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State power and public R & D in Korea: A case study of the Korea Institute of Science and Technology

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STATE POWER AND PUBLIC R & D IN KOREA

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ABSTRACT

Government-led R & D is a prominent characteristic of South Korean (hereafter refer to Korea) development. Korea's state-led model of R & D and the workings of government-financed strategic R & D institutions in the past two and a half decades suggest the need for a close look at the dynamics of state power and local R & D in rapidly industrializing countries.

From a comparative policy analysis perspective, this study centered on why and how the Korean government pursued policies of strategic R & D institution-building, what are the performances of public R & D, and what constraints are there and why? These questions are examined through a case study of the Korea Institute of Science & Technology (KIST), the prototype for Korea's government-financed R & D centers for industrial technology and other think-tanks.

The central thesis of this dissertation is that policy environment variables exert a great influence on the workings of public R & D in Korea. The environment variables in this study are operationalized as Korea's bureaucratic-authoritarian political system, industrialization policies, and global systems of technology transfer and vertical production arrangements.

The KIST case affirms that local industry's choice of technology has been affected by the government's industrialization policies of export-promotion and technology

transfer, as well as TNC power over the international circulation of technology. This situation has contributed to weakening KIST-industry linkage. President Park Chung-Hee empowered scientists to accomplish his regime's "fundamental policy" goal of industrialization, and also to enhance his political legitimacy in domestic politics. This certainly was an important latent function of public R & D in Korea. Presidential power (both overt and implied) was involved in resolving conflicts of interest which arose between KIST-developed technology vis-a-vis TNC technology, and functioned as leverage against TNCs to protect domestic R & D. The nature of government intervention in R & D in this study clearly indicates that the Korean model of government intervention in R & D goes beyond "promotional" to being "directive" in nature.

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LIST OF ABBREVIATIONS

AAKIST	Assistant Act for the Korea Institute of Science and Technology
AERI	The Atomic Energy Research Institute
BMI	Battelle Memorial Institute, Columbus, Ohio, U. S. A.
BOT	Board of Trustees, KIST
CAPMIT	Center for Policy Alternatives, Massachusetts Institute of Technology, U. S. A.
CGI	Capital goods import
CSTP	Center for Science and Technology Policy-KIST affiliated
DFI	Direct foreign investment
DPRK	Democratic People's Republic of Korea
EPB	Economic Planning Board, Rep. of Korea
ESPL	Engineering Service Promotion Law
FCIDC	The Foreign Capital Inducement Deliberation
FCIL	The Foreign Capital Inducement Law Committee
FECNA	Finance and Economy Committee, National Assembly, Rep. of Korea
FFEDP	The First Five-Year Economic Development Plan
FFPTD	The First Five-Year Plan for Technical Development
FL	Foreign licensing
FRS	Forest Research Station
ICA	International Cooperation Administration, U. S. A.
KAIS	Korea Advanced Institute of Science, currently KAIST
KAIST	Korea Advanced Institute of Science & Technology
KCCI	Korea Chamber of Commerce & Industry
KCGF	Korea Credit Guarantee Fund
KDFC	Korea Development Finance Corporation
KDI	Korea Development Institute
KIST	Korea Institute of Science and Technology
KISTAI	Korea Institute of Science and Technology Articles of Incorporation
KORSTIC	Korea Scientific & Technological Information Center
KOSEF	Korea Science & Engineering Foundation
K-TAC	Korea Technology Development Corporation
MAF	Ministry of Agriculture and Fisheries, Rep. of Korea
MHS	Ministry of Health and Social Affairs, Rep. of Korea
MCI	Ministry of Commerce and Industry, Rep. of Korea
MOC	Ministry of Construction, Rep. of Korea
MOE	Ministry of Education, Rep. of Korea
MOF	Ministry of Finance, Rep. of Korea
MOR	Ministry of Reconstruction, Rep. of Korea
MOST	Ministry of Science and Technology, Rep. of Kroea

