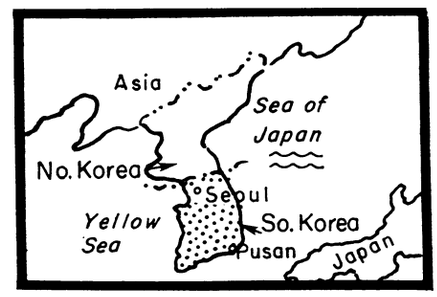
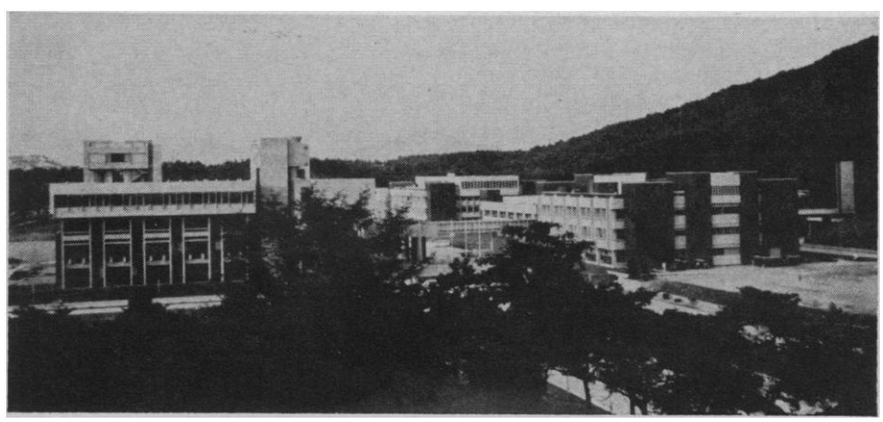
Korean Science Institute: A Model for Developing Nations?



The Korean peninsula, a rugged, mountainous land that juts off the coast of northeast Asia toward Japan, has been a battleground and a pawn in Asian power struggles throughout most of its recorded history. The Koreans spent long years under Chinese and Japanese domination, and from 1910 to 1945 they were occupied by the Japanese. With the military collapse of Japan in 1945, the peninsula came under the sway of the superpowers. Soviet troops occupied the northern half, above the 38th parallel, while American troops occupied the southern half. The dividing line, at first drawn arbitrarily to facilitate the surrender of Japanese troops, soon hardened into one of the most impenetrable barriers in the world. Not much is known of conditions in the Communist North. But South Korea, an Indiana-sized territory of some 33 million people, has in recent years become one of the world's most rapidly developing nations.

The United States has invested heavily in the military and economic development of South Korea. On the military side, American troops played the key role in rescuing South Korea from defeat in the Korean War of the early 1950's. The United States still maintains some 55,000 troops in South Korea, and American assistance has helped the Koreans build their armed forces up to some 600,000 men, the third largest military force among non-Communist nations. On the economic side, the United States has poured some $4 billion into South Korea since the armistice which concluded the Korean War in 1953.

Now, in one of the latest chapters of the effort to build a viable nation in South Korea, the United States is helping to establish a high-quality scientific institution, known as the Korea Institute for Science and Technology (KIST). With American financial and technical assistance, modern laboratory facilities have been built on a choice piece of ground on the outskirts of Seoul, the capital city; a talented staff has been recruited from among Korean expatriates; and the institute has already begun to perform contract research for the government and for industry. The goals of the $24 million project are ambitious: to bring science and technology into a developing nation quickly; to spur economic development by applying science to local industrial needs; and to reverse the "brain drain" that takes so many talented individuals away from the struggling nations that need their services. One Western observer describes the project as "a Minerva operation," likening KIST to the Roman goddess who sprang full-grown from the brow of Jupiter.



KIST's research facilities lie in a forest preserve on the outskirts of Seoul, one of the world's largest cities, with more than 4.3 million inhabitants.

The institute faces an uphill struggle to prove its worth. Some pessimists question whether a developing nation really needs a high-class scientific facility, and warn that the project may turn into an expensive boondoggle, a useless frill that pleases the Korean ego but does little to contribute to the nation's growth. The success of the experiment probably can't be assessed for at least a decade. But most initial signs are hopeful, and there is some feeling that KIST may serve as a prototype for similar institutions in other developing nations. Says Donald F. Hornig, science adviser to former President Johnson, who originated the idea of KIST and was the driving force in getting it started: "I don't know of anything else quite like KIST. We may have stumbled onto something that could be a model."

