PN-AAP-798
in: 34275

1203-S
3624 by William Paupe
51

THE KOREA INSTITUTE OF SCIENCE AND TECHNOLOGY (KIST)

"What ought developing countries to be doing to equip themselves sufficiently to be able to get over the hump? I believe that it is essential for them to create infrastructures and environments conductive to the development of organized problem-solving capability, rather than indulging in random --- and therefore ineffective --- research efforts."

Hyung-Sup CHOI, Ph.D.
former Minister of
Science & Technology
Republic of Korea, and
first President of KIST.

HISTORY:

Throughout the early 1960's, the industrial sector in the Republic of Korea ma impressive gains. During this period, many advanced technologies were brought Korea, the level of exports rapidly increased, and the average annual rate of growth exceeded 10 percent.

Despite these advances, it was apparent to the ROKG that the level of native industrial technology was quite low and that Korean industries were suffering numerous technological problems. After seeking expert consultant advice, and after engaging in numerous intergovernmental discussions, the government decided that it was essential that a research and development organization be established.

In May, 1965, during summit talks between President Chung-Hee Park and President Lyndon B. Johnson, " . . . the two Presidents, recalling their respective earlier careers as school teachers, discussed together the needs, challenges and opportunities of education at all levels in both countries." 1/ Both Presidents found that they had a mutual understanding of the need to establish a multidisciplinary industrial research and development institute in Korea.

President Johnson offered U.S. support for such an institution and in July, 1965, dispatched a team of experts to the Republic of Korea to advise on the implementation of the agreement. This team was headed by the President's Special Advisor for Science and Technology, Dr. Donald F. Hornig.

Subsequently, the Governments of the Republic of Korea and the United States engaged the services of the Battelle Memorial Institute to study the needs and attitudes

1/ From the Joint Communique, May, 1965.

of Korean industry and to set forth a plan for bringing into being an organization that would fulfill these needs. The Battelle Memorial Institute was to later become the "sister" institute of the Korea Institute of Science and Technology throughout its formative years. In February, 1966, the Governments of the Republic of Korea and the United States entered into a formal agreement to establish KIST.

PURPOSE:

At the time the original US/ROK agreement to establish KIST was signed, it was agreed that the Korean industrial sector had developed without a traditional "in-house" research and development capability and that many production operations were rapidly becoming obsolete. It was apparent that the industries could not solve their technological problems without heavy investments in research and development facilities. At that stage of Korea's industrial development, these facilities were far too costly, given the size of individual plants and factories.

Hence, it was decided that KIST would assist the acceleration of the industrial development process by channeling science and technology innovations into industrial action.

In the first months of its existence, KIST engaged in a comprehensive "state-of-the-art" survey. Its formative years (1966-1970) were devoted to providing technical services for solution of "spot" problems encountered by industries, and to concentrating on the building of a generalized research atmosphere. The following years (1970-1975) found KIST carrying out comprehensive surveys of long-term energy supply and demand; assisting with the expansion of the industrial sector and the development of an electronics industry; and carrying out a wide variety of government and private sector-sponsored research projects. Additionally, KIST participated in the formulation of the national economic development plans; carried out basic studies for the heavy and chemical industry sectors; brought about the transfer of advanced technologies from abroad, and began to accumulate indiginous technologies.

In the latter half of the 1970's, in response to the movement of Korea's industrial sector toward a higher level of technology (electronics, heavy and chemical industries) KIST became involved in the development of strategic industries and integral technologies and research in the field of knowledge and information industries. In 1978, KIST's role was redefined in perspective of long-range goals for technological and industrial development in the Republic.

More recently, KIST has become a think-tank for the provision of support for the establishment of government economic and scientific policy, while at the same time continuing to provide active assistance for the import of advanced technology and, of equal importance, to develop this imported technology for successful adaption by domestic industry. Increasingly, KIST will play a precursor role in carrying out large, long-term national projects, such as utilization of domestically available resources, research toward increasing food production, and the development of technology-intensive products.

ORGANIZATION:

From the beginning, it was decided that KIST should have maximum independence. Consequently, President Park authorized the enactment of a special law, the KIST Assistance Act, which guaranteed Government appropriations of money and land, however, with no authority to either audit KIST accounts, or to have any say in determining KIST's plan of operation.

All parties involved in the original organization of KIST agreed that the Institute should be an independent, incorporated organization with a high degree of autonomy. It was further agreed that the Institute should have a research environment of the highest quality, in order to attract an outstandingly trained and qualified staff.

