen are essential for successful industrialization. However, the attitude of Korean society was only to respect scholars and most Koreans did not want to be technicians or craftsmen. To overcome such an atmosphere, he introduced the 'Act on National Technician Qualification System.' This act focused on enhancing the social status of technicians by providing the best benefits and incentives such as an exemption of military service for proficient technicians; in addition, he also introduced the concept of technical colleges for educating and training proficient technicians. However, there was opposition from the Ministry of Education insisting that they should not be called 'colleges' but only 'training centers.' A compromise was made by President Park that all technical colleges could be deemed 'colleges' under the auspice of the Ministry of Science and Technology.

Research and Development

Dr. Choi understood the importance of research and development in promoting science and technology. He argued that R&D was as important as capital investment and needed long-term investment. He established many government-supported research institutes that focused on various industrial technology (chemical, electronics, and materials). To draw synergy effects by linking them closely, he proposed to create a research complex one hour from Seoul in Daedeok, near Daejeon city.

To promote the development of advanced industrial technology, he proposed to enact the 'Promotion Act for Development of Advanced Technology' (Promotion Act) in 1972. This act provided tax credits for corporate R&D and created a research association system that benchmarked a number

[5] For details, refer to http://www.ddinnopolis.or.kr/eng/

of European countries. The research association system promoted the Public-Private Partnership by providing 50-70% of expenditures with public funds if the joint R&D projects were carried out under the research association scheme.

The Promotion Act produced major accomplishments. For example, Samsung and Sunkyung (present SK) were eager to introduce polyester film technology for videotapes. While Samsung tried to import the technology from Toray (a Japanese firm) by paying essential royalties, Sunkyung tried to develop the technology in collaboration with researchers at KIST. Later, Sunkyung succeeded to develop the technology and collaborated in production with Toshiba that was in cooperative relationship with Toray. Toray offered to transfer its technology royalty free to Samsung and grandfather out the competing technology developed by Sunkyung. However, Samsung needed government permission under the Promotion Act, which regulates technology imports in case of available domestic technology. Dr. Choi firmly rejected the petition by Samsung in order to protect technology that had been developed domestically.

Scientists and Engineers

Dr. Choi placed top priorities on the development of high-quality scientists and engineers, he felt it was important to mentor and motivate them. After taking office, he realized that the S&T-majored staff consisted of less than 5% of the ministry and that it was almost impossible to support thbese scientists and engineers with the remaining 95% of the staff that did not have the skills necessary to understand scientific concepts. Therefore, he started to replace his staff at the junior to senior levels with those that had S&T backgrounds. Three years later, more than fifty percent of staff in the ministry were filled with staff that had S&T backgrounds.

Dr. Choi introduced the science council system and replaced the research direction bureau. This was because the research-directing bureau frequently created problems for the researchers by focusing on administrative regulations rather than focusing on the support researchers. With the science council system, he urged staff in the science council (mostly filled with S&T-majored civil servants) to focus on developing long-term plans and policies in consultation with scientists and engineers in research fields.

Dr. Choi was well known as the 'Minister of KIST' as well as the 'Minister of MOST.' The reason was that he always opened his door to researchers (professors in S&T departments, as well) to discuss problems or troubles they encountered while interacting with the government officials in the ministry. Consequently, the morale of researchers was raised. In persuading his staff to change attitudes, he emphasized that the ministry existed to help researchers concentrate on research; not for administrative conveniences. He always asked the staff to do their best to help support scientists and engineers despite administrative difficulties and hurdles.

Public Awareness

During his term as the minister of science and technology, he paid special attention to public awareness of S&T. This attention was realized with the 'Campaign for National Science Awareness,' that was to change the public attitude of looking down on or ignoring S&T. In such an atmosphere, raising excellent scientists and engineers was impossible. To execute this campaign effectively, he established a special unit under the ministry called the 'Division for Fostering S&T Climate,' to develop various policy measures to foster the public awareness of S&T. This campaign became a national campaign by President Park in his address to the National Convention for Educators in 1973. A number of specific programs were initiated including campaigns of 'One skill per Person,' 'Science in

Daily Lives,' and 'Technological Independence'. In line with such campaigns, the National Science Museum was established to distribute S&T books to the public and provide free classes on practical science and technology.