The partitioning of the peninsula left North Korea with most of the industry and natural resources and South Korea with most of the people and agriculture. But South Korea has rapidly expanded its industrial capacity and its manufactured exports. The nation's gross national product increased by 13.3 percent in 1968 and 15.5 percent in 1969—one of the highest rates in the world. South Korea today is reminiscent of Japan in the 1920's—rich in human resources, poor in natural resources, and poised on the verge of an economic takeoff.

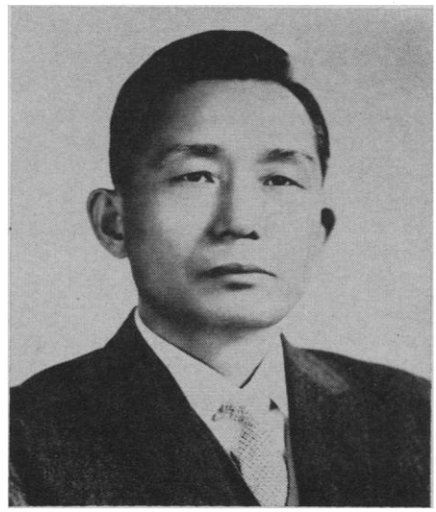
Like other developing nations, however, South Korea lacks a strong scientific base. The government, which supports the bulk of the nation's research and development effort, budgeted only about $8.7 million for R & D in 1969. Industrial research is almost nonexistent, and consists almost entirely of testing and quality control. One Western observer notes that there are 80 or more scientific institutions in South Korea but claims that "few, if any, are worth the powder to blow them up." There is also a tremendous shortage

of scientific and technical manpower. As Dong Shik Shin, senior secretary to South Korea's president, Chung-hee Park, described the situation at a 1968 symposium: "We have an oil refinery in the city of Wulsan in Korea which turns out 100,000 barrels of oil daily; it took only two years for its construction. But it will take another 20 years or more to train scientists and engineers to test its products and operate the machines installed there."

KIST is designed to fill much of this scientific vacuum. It will help businessmen select and adapt technologies already developed abroad; improve production methods; determine the best areas for investment; find new ways for using native materials; upgrade the quality of their exports; and produce important products that must now be imported, such as machine tools and mechanical equipment. KIST will also hold training sessions for scientists, technicians, and managers from government, industry, and the universities. Says Y. J. Chang, vice minister of Korea's Economic Planning Board: "We have capital, labor, entrepreneurs, and scholars. But we need technical know-how in a wide sense. KIST will play an important role in these circumstances."

The idea for KIST was proposed by Hornig in the course of preparations by the Johnson Administration for a visit to Washington by President Park in May 1965. Much to the surprise of the Koreans, President Johnson departed from the prepared agenda and offered to send Hornig to South Korea to explore the possibilities for an institute. President Park accepted, and Hornig subsequently led a mission to Korea that included, among others, James B. Fisk, president of Bell Telephone Laboratories, and Bertram D. Thomas, then president of Battelle Memorial Institute in Columbus, Ohio. Hornig's group recommended that an institute be established; a team from Battelle, after more detailed study, reported that the project was feasible and desirable; and in February of 1966 KIST was founded.

Thus far it has cost $24.1 million to build, equip, staff, and endow the institute. The U.S. Agency for International Development (AID) has contributed $9.2 million in dollars, including $7.2 million in grants and $2 million in loans. Another $12.2 million has been supplied from "counterpart funds," which have been generated by American supporting assistance grants



Korea's President Park

to South Korea and are jointly controlled by the Korean and American governments. The remaining $2.7 million was contributed by the Korean government in the form of land and subsidies. A big chunk of the American dollar contribution—some $3.1 million—has paid for the services of Battelle Memorial Institute, which has been guiding the development of KIST.