The President of KIST is appointed by a self-perpetuating, eleven-man Board of Trustees. Three (3) members of the Board are from the academic community, three (3) from the business community, and five (5) ex-officio members, -- the Vice Ministers of the Economic Planning Board, the Ministry of Commerce and Industry, and the Ministry of Science and Technology; a representative from the U.S. Agency for International Development in Korea; and a representative from the Battelle Memorial Institute.

(Note: Since the closing down of the U.S. AID Mission in Korea on September 30, 1980, the USG is represented on the Board by the Science Attache, U.S. Embassy, Korea.)

Under the President, three Vice Presidents manage the operating elements of KIST:

Vice-President for Research

- Polymer Science Research Department
- Chemical Engineering Research Department
- Applied Chemistry Research Department
- Food and Feed Technology Research Department
- Process Engineering Research Department
- Electronics Engineering Research Department
- Material Science Research Department
- Mechanical Engineering Research Department
- Metallurgy and Metallurgical Engineering Research Department

Vice-President for Technical Services

- Industrial Economics Research Department
- Software Development Center
- Technology Transfer Center
- Precision Machinery Technology Center
- Foundry Technology Center

Vice President for Administration

- Administrative Management Division
- Operational Management Division

In 1974, the Korea Technology Advancement Corporation (K-TAC), was established as a wholly-owned KIST affiliate. K-TAC has the status of a business corporation, with the dual purpose of helping in the commercialization of research results and contributing to the financial stability of KIST.

In late 1980, a special legislative committee determined that KIST should be merged with two other ROK science and technology institutions, -- the Korea Advanced Institute of Science (KAIS) and the Korea Science and Engineering Foundation (KOSEF).

KAIS was founded in 1971 " . . . to produce for Korean industry a supply of engineers and applied scientists who combine high ability with advanced training oriented towards the technological needs of modern industry." At that time, it was determined by ROKG science and technology officials that Korean graduate schools in science and engineering were making insignificant impact on the development of the Korean economy. Many students went abroad for graduate education and few returned. Those that did return were for the most part oriented toward developed country needs, --- not to those of a developing country. To assist in this effort to modernize and upgrade Korean higher education in science and engineering, USAID authorized a $6 million development loan.

KAIS, operating under a law similar to that which authorized KIST, has also enjoyed a high degree of autonomy. KAIS is the only authorized graduate degree-granting institute in the Republic which is not under the Ministry of Education, and therefore not subject to hidebound rules and regulations and bureaucratic manipulation. Over 40 percent of KAIS's students are young scientists and engineers supported by private industry and research institutes, thereby permitting KAIS to maintain a continuing linkage with the industries it was designed to support.

The Korea Science and Engineering Foundation (KOSEF) was founded in May, 1977, to foster science and engineering research capabilities, to promote science and engineering education, and to enhance international cooperation. KOSEF makes grants for scientific research in science and engineering fields; gives research fellowships to train young researchers; and encourages cooperation among researchers, both domestic and abroad, and among different institutes.

KOSEF is an independent foundation incorporated under a special law to preserve autonomy and function with flexibility in response to shifting needs and priorities. KOSEF is controlled by scientists and engineers and a Board of Trustees consisting of representatives from academia, government and industry.

METHOD OF OPERATION:

At the time KIST was founded, the concept of an autonomous organization was truly unique. The government was asked to capitalize an Endowment Fund, which had no precedent in Korea. It was also asked to make available large amounts of money and valuable land and place control of these assets in the hands of an independent Board of Trustees, most of whose members were not within the government establishment. While it took some time for the idea of autonomy to be understood and

accepted, this unique concept undoubtedly has been a major factor in KIST's successful operation and significant achievements over the years.

There are additional important considerations which were highly beneficial to the establishment of KIST's successful method of operation. First, from the beginning, KIST has carried out extensive surveys of the Korean industrial sector to insure that it had a clear understanding of the industry, its problems, and the processes necessary to further its development. Indeed, before KIST planned its first research activity, a team of 80 Korean and foreign scientists, engineers and economists carried out an extensive analysis and inspection of over 600 industrial plants. KIST continues today to constantly upgrade its body of knowledge concerning shifting technology needs and availabilities in the industrial sector, as well as the changing export opportunities in the world marketplace.