MTI	Ministry of Trade and Industry (formerly, Ministry of Commerce and Industry), Rep. of Korea
NIRI	The National Industrial Research Institute
NSF	The National Science Foundation, U. S. A.
OPC	Office of Planning and Coordination, EPB
PDD	The Project Development Department, KIST
POSCO	The Pohand Iron and Steel Company
RBD	Reverse brain drain
RDA	Rural Development Agency
RIMM	The Research Institute of Mining and Metallurgy
SERI	The System Engineering Research Institute-KIST affiliated
TC	Technical consultancy
TDFKDB	Technology Development Fund of the Korea
TDFL	Technology Development Promotion Law Development Bank
TESKIP	Technical Economic Survey of Korean Industries Project of KIST
TID	The Technical Information Department, KIST
TMD	The Technical Management Division, EPB
TTCKIST	The Technology Transfer Center, KIST
USAID	United States Agency for International Development
W	Won (the Korean currency)

*In Korea the surname appears first followed by given names. However, given popular usage in the West some Korean names are better known by names following Western system such as Syung Man Rhee and Hahn-Been Lee.

CHAPTER ONE

INTRODUCTION

Objectives of Research

This study analyzes the Korean government's[1] technology policy towards public sector research and development (hereafter referred to as public R & D policy).[2] The analysis is primarily based upon a series of Korean government policy decisions concerning the creation of and support for the Korea Institute of Science and technology (KIST)[3] as the central component of institutionalized public R & D in Korea with the mission for solving local industry's technological problems.

The objective of the study is to understand the politics of Korea involved in technology development issues. Specifically, the study aims to analyze: 1) the degree and nature of government's involvement in technology development; 2) the technology policy-making and implementation structure of Korea; 3) the manifest as well as latent functions of public R & D; and 4) the importance of Korea's economic policies as well as international technology transfer to the workings of a public R & D institution.

Rationale of the Study

Only during the past few decades have studies of technological development in the developing countries begun to receive attention from social scientists. This emerging trend seems to stem from a realization of the inseparable, crucial relationship between technology and national development.[4] This realization acknowledges the conventional economic wisdom that technology serves as a potential contribution to aggregate economic growth and, in addition, notes technology's effect upon the distribution of wealth and power among different members of a given society. Furthermore, observations of international technology transfer from the industrialized countries to the developing regions during the past decades have led social scientists to transcend preoccupation with national boundaries and investigate just how technology has manifested itself as a potential source of power in world politics today and just what impacts, both beneficial and adverse, has it had on the national autonomy of the developing countries.[5] The increasing interest of social scientists in the technological issue truly requires a reconceptualization of the meaning of political power which includes human knowledge (i. e., technology). Indeed, the study of technology helps us to understand the politics of power.

In addition to academicians, there have been growing concerns over the technological development issue among practitioners in the political arena around the world. This stems from the realization that the economic development strategy of industrialization (often defined as development _per se_) requires a considerable commitment to modern science-based technology. The costly product of organized R & D often accompanies heavy capitalization. Particularly, to most developing countries pursuing industrialization, the technological vacuum in the local industrial sector has been viewed by many policy-makers as a serious obstacle in their early industrialization efforts. This has led the governments of many developing countries to intervene directly in the planning of science & technology (S & T). Technology policy for the creation and support of public institutions in R & D became an important element in this planning framework. The government intervention in R & D in many developing countries does not stem from the ideological inclination for the advocacy of a socialist conception of the planned economy. Rather, it has been justified by developing country policy-makers in the name of efficiency in R & D: Through the planning of S & T by the national government, policy-makers expected maximum returns from R & D.[6] Public R & D was valued not only for the potential contribution to the enhancement of local technological capacity *per se*, but also, or perhaps far more importantly, as an effective means to accelerate industrialization.

Indeed, institutionalization of public R & D was a global catch phrase in the 1960s.[7] It has received high priority in various policy agendas of many developing countries, and great amounts of national resources have been used to create national R & D centers. The worldwide campaign, in addition to the demonstration effect of institutionalized R & D in the industrialized countries, seemed to have provided a great deal of confidence for policy-makers in many developing countries in terms of politically justifying the building up of infrastructures for public R & D systems.