The president of KIST, and the man who is given most of the credit for KIST's early successes, is Hyung Sup Choi, a dynamic 49-year-old metallurgical engineer who holds a bachelor's degree from Waseda University in Japan, a master's from Notre Dame, and a doctorate from the University of Minnesota. Choi had previously been serving as director of one of the better laboratories in South Korea, the Atomic Energy Research Institute. A key reason for Choi's success is that he enjoys the confidence of President Park, who on several occasions has knocked heads to spur the institute's development.

KIST's President Choi

Park's support proved invaluable in obtaining a desirable site for the new institute. Choi reports that he examined more than 40 potential sites and had resigned himself to putting the institute in a historic graveyard some 40 kilometers northwest of Seoul, when President Park ordered the Ministry of Agriculture to give up 65 acres of choice land in a Forest Research Station on the outskirts of Seoul. The site, on hilly, wooded land, surrounded by mountains, is one of the most beautiful in all Korea.

Park also had his army engineers supervise construction activities, a move which encouraged contractors to make sure that supplies arrived on time and their men showed up for work. Construction has been essentially completed. The site includes more than a dozen buildings, including research laboratories; a fabrication building; a building for making pilot plants; housing for the staff; and a plush guesthouse for visitors. Many of the labs are not yet well equipped, partly because equipment needs have not been fully worked out, and partly because the institute plans to assemble as much of its own equipment as possible to cut costs. The institute does have a Control Data 3300 computer, making it the most sophisticated computer facility in Korea. It also has an electron microscope, which was donated by several Japanese companies at the behest of Choi's friends in Japan; an emission spectrograph; various x-ray analysis equipment; and other sophisticated gear. The U.S. National Bureau of Standards has supplied various volume, length, and weight standards, and KIST will serve as the standards center for Korea. Its library, which will have some 50,000 volumes and 1200 journal subscriptions, will serve as Korea's major center for technical information.

Establishing a research environment in a land where research is essentially unknown has not been easy. Almost all participants in the project—both American and Korean—agreed at an early stage that KIST should be an autonomous, not-for-profit institute that could serve the needs of government and industry without being subject to the political control of either. Indeed, one of the reasons for building the new institute from scratch was that the existing

NEWS IN BRIEF

• **SCIENTISTS PROTEST DRUG BILL:** A committee of prominent scientists has objected to the Administration's drug-abuse bill as giving all scientific and medical decisions about drug abuse to the Department of Justice, rather than to the Department of Health, Education, and Welfare (*Science*, 6 February). The group of about 60 scientists, physicians, and legal experts includes Dr. Dana Farnsworth, director of Harvard University Health Services; Nobel laureates Joshua Lederberg and Salvador Luria; Dr. Karl Menninger; Dr. F. D. Redlich, dean of the Yale Medical School; and Dr. Jonathan Cole, superintendent of Boston State Hospital, who is chairman of the group. Several of the committee have testified before a House Commerce subcommittee. The bill has been passed by the Senate.

• **HAWAII LIBERALIZES ABORTION LAW:** The Hawaiian legislature has approved a bill that would make the state's abortion law the most liberal of any state. The bill repeals the state's 101-year-old abortion law and legalizes any abortions performed in a licensed hospital by a licensed physician on a woman who has lived in Hawaii for at least 90 days. The embryo must be "nonviable," which has been interpreted to mean before the fifth month.

• **GUIDE TO CAMPUS HARMONY:** The National Association of State Universities and Land-Grant Colleges has compiled a report listing steps taken by 113 state and land-grant universities to decrease campus tensions. The first part of the report deals with student participation in university policy-making; the second with policies and procedures on conduct and disruption. *Constructive Changes to Ease Campus Tensions* is available for $2 from the association at One Dupont Circle, NW, Suite 710, Washington, D.C. 20036.