A second somewhat unique methodology employed by KIST is its outstanding staff recruitment program. To secure necessary staffing at the time of its founding, KIST initiated a well-designed and executed "counter brain-drain" operation. This effort resulted in the recruitment of nearly 30 expatriate scientists, living and working abroad, all of whom had at least five years of relevant experience beyond the doctoral degree level. Because of its autonomous status, KIST is able to continue to attract outstanding scientists and engineers by offering salaries well above civil service levels, attractive working environments, paid sabbaticals, and generous benefit packages, including housing, transportation, etc.

In addition, KIST has established "sister" institution relationships with outstanding research facilities throughout the Free World, including,

- Battelle Memorial Institute laboratories in North America and West Germany
- Research Triangle Institute, North Carolina
- Mitsubishi Research Institute, Japan
- Nippon Steel Corp. of Japan
- Netherlands Organization for Applied Scientific Research
- Industrial Technology Research Institute, Taiwan
- Royal Scientific Society, Jordan

KIST also has maintained a close relationship with the (U.S.) National Academy of Sciences.

The day-to-day activities of KIST are generally divided into three areas. First, the Research activity involves the performance of a wide range of research projects, on a contract basis, sponsored by individuals, corporations, Government agencies and international organizations. Prospective sponsors present their research problems to KIST through its Project Development Division, which arranges meetings between the client and KIST specialists in the field of the problem. The KIST specialists study the technologic and economic feasibility of their approach to the problem. After KIST determines that the research project is feasible, a course

of action proposal is prepared and submitted to the client for approval. If approved, a research contract is signed. During the course of the research, there is constant KIST/client communication, and KIST provides all data and information derived from the research to the client. KIST also arranges the assignment of all proprietary rights, including patents, to the client. KIST derives the bulk of its income from these research contracts.

The second major area of activity involves the specialized Centers which provide a wide range of technical services. A Software Development Center, with modern sophisticated computer equipment, provides government, industry, universities and other research institutions with consultation and training services in the general computer area. A Technology Transfer Center assists local industry with plans to import advanced foreign technology, including the analysis of the appropriateness of the technology. The Foundry Technology Center provides the Korean foundry industry with testing, surveying, technical information, and consulting services. The Precision Machinery Technology Center is concerned with introducing advanced precision machine technology, as well as design and processing techniques, to Korean industry.

The Third area of activity is the Administrative sector, responsible for personnel management, budget and fiscal operations, and all other administration and management activities.

Perhaps the most unique feature of the KIST organization is the Korea Technology Advancement Corporation (K-TAC), a KIST wholly-owned business affiliate, which provides a considerable amount of income for KIST. K-TAC studies selected KIST research developments to determine the economic and technological soundness for commercialization. K-TAC can exploit the research development in one of two ways. They may make a direct investment in the product and establish a pilot production capability, or they may negotiate the transfer of industrial rights to private industry directly. In the past, K-TAC has commercialized such KIST developed products and processes as a Clinical Diagnostic Strip, Silicon Oil, an Organic Fertilizer Plant, an Anticancer Drug, Soy Protein Food, and Flame Retardants. K-TAC has also exploited, for the financial benefit of KIST, such KIST-developed processes as a new artificial diet for silkworms, a polyester film synthesizing process, and a newly developed chemical fertilizer.

BENEFITS:

The benefits accruing to Korea as a result of the establishment of KIST have been considerable. KIST has developed a variety of products which have resulted in significant import substitution. For example, in the early years of KIST's life, Korea imported 100 percent of its industrial requirements for copper, --- an expensive commodity. KIST scientists developed a copper-plated wire which proved to be as efficient as solid copper wire, thereby considerably reducing import requirements. Later, KIST developed a tuberculosis medication by synthesis, resulting in the total import substitution of nearly $1 million of foreign produced drugs annually. KIST has also developed a wide assortment of new products for export, as well as for domestic consumption.

KIST recruitment practices over the years has resulted in the repatriation of hundreds of Korean-born scientists and engineers from abroad, a not insignificant benefit for any developing country. KIST staff now numbers nearly 1,500, of whom half are professional scientists and engineers, staffing some 50 laboratories covering virtually the entire spectrum of modern industrial technology.

KIST research and analysis concerning the appropriateness of imported technologies, as well as its comprehensive surveying of local industry capacities, have provided a mechanism for considerable technological "leap-frogging." More broadly, KIST achievements have led ultimately to increases in employment and productivity in the industrial sector; to improvement of services within the government infrastructure; and to the establishment of vastly improved communications and cooperation between the research institutes, universities, the government and the private sector. Such important end-products and collateral effects have profoundly modified for the better the lives of a great number of people throughout the Republic.