But the creation of a few national R & D centers in itself may not serve as a powerful indicator of technological development. Despite the existence of national R & D centers, a weak, indigenous, technological capacity continues to be a serious problem common to developing countries and technological dependence[8] became an issue in the global political debate in past decades. Analyses of public R & D institutions in developing countries in fact have created skepticism among many observers. Charles Cooper, a leading scholar in this field points out that

> ...local (public) R & D and other scientific activities are more or less "shut out" of the productive sectors or at least play a strictly circumscribed role.9

A policy analyst should ask <u>why</u> public R & D institutions in developing countries perform disappointing research, and <u>if</u> their performances are unsatisfactory then <u>why</u> does the developing country government still pursue such a policy? In the Korean context, how informative is the developing countries' general experience in public R & D to the analysis of Korea's public R & D institutions? As yet, these questions have not received adequate attention from policy analysts as a primary research focus in the political science discipline. This study attempts to answer these questions through a case study of KIST. From the academic standpoint, investigation of such questions is very important for a number of reasons. Before turning to that issue, however, it may be proper to present an overview of Korea's public R & D system first.

Public R & D Policy in Korea: An Overview

As in other developing countries, the Korean government began to build up an R & D infrastructure in the mid-1960s,[10] and this policy is likely to be pursued even more vigorously in the 1990s. The past decades witnessed a phenomenal growth in R & D sector. As Table 1.1 shows, R & D investment has been in steady increase, from $9.5 million in 1963 (0.24% of GNP) to $3,870.8 million in 1988 (2.1% of GNP).[11] Private sector R & D in particular has expanded dramatically in the 1980s and accounted for 74% of Korea's total R & D investments in 1988. And yet, the table clearly indicates that Korea's R & D was a state-initiated activity. R & D organizations have also mushroomed, as shown in Table 1.2, from a total of 319 in 1972 to 2,821 in 1988 with research manpower capacity of a total of 5,599 to 56,545 in respective years. The number of R & D institutions grew almost nine times during 1972-1988 period. By 1980, public sector R & D institutes[12] alone account for a

Table 1.1

R & D Investment in Korea

Unit: Million US$.

	'63	'70	'80	'86	'88
R & D Investment:	9.5	40.5	480	1,768	3,870.8
Government Sector	9.2	31.0	325	460	988.4
Private Sector	0.3	9.5	155	1,300	2,882.4
Proportion of GNP (%)	0.24	0.48	0.86	1.99	2.10
Ratio (Gov't:Private)	97:3	77:23	68:32	26:74	26:74

Source: Ministry of Science & Technology, and the Korea Engineering Foundation data (Daeduk, Korea, 1990).

little over 30% (196) of the total number of R & D institutions, 44% of the total number of researchers, and in particular, houses 50% (1,877) of a total of 3,417 Ph.D. holders engaged in the nation's R & D system. Among these public R & D institutes, those which are accommodated in the Seoul Science Park (SSP) and the Daeduck Science Town (DST), the S & T complexes specially created by the Korean government in 1969 and 1974 respectively, have special meaning for Korea's public R & D for a number of reasons.

First, as Table 1.3 shows, these institutes were created by the Park Chung-Hee regime (1961-1979) when it launched nation-wide, massive industrialization in the early

Table 1.2

R & D Institutes by Organization and Manpower

Org. by nature	# of Institutes			# of Researchers[a]		
	1972	1980	1988	1972	1980	1988
Public	120	124	163	2,703	4,598	9,581
Govt. & Public	92	101	84	-	2,190	-
Non-Profit Org.	28	23	79	-	2,408	-
Univ. & College	66	202	1,025	1,747	8,695	18,665
Govt. & Public	27	72	321	-	3,598	-
Private	39	130	704	-	5,097	-
Companies	133	321	1,633	1,149	5,141	28,299
Total	319	647	2,821	5,599	18,434	56,545

Note: a. Refers to professional level researchers only. Thus, it excludes assistant level researchers and other supporting personnel, both in technical/engineering and administrative fields.