• **NEW CANADIAN ORGANIZATION:** A new national organization, intended to represent almost all of the Canadian scientific, engineering, and technological community, has been formed. SCITEC (The Association of the Scientific, Engineering and Technological Community of Canada) plans to advise the government on science policy and to explain science and technology to the public.

institutions in Korea were so hobbled by nepotism and incompetence that it seemed impossible to flush them clean. A special law was drawn up which allowed the government to donate money and land to KIST, but provided that the government could not audit KIST and could not exert approval power over its plans. Choi reports that the Korean legislature got "very upset" over the idea of handing out money without controlling it. Thus, when the legislature finally passed the law, at a time when Choi was out of the country on a recruiting trip, it changed the wording and stripped KIST of its autonomy. "I really got mad," Choi recalls. "I went to the President and told him he had better forget about the institution. He was surprised, but he listened and said he understood what I meant." Subsequently, with the support of both the Korean and American governments, the law was amended to restore KIST's autonomy. Another law has encouraged industry to use KIST by providing special tax incentives. This provision angered the Ministry of Finance, which didn't want to lose the tax revenues, and also troubled other research institutions, which were not granted similar privileged status.

KIST's greatest triumph so far has been its ability to attract a competent staff. At the outset it was hoped that KIST would lure back some of the 1400 or so Korean-born scientists and engineers who were working in the United States, but no one expected that KIST would be quite so successful. "They brought home more people than we ever dreamed possible," comments Hornig.

With the help of Battelle, KIST sent recruiting brochures to some 800 Koreans who had gone to work in the United States or Europe. Amazingly, some 500 sent back letters in reply. KIST and Battelle combed the list and picked out about 70 of the most promising prospects for interviews. Choi, who made recruiting trips to the Western Hemisphere, told the prospects: "You have to be interested in solving our industrial problems rather than building up your academic reputation. If you're after a Nobel Prize, you'd better stay in the United States." Prospects who were genuinely interested in performing applied research were invited to submit research proposals. Ultimately, about 30 were brought back, mostly from the United States but also from Europe. When coupled with some 17 scientists hired from within Korea, they give KIST a research staff numbering about 47 in all. The staff could be expanded almost at will, but Choi has held down recruiting within Korea so as not to denude other institutions of talent, and he has decided to halt recruiting abroad until the institute builds up its research volume.

The attractions at KIST seem to be the facilities, which are excellent by any standard; the autonomous research environment; a salary scale which is high by Korean standards ($3600 to $6000 a year for principal investigators); and fringe benefits that include inexpensive housing and a year's paid sabbatical overseas for every 3 years of service. But the real reason for KIST's success seems to be that it gives skilled Koreans an opportunity to use their talents in the service of their country.

Kyung Suh Lee, a young M.I.T. graduate who was working at a Cambridge consulting firm after getting his doctorate at M.I.T., had intended to stay in the States for at least another decade because he felt there was "nothing to go back to." He recalls that some touring Korean businessmen told a group of Korean graduates of M.I.T. that "they couldn't afford to invite us back—that was their frank opinion." But Lee had always wanted to "work for my country" and he gradually became worried that his children would suffer from discrimination in the United States. "So when I found an opportunity with KIST, I grabbed it," he recalls. He now heads KIST's fluid machinery lab, which, at the time I visited last November, consisted of himself, one assistant, and a nearly empty room.

Some of the same motivations brought back Young Ok Ahn, who had been in the United States for 14 years, graduating from Berkeley, winning his doctorate at Iowa State, and working first for Union Carbide, then for the DuPont Experimental Station. "A lot of my friends came with me," Ahn says. "We all decided to go home and see what we could do. But it would have been awfully difficult to come back if KIST weren't here." Ahn now heads KIST's polymer lab and finds the atmosphere more congenial than at the giant DuPont laboratories where "I was one of 2000 Ph.D.'s and it was kind of overwhelming."

One of KIST's biggest problems has been to persuade Korean businessmen that they can benefit from contract research and that KIST is competent to perform such research without spilling industrial secrets. Choi recalls that

when he first approached the president of an engine manufacturing company and proposed that KIST perform some research relating to lubricants for him, the man tried to give KIST a donation and told Choi not to bother submitting a report on the research. "I told him I wasn't begging," recalls Choi. "I said he could either take our report or forget the whole thing. He finally made a contract—our first contract with industry."

KIST has already completed a number of major projects. Joint teams from KIST and Battelle have made surveys of 18 industrial sectors to determine what needs to be done to improve Korean industry. They have also made projections of energy supply and demand that are proving more accurate than competing government surveys. At the time I visited last fall, KIST had completed 36 research contracts and was working on 95 more. About half had been financed by industry, half by government. KIST's income from contract research jumped from about $300,000 in 1968 to about $600,000 in 1969 and is projected to reach $1.3 million in 1970.