Finally, a KIST-like institution can act as an "acting mother" for additional fledgling institutes --- until they become viable --- with the recipient thereby taking advantage of the mother institute's already established facilities and staff development. KIST has "mothered" a number of newly-formed institutions, including the Korea Ocean Research and Development Institute (KORDI), the Solar Energy Research Institute (SERI), and the Regional Development Research Institute (RDRI).

COST AND COST EFFECTIVENESS:

The total initial cost of buildings, equipment, staff recruitment, training, and endowment fund totaled $24.1 million. Of this amount, U.S. AID provided $9.2 in dollars, including $7.2 in grants and $2 million in development loan funds. Another $12.2 million was supplied from "counterpart funds" and the ROKG provided the balance of $2.7 in the form of land and subsidies. AID's budgetary inputs to the establishment of KIST actually extended over a period of five years, involving FY 1966 through FY 1970 allocations. Counterpart Fund allocations were spread out over a period extending to FY 1973.

At the beginning of the KIST project, Battelle Memorial Institute consultants estimated that KIST would need financial assistance for 5-10 years, pointing out from their own experience that the Battelle laboratory at Columbus, Ohio took nine years to reach the break-even point. Indeed, AID dollar support was not required after FY 70 and KIST has been virtually self-sufficient since the expiration of AID dollar and counterpart fund support. In fact, the ROKG has never earmarked national budget funds for KIST as a "line-item" allocation. They do however insure an annual appropriation to support all ROKG agency-sponsored research contracts at KIST.

It is difficult to quantify precisely the cost effectiveness of KIST's activities in support of the phenomenal industrialization process which has taken place in

Korea. However, KIST's outstanding accomplishments over the years, and its demonstrated acceptance and utilization by the industrial sector, are ample evidence that the inputs have indeed yielded considerable benefits to the Korean economy.

Some significant evidence of cost effectiveness can be shown by the numerous examples of import substitution and new product development resulting from KIST initiatives. The cases of the copper-coated wire and the anti-tuberculosis drug development were cited in the "Benefits" section of this paper. There are of course others. K-TAC, for example, established a ceramics manufacturing plant, introducing a KIST-developed innovation (refractory saggar technology), which resulted in a higher quality product at a lower cost. This innovation enabled the company to export products valued at $400,000 the first year, as well as to satisfy a domestic demand to the extent that import substitution amounted to $3 million annually thereafter.

In the mid-1970's, KIST developed a carbon fluoride process, by applying U.S. technology to local production and using an abundant local mineral - fluorite. K-TAC built a pilot plant capable of five tons per month production. After demonstrating the feasibility of mass production, KIST/K-TAC provided technical advice to a private commercial firm to build a 2,000 ton/year capacity plant. This significant development resulted in import substitution valued at $4 million per year on this one item alone.

In early 1970, KIST developed a new model, pocket-size calculator. This product was commercialized and first exported to the U.S. in 1972. By 1975, exports of this item to the U.S. were valued at $10 million.

There are hundreds of examples of new product development by KIST, and of successful product commercialization by K-TAC. During the first five years of operation, KIST estimates that its R&D contributed about $20 million to the Korean economy in direct benefits alone.

Perhaps the best overall measures of KIST's cost-effectiveness are found in two specific areas. First, KIST has demonstrated its ability to select U.S. and other developed country technology; to realize that Korea is different; and, to realistically adapt this technology to Korean needs. Second, KIST has demonstrated its outstanding responsiveness to the needs of the industrial sector and that entrepreneurs are eagerly willing to pay for KIST research and development activities. The bottom-line is that KIST pays its own way through endowment fund investment earnings, research contract earnings, and commercialization sales; and, that it has the capacity to absorb high technology and adapt it to the Korean industrial sector needs.

LESSONS LEARNED:

If one accepts either or both of the often espoused theories that "economic development" actually means "industrialization," and that " . . . technology transfer is

a necessary ingredient in the development process," it would be difficult to argue that the Republic of Korea has not benefitted tremendously from the establishment of KIST.