Source: MOST, _'88 Kwahak Kisul Nyungam (Science & Technology Annual 1988_ (Seoul: MOST, 1989), pp. 378-415; MOST, _'89 Kwahak Kisul Nyungam (Science & Technology Annual 1989)_ (Seoul: MOST, 1990), p. 446 & 451; and MOST, _Kwahak Kisul Nyungam 1981 (Science & Technology Annual 1981)_ (Seoul: MOST, 1982), P. 300.

Table 1.3

Strategic Public R & D Institutes in Korea[a]

As of 1980

Name of Institute (Acronym)	Year Established	location	Control-Ministry
Korea Scientific & Technological Information Center (KORSTIC)	1962	SSP[b]	MOST
Korea Institute of Science & Technology (KIST)	1966	SSP	MOST
Korea Advanced Institute of Science (KAIS)	1971	SSP	MOST
Korea Ocean Research & Development Institute (KORDI)	1973	DST	MOST
Korea Atomic Energy Research Institute (KAERI)	1973	SSP	MOST
Korea Standards Research Institute (KSRI)	1975	DST	MCI
Korea Institute of Electronic Technology (KIET)	1976	DST	MCI
Korea Institute of Machinery & Metals (KIMM)	1976	DST	MCI
Korea Research Institute of Chemical Technology (KRICT)	1977	DST	MCI
Korea Research Institute of Ships (KRIS)	1977	DST	MCI

Notes: a. In addition to those 10 strategic R & D institutes listed in the table, six more institutes are publicly endowed under the administrative aegis of the Ministries of Energy (3), Finance (2), and Communications (1).

b. In addition to KORSTIC, KIST, KAIS, and KAERI, SSP houses two other research institutes: Agency for Defense Develop-ment for military R & D and the Korea Development Institute (KDI), a think-tank specializing the nation's economic development plans.

Source: MOST, Science & Technology Annual 1980.

1960s. As the names of these institutes by themselves reveal, they are mission-oriented research institutes, and were set up by the Korean government in selected industrial fields perceived by policy-makers at that time as strategically important to Korea's industrialization process. Second, with the heavy investment of national resources such as capital, land, and manpower, these strategic institutes received primary attention from the Korean government. Korea's public R & D policy is by another name a policy for the development of these strategic institutes. From the perspective of R & D spending by the government alone, support to them is remarkable. During the 1975-1979 period, the Korean government's support increased from 7.5 billion Won to approximately 16 billion Won. In the 4th Five Year Economic Plan (1977-1981), about 70% of total national R & D expenditures was budgeted for these institutes.[13] The concentration of the nation's budget on public R & D institutes continued in the 1980s. During the 1983-1988 period, on average 55.7% of the nation's S & T budget was allocated for public R & D institutions. Government supports are likely to be accelerated in the coming decades. A new Korean government's plan is to invest $1.12 billion (of which about 25% will be funded by government and the remainder provided by local businesses) to build a high-tech "technopolis" (a city of science, technology and culture) with "internationally recognizable quality" in DST by 1992.

The research town would be the first of its kind in the country and will house 50 R & D centers of both public and private sectors. As of June, 1990, 15 government-sponsored and 3 private R & D institutions had moved into DST.[14]

Thirdly, these institutes have received special privileges from the government. Although they were created with public funds, they are not structured within the government organizational chart. As independent from the government, their organizations are defined as non-profit, contract research institutes which are modeled after the R & D institutes in industrialized countries of the West. This particular organizational form placed a great deal of managerial and research autonomy in the hands of the institutes themselves. This practice continued until 1981 when President Chun Doo-Whan consolidated the nation's public R & D system in the name of social and economic streamlining. A total of sixteen publicly endowed R & D institutions were forced to merge into nine "new" institutions.[15] During the Chun era (1980-1987), government control of such strategic R & D institutes increased whereas those R & D centers' institutional autonomy suffered. Since Roh Tae-Woo came into power in 1988, a series of restructurings of such R & D institutes have taken place, resulting in another merger and "break up" among institutes. KIST regained its organizational independence back in 1989. The Roh regime also showed signs of improvement by allowing more institutional autonomy to those R & D centers, more autonomy than the Chun regime, but still far less than what the Park regime allowed. As such, publicly endowed R & D centers were targets of political manipulation in the 1980s, but they still constitute the core element of Korea's public sector R & D system receiving favorable policy benefits (i. e., budget).