Sang Joon Hahn, vice president of KIST, seems to have solved the mystery of why cars don't last very long in Korea. Japanese engines used in Korean cars generally die after covering about one-third the mileage that would be expected in Japan. Hahn traced the chief problem to poor quality engine oils used in Korea, and KIST is now trying to persuade the oil manufacturers to change their processes, thus far to no avail. The government has, however, passed regulations to prevent contamination of the oil while it sits in storage containers.

In another project, KIST scientists devised a means for extracting titanium and zirconium oxides, which are important in making paints and ceramics, from heavy sand. The project, which is now at the pilot plant stage, may help Korea make use of a native raw material and reduce its reliance on imports.

KIST has obviously got off to a good start, but it still faces formidable obstacles. Previous American efforts to improve Korean science, including a multimillion dollar effort to boost the capability of a leading Korean university, have generally been considered failures. The supporters of KIST are keeping their fingers crossed, but it is not hard to imagine all sorts of disastrous fates for the institute. KIST might fall prey to the nepotism and corruption that sometimes cripples Korean institutions; it might not be able to persuade Korean industry to rely on its services; it might fail to do anything useful for the skeptical businessmen; or its staff might become discouraged by the kind of work industry wants, as indeed seems to have happened in the case of at least one KIST scientist. Moreover, KIST has enemies. Other Korean institutions have shown jealousy over the privileged position granted KIST, and even some officials in the U.S. Agency for International Development initially opposed KIST, preferring to sink more money into one of the institutions AID was already supporting.

It took Battelle's Columbus, Ohio, laboratory 9 years to reach the break-even point on an annual basis, so it may well take KIST at least that long. KIST is merely an "infant starting to crawl," according to Richard F. Goodrich, of the AID mission to Seoul. But if KIST eventually learns to stand and walk, it may indeed prove to be a prototype for bringing science to the service of developing nations.

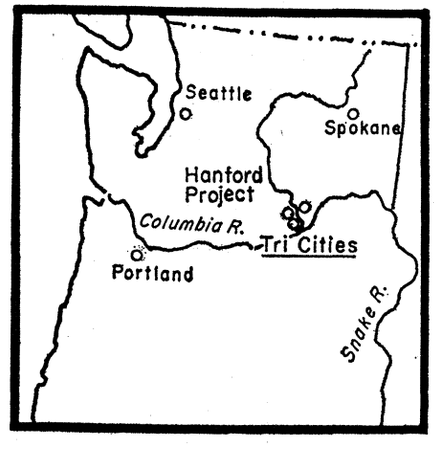
—PHILIP M. BOFFEY

Swords into Ploughshares: Hanford Makes the Switch

Richland, Washington. The "Tri-Cities," an urban complex of 84,000 people here in the arid region east of the Cascades, is an offspring of war. For this was a desert area with only a few hamlets and small towns until the construction of the Hanford plutonium works, which produced the material for the Nagasaki bomb, began in 1943. Since 1964, however, the government has been cutting back production of plutonium, and six of the nine reactors at the Hanford works have been shut down and a seventh is being closed down now. Such a cutback could have precipitated a disastrous economic decline for Richland and the neighboring towns of Kennewick and Pasco. But what in fact has happened is that a good start has been made toward converting sword into ploughshare.

The conversion has not been free of trouble, and, at the moment, people here are protesting that reactors are being shut down and old jobs are being eliminated faster than new job-creating activities can be established. With substantial unemployment in the area (8.2 percent at the end of January), clearly there is reason for this concern. However, the process of changing from an economy based largely on the production of plutonium to one based on a diversity of activities has gone far enough already to allow real hope for the future.

How this has occurred makes an instructive story. To cushion the reactor shutdown's impact on the Tri-City area, the federal government has used the persuasive power of its contract dollars to bring in new industry



and research activities. This has been done partly because Tri-City business leaders have been highly resourceful and have had potent representation in Congress.

The Hanford works took its name from the small village of Hanford, which became the site of a temporary wartime construction camp that at one point had 51,000 people. The Hanford reservation extends over 575 square miles (about half the size of Rhode