An examination of those LDC's in the Asia region which have achieved the most enviable rates of economic development (Taiwan, Korea, Singapore, Hong Kong) lends credibility to the theory that "economic development" does in fact actually mean "industrialization." Of course, "industrialization" is not new --- as a priority in the development process --- however, " . . . less significance has been placed upon the need for industrial research in the country where industrialization has been chosen as the economy's prime mover. 2/ Research is of utmost importance to keep abreast of shifting international patterns in the export market place, as well as changing methodologies and techniques in manufacturing. And, while there may be concensus in the donor community that technology transfer is a necessary ingredient in the development process, --- there needs to be a priority concern for the appropriateness of the quality and the quantity of the technology being transferred.

In the view of the author of this paper, the most important "lessons learned" in the implementation of KIST, with respect to AID assistance, were:

1. A total, uncompromised commitment to the institution building process on the part of both the donor and recipient (USG/ROKG).

2. A willingness on the part of AID to adequately (actually "generously") fund the project over a long enough period to insure institutional viability.

3. The insistance by donor planners that the proposed institute have maximum autonomy.

4. The foresight of planners to negotiate a contract with a first-rate, world-renowned, scientific research institute (Battelle) to provide major across-the-board services, including planning, consulting, training, organizing and implementing of KIST.

5. The utilization by AID of a valuable national resource (National Academy of Sciences) to provide continuing advice and assistance in the development of KIST.

2/ "Industrial Research in the Industrialization of a LDC," Hyung-Sup CHOI, Ph.D. Proceedings of a World Congress, June 10-12, 1975, Ester Park, Colorado

Throughout the literature on the subject of establishing industrial research institutes in developing countries, authors universally stress the importance of autonomy. Blackledge 3/ found that there was little incentive for government institutes, managed by civil service personnel, to actively seek contract research support, since the money generated, in most instances, legally reverted to the national treasury. Autonomous institutes can utilize some of these funds for incentive payments to staff, for facilities upgrading, for staff training, etc. Numerous studies have shown that major problems inherent in the process of interaction between the industrial research institute and the clients in many countries have to do with low civil services salaries, limited training opportunities, and inequitable reward systems for meritorious performance. KIST autonomy has permitted it to avoid these problems. Bass 4/ reinforced the importance of autonomy, following a comprehensive study of the problems of industrial research institutes in developing countries, by concluding that it was ideal for these institutions to be " . . . autonomous multipurpose organizations."

In summary, it appears that the U.S. and Korean planners performed magnificently in anticipating potential problems in the establishment and operation of an industrial research institute. It is unclear if there was significant literature available at that time or if the U.S. AID, Battelle and NAS planners and their Korean colleagues were able to gain these insights as a result of the intensive pre-project development surveys of local industry to determine industry research and technology transfer needs.

Whatever the case, the combination of autonomy; the decision to give high priority to research contracting; the assignment of KIST as the conduit for the transfer of higher technology; the involvement of Battelle and NAS; the dedication of both governments to building a first-rate, self-supporting institute; and, the provision of adequate funding over an appropriate period of time, appear to have precluded the development of most of the problems which developing country industrial research institutes have experienced.

OTHER TECHNICAL INSTITUTES IN ASIA - ADAPTING TO THE KIST MODEL:

Before discussing other technical institutes in Asia and the potential use of KIST as a model for use in other countries, it is necessary to give the reader a basis for understanding what it was about KIST that set this remarkably successful institute apart from most, perhaps all, other technical institutes of its kind.

Since the writer is not a technical expert in this area, it is fortunate that an AID-financed comprehensive analysis of industrial research institutes in developing countries has previously been accomplished. 5/

3/ The Role of the Research Institute in Industrial Growth. James Blackledge, Denver Research Institute, 1972.

4/ "The Role of Technologic Institutes in Industrial Development." Lawrence W. Bass, World Development, Vol. 1, No. 10, Oct. 1973.

5/ "The Industrial Research Institute in a Developing Country: A Comparative Analysis" submitted to AID/TAB/OST, by James P. Blackledge, DRI; 1975.