RETIRED: *Sharing the Knowledge*

– Dr. Chio's Book 'Development Strategy of Science and Technology for Less Developed Countries' and its three English versions

He stepped down from the ministry in 1978 after remarkable success. The Korean S&T policies and system he founded during his term has become internationally known and a role model for many developing countries. As soon as he retired, he wrote an internationally influential book, 'Development Strategy of Science and Technology for Less Developed Countries,' by recollecting all his memoires and discussing appropriate strategies for S&T development in developing countries. This book has been translated into English, Chinese, and Arabic.[6]

He had been requested by many international organizations such as UNDP, UNESCO, UNIDO, and ESCAP to discuss the Korean S&T system and his experiences. In addition, he was invited by many developing countries to consult and establish indigenous S&T policies. He traveled to many countries such as Thailand, Sri Lanka, Myanmar, Saudi Arabia, Senegal, Pakistan, and Bangladesh. His presentations and suggestions customized to each country have contributed to developing local S&T development plans.

A prime example of international development was the consultation with Thailand. It was to consult the Thai government to develop a 'Five-Year Plan for the Development of Science and Technology' as a part of the 'Five-Year Economic Development Plan.' At first, when Mr. William E. Paupe, the Administrator of the United States Agency for International Development (USAID), requested him to assist in the ambitious plan of Thailand, he hesitated to take this job since he had no international consulting experience and was unsure if his consultation for other countries would be appropriate. Although he finally accepted this invitation after extensive persuasion, he realized that the situation was worse than he expected. There were only a 15 staff members in the ministry and even they seemed not competent enough to carry out the mission. He first formed a task force team consisting of competent staff with top-level education from abroad. Despite their individual capabilities, he however soon discovered that there was an inability to plan or coordinate. He had to start with teaching and training them in the concept and process of planning. He requested them to work hard, frequently asking for overtime. Upon the Thai request, he extended his work to develop a follow-up action plan. In addition, he became involved in designing a number of research centers that focused

[6] Three English versions include 'Bases for Science and Technology Promotion in Developing Countries' (APP Tokyo, 1983), 'Technology Development in Developing Countries' (APO Tokyo, 1986), and 'Springboard Measures for Becoming Highly Industrialized Society' (APCCT/UNESCAP, 1989).

- Dr. Choi presenting in an international seminar on 'Science and Technology Planning and Management,' Beijing, China

on technology transfer and S&T information to effectively support the adoption and applications of foreign technology. He tried to reform the Thailand Institute of Scientific and Technological Research (TISTR), an equivalent to KIST in Korea. TISTR was already established at that time with the support of Australia but suffered from bad management and weak incentives for research. His opinion was that the TISTR did not have any autonomy from the administrative bureaucracy and he tried to reform it despite the bureaucratic challenges.

REMEMBERED AS A FOUNDER OF KOREAN S&T

Dr. Choi, Hyung Sup passed away on May 29, 2004. Remembering his remarkable achievements in founding Korean S&T, he was inducted as an honorable member of the Hall of Fame in Science and Technology at the Gwacheon National Science Museum. He has left a number of memorable legacies as well as a significant impact in founding contemporary Korean S&T.

Minister Choi served a record-setting seven and a half years in the ministry, even though he consistently opposed the opinion of President Park. In his later year in a private meeting with his family, he lamented, "I went too far. I should have agreed to his opinion at least a few times." The achievements and successes of Dr. Choi would not have been possible without the consistent trust of President Park. With the unwavering support of President Park, Dr. Choi, Hyung Sup was able to accomplish many important successes for founding the Korean S&T system and will be remembered as a founder of contemporary Korean S&T.

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Korea Science & Technology Hall of Fame (http://www.kast.or.kr/hall/)