In addition, AID has also financed a Denver Research Institute program " . . . to assist industrial research institutes in developing countries to become more useful and relevant . . . and thus contribute more effectively to industrial development in their country." 6/

The following is quoted from the "Introduction" of the official report of this latter activity, in order to more fully comprehend KIST's uniqueness:

> "Nearly every developing country in the world has one or more technological institutes, most of which were established some 15 to 20 years ago with guidance, financial assistance and expertise provided by the United Nations. (The notable exception is the creation of the Korea Institute of Technology--KIST--with assistance from the U. S. Agency for International Development.) U.N. assistance was, in nearly every instance, for limited periods of time, after which the technological institute's government, public enterprise and the private sectors were expected to utilize the services of the institute and provide adequate financial support. The developing country governments appeared to have a genuine interest in making available, to public and private enterprise, technical assistance, research and development, trouble-shooting and-problem solving, and analyses, tests, and development of standards for industrial products.
>
> In reality, the majority of such institutes, which, in nearly every case, are civil service organizations attached to a ministry of industry or some equivalent government entity, have been largely ignored by their governments and, with few exceptions, have tended to do internal research of personal interest to the research staff member, or to replicate research which has already been done elsewhere. During the course of a two-year extensive study conducted by Blackledge, with financial support from USAID (Contract No. AID/csd-3316), approximately 60 technological institutes in 30 developing countries were evaluated to ascertain the extent of interaction between these institutes, government entities, universities, public enterprise and the public sector.
>
> The results of this comparative analysis were clear. In the majority of the institutes evaluated, little or no interaction was occurring with the private sector. The government entities (planning, industrial development, science councils, etc.) tended to regard their technological institutes as "ivory towers" dedicated to basic research and thus of little value as contributors to the country's industrial growth and economic development. The research staffs of the institutes, with no motivation or mandate to seek industrial problems, thus gained no experience in identification of

6/ "Methodologies for Strengthening Industrial Research Institutes" submitted to AID/TAB/OST, by DRI, 1976.

such problems and doing the applied research and development necessary to solve these problems. In nearly every case, senior institute management was not consulted or involved in development of the country's development plan.

It was apparent that these LDC institutes required technical assistance and management guidance. It seemed equally clear that the concept of providing experts, as individuals representing themselves (and the U.N.) and who would probably not return again to the same institute, did not provide the continuity, the opportunity for frequent follow-up, the diversity of expertise available quickly, and the many other resources which could be supplied through a linkage between the LDC IRI and an experienced U. S. contract research institute."

Blackledge's comparative analysis included a study of several Asia region industrial research institutes and a discussion of some of their weaknesses. In some cases, early institutional problems have been solved, as with Singapore's Institute of Standards and Industrial Research (SISIR). Others have not lived up to original expectations that they would participate significantly in the continuing economic development of their countries.

The following is a representative listing of Asia region industrial research institutes (from Blackledge):

SINGAPORE INSTITUTE OF STANDARDS AND INDUSTRIAL RESEARCH (SISIR)

Established in 1969 and now considered to be one of the finest industrial research institutes (IRI) in the world. SISIR's original objective was to undertake research which would lead to the development of new industries in Singapore. However, entrepreneurs were not ready to exploit SISIR research and the institute floundered for several years. In 1968, SISIR initiated a policy of establishing close communications and interaction with private industry, exploring their shifting technology requirements and surveying the market place, domestic and international. (A KIST initiative from its beginning.) From that point on, SISIR has been an effective force in the industrialization of Singapore.

NATIONAL INSTITUTE FOR SCIENTIFIC AND INDUSTRIAL RESEARCH(NISIR), MALAYSIA

Originally intended to be a multipurpose research and development institute, but vested interests of other specialty institutions interfered. Consequently, there has been wasteful overlap of research activity and bureaucratic problems associated with the civil service system. NISIR has good interchange with industry but recovers only 5-10 percent of costs from contracts, therefore government costs are high, and government (bureaucrats) can meddle in the institutes plans.

METALS INDUSTRY RESEARCH AND DEVELOPMENT CENTER (MIRDC), PHILIPPINES

Established in 1966, MIRDC has a high degree of autonomy, despite having four government representatives on a seven-man governing board. MIRDC has an active program for developing contracts with industry and makes frequent staff visits to individual plants. Contract fees are deposited in a MIDC-managed revolving fund and can be used for incentive payments to staff, etc. MIDC closely models KIST in many respects but does not have the multipurpose capacities of KIST.

THE NATIONAL CENTER FOR RESEARCH, SCIENCE AND TECHNOLOGY AT PUSPIPTEK, INDONESIA

Puspiptek is a major R&D institution with a wide range of activities, including developing test and measurement instrumentalities and capabilities, developing domestic nuclear technology, storing and maintaining national units of measurement, and carrying out R&D activities in electronics, telecommuncations, machineries, processing, etc. Puspiptek does not have a strong orientation toward industrial research and lacks interchange with local industry. Its governing board is appointed by the Minister of Science and Technology and it therefore has little autonomy.

PAKISTAN COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH (PCSIR)

Founded in 1953, and achieving its present statutory status in 1973, PCSIR is the largest technological organization in Pakistan. Although calling itself autonomous, it is controlled and financed by the government. PCSIR has increased its services to industry steadily since 1965; however, industry pays very little of the total cost. PCSIR's most serious problem is its salary scale, which is much lower than the private sector. Consequently, many of the institute's most talented staff are lured away. At a 1976 Workshop on Science and Technology Policy in Pakistan, jointly sponsored by the Ministry of Science and Technology and the U.S. BOSTID/NAS, it was determined that the industrial research sector in Pakistan involved a number of Federal Laboratories, with considerable weaknesses in staff and facilities. The Workshop concluded that there was significant wasteful overlap of research activities and recommended that " . . . it is essential that their activities should cover the broad spectrum from basic research to pilot-plant activities and guidance for industrial commercialization." (Similar, presumably, to KIST's method of operation.)

COUNCIL OF SCIENTIFIC INDUSTRIAL RESEARCH (CSIR), INDIA

Founded in 1942 with the objective of promoting science and its application for national development, SCIR was attached to the Department of Science and Technology of the Ministry of Planning in 1971, to more closely introduce science and technology into national economic planning. SCIR's entire budget is financed by the government and any money generated from patents, testing, etc. are returned to the national budget. India's science and technology system, though often exalted, appears to suffer from the civil service domination and lack of KIST-like autonomy. In a

self-assessment by India's own National Steering Committee on Science and Technology in 1979, the Committee concluded that when the system was entrusted with a clear-cut mission and backed up with requisite facilities and funds, it has invariably accomplished its mission; however, " . . . there is non-uniformity and unevenness in this growth of the system, and . . . sufficient attention has not been paid to technology delivery and extension services." Further the assessment concluded that the system had concentrated on developed-country technologies wihtout considering the appropriateness of such technologies for development.

APPLIED SCIENTIFIC RESEARCH CORPORATION OF THAILAND (ASRCT)

Established in 1963 and in operation in 1964, ASRCT is the main center for government research. Although touted to be an autonomous governmental applied science corporation, its board is appointed by the Cabinet, and there is little incentive for contract research, as fees received from projects go to a special fund managed by ASRCT's Governor (Chairman of the Board). Contract research generates only a small percentage of total financing. In addition, there is no project budget so that it is difficult to budget money specifically to research for industry.

Some ASRCT research results are considered by analysts to be economically significant. Most important benefit appears to be ASRCT's stimulus to other research groups. While staff salaries are one and one-half times that of civil service, ASRCT continues to have recruitment problems because of a lack of fringe benefit packages.

CONCLUSION:

A review of available literature on industrial research institutes in developing countries reveals quite clearly that most of these institutes have experienced considerable problems in their quest to contribute significantly to the economic development of their countries.

The literature also reveals that many of these problems stemmed from the fact that the institutes either lacked real autonomy, --- were not permitted to be involved in the national development planning process, --- were not given full responsibility for technology transfer and adaptation, --- did not maintain a vigorous program to interact with local industry, --- or, did not maintain a high-intensity "linkage" with a developed country research institute.

Rather by design through careful planning, by good fortune, or by a combination of both, KIST appears to have avoided most of the implementation and operational problems experienced by other developing country institutes of its kind. The fact remains, KIST is a highly effective and productive research institute. It has been blessed by having been established as a truly autonomous institute, with strong Korean-U.S. Government support, and generous funding throughout its formative years to build, equip and staff a first-rate facility.

There does not appear to be another research institute in AID-assisted Asia countries which fully approximates KIST. Some do extremely useful and productive research, but most have significant problems, often associated with a lack of true autonomy. It appears wholly feasible to utilize KIST as a model to improve the operation of research institutes in other developing countries.

In exploring specific opportunities, it is suggested that a Country Study Team could be assembled to analyze a developing country's industrial research capabilities and to devise a plan of action to restructure the system in conformity with a KIST-like operation. Ideally, such a team would include representatives from KIST; the Battelle Memorial Institute; The Board of Science and Technology for International Development, National Academy of Sciences; U.S. AID's Office of Science and Technology; and, of course, the host country concerned. The team should most certainly include Dr. James Blackledge or one of his colleagues at the Denver Research Institute.

The individual country study groups should require relatively modest financing and could perhaps be tasked and funded under the terms of AID's new 5-year grant to BOSTID/NAS/NSC ($36 million).

WEPaupe:sb:5/19/81

KIST

17 NOV 1981

INFORMATION MEMORANDUM FOR THE ACTING ADMINISTRATOR

THRU : ES

FROM : AA/ASIA, Jon D. Holstine J.D.H.

SUBJECT: The Korea Institute of Science & Technology (KIST) A Preliminary Proposal for Developing a KIST-Model Technology Transfer Project.

Background:

During my years of service on the staff of the House Foreign Affairs Committee, I had the opportunity to visit the Republic of Korea on several occasions, and to become familiar with the organization and operation of the Korea Institute of Science and Technology (KIST).

KIST is an impressive institution and is recognized throughout much of the international science and technology community as possibly the most successful facility of its kind in the developing world.

Consequently, after assuming my present position, it occurred to me that KIST's outstanding record of accomplishment and its unique character might provide the opportunity for the Agency to examine KIST as a model for potential application in other AID-assisted developing countries.

Discussion:

Following up on my initial thoughts regarding the possibility of taking maximum advantage of our experiences with the development and operation of KIST, I asked Bill Paupe, former AID Representative in Korea, who directed the final phase-down and closeout of the U.S. AID Mission to Korea, to prepare an analysis of KIST as a possible technology transfer vehicle for application in other AID-assisted countries.

Paupe's long-time personal involvement in the operation of KIST provided the Asia Bureau with a unique insight to

16

investigate available studies and analyses of other developing country industrial research institutes; and, the opportunity to make recommendations as to how AID might best utilize our experiences to enhance institutional development and technology transfer/adaptation in other AID-assisted developing countries.

Paupe's report (ATTACHMENT A) demonstrated to my satisfaction that KIST is indeed a unique and highly effective development instrument. Over the years, this institution has demonstrated an outstanding ability to adapt higher levels of imported technology to Korean industrial requirements, and has established an enviable record of remaining responsive to the changing needs of the indigenous private enterprise sector. The Report has documented the benefits accruing to Korea as a result of the establishment of KIST. Firstly, the successful economic development process accomplished in Korea was significantly enhanced by the ROK government's giving high priority and incentives to the development of the private industrial sector, and its unqualified support of KIST activites. Secondly, KIST has demonstrated continuously its outstanding responsiveness to the needs of the industrial sector and entrepreneurs are eagerly willing to pay for KIST research and development services. Finally, KIST pays its own way! It does not require annual national budget allocations to support its operations.

Comparative analyses of other developing country industrial research institutions by respected authorities (Denver Research Institute, Battelle Memorial Laboratories, etc.) have revealed that most of those institutions have significant weaknesses, which has restricted their ability to make significant contributions to the economic development progress of their countries. The literature also reveals that many of the problems being experienced by these institutions were either avoided by KIST through careful planning, or were eliminated early in KIST's development by discriminate research and good management practices.

Conclusion:

The fact remains that KIST is a highly productive and effective industrial research institution. It appears wholly feasible that AID, in consort with other appropriate organizations, might utilize KIST as a model to improve the operation of research institutions in other AID-assisted developing countries.

17

As a follow-on to Paupe's report, the Asia Bureau convened a meeting on September 9 to discuss our proposal to initiate a KIST-model transfer project. This meeting was attended by representatives of AID's Bureaus for Science and Technology and Private Enterprise Development, the Office of the Science Advisor, Asia Bureau offices, and the National Academy of Science's Board of Science and Technology for International Development (NAS/BOSTID). From this meeting, it was determined that the proposed project's principal objectives should be:

--- to examine KIST technology and methodologies,

--- to identify industrial research institution problems in AID-assisted countries, and

--- to design appropriate KIST-model technology/methodology assistance schemes.

It was further determined that the most attractive course of action in carrying out this project activity would be to request S&T Bureau consideration and approval for tasking the NAS/BOSTID, under its current grant from AID, to design an appropriate project proposal.

At this date, NAS/BOSTID is engaged in the preparation of an initial project design which will include a methodology for convening an international meeting to provide a forum for targeted countries to present a case study analysis of their country's industrial research problems. BOSTID will submit their recommendations to the S&T Bureau Project Manager for the NAS/BOSTID grant.

The purpose of this memorandum is to alert you to our initiatives in promoting technology transfer and infrastructure building schemes in the indigenous private enterprise sector.

Drafted:WEPaupe:alh:11/17/81

18