On the other hand, personnel in such strategic institutes are not subject to the civil servant salary scale, which is far lower than that of employees in the non-public sector. When KIST was set up with these privileges in the mid-1960s (Chapter four), it was a revolutionary approach by Korean standards in the management of the public sector economy and evoked heated, and controversial debates.

Among these strategic R & D institutes, KIST received special attention from the Korean government as the central component of institutionalized public R & D in Korea. The importance of KIST in Korea's R & D system lies in several areas. First of all, KIST is the first contract research institute for industrial technologies of its kind in Korea where concepts such as "R & D," or "contract research" were new to most entrepreneurs and policy-makers, not to mention ordinary citizens. Significantly, KIST's birth took place in the early phase of Korea's industrialization, and KIST's development informs us of the relationship between technology and Korea's economic development.

Secondly, KIST is publicly-sponsored, and as President Park's first project in the S & T area, it received special attention from him. The analysis of KIST thus provides us with valuable information about why and how the state has expanded its role in the S & T area, and Korea's S & T policy processes. In fact, the cabinet-level national S & T planning body, the Ministry of Science and Technology (MOST) was created in 1967, a year after the birth of KIST. The political implications of KIST will be fully discussed in later chapters, but briefly stated, the industrialization of Korea was a catchword of Park, and KIST's success or failure seemed to have an important symbolic value to his industrialization efforts. Thirdly, KIST, as the first R & D institute, has served as a prototype model in R & D institution-building (or think-tank-building in general) in Korea.[16] As a matter of fact, most of the aforementioned strategic institutes were sub-units of the KIST research laboratories in the late 1960s and the early 1970s. When they became independent from KIST, they replicated KIST as a model in terms of organizational structure, management style, and the relationship with industry and government, and so forth. The spin-off effects of KIST as a prototype model of think-tank also spread into other non-scientific institutions (i.e., KDI and The Institute of Foreign Affairs and National

Security) as well as in private sector R & D establishments. Overall, such cross-sectoral institution-building has undoubtedly contributed to the rise of technocratic power in Korea. For these reasons, the analysis of KIST is very informative not only in understanding Korea's public R & D system *per se* but also the newly emerging technostructure of the nation.

The operations of KIST in the past decades have elicited ambivalent reactions from observers. Some praise KIST as a "successful" model institution[17] while others hold a rather negative view about its contribution to the industrial technology development in Korea.[18] Nevertheless, foreign technologies have played a major role in Korea during the past decades. As Table 1.4 shows, the number of technologies imported from foreign countries has dramatically increased from an average annual number of 6.6 during the 1962-1966 period to 245 between 1977-1981. The 1982-1988 period has witnessed a phenomental growth in technology importation in Korea: A total of 3,333 cases or on an average of 476.1 cases annually. In terms of payment for the importation of technologies, the same trend is also noticeable. On the other hand, local industries, the main clients, do not seem to seriously consider KIST and other public R & D institutions as industrial technology sources.[19] As a matter of fact, by the late 1970s Korea's large corporations began to massively plan to create/expand

Table 1.4

An Overview of Technology Importation during 1962-1988

Period	Technology Importations (Unit: case)		Payment (Unit: US$1 million)	
	Total	Annual Average	Total	Annual Average
1962-1966	33	6.6	0.8	0.16
1967-1971	285	57.0	16.3	3.26
1972-1976	434	86.8	96.5	19.30
1977-1981	1,225	245.0	451.4	90.28
1982-1986	2,078	415.6	1,184.0	236.98
1987-1988	1,255	627.5	1,200.0	600.00

Note: This table is made based upon statistics in MOST, _'88 Kawhak Kisul Nyungam (Science and Technology Annual 1988)_, pp. 426-427 and _'89 Kawhak Kisul Nyungam (Science and Technology Annual 1989)_, p. 459 & 462.

in-house R & D facilities (Tables 1.1 and 1.2). The 1980s has witnessed a technological take-off by private sector R & D both in terms of size, magnitude and depth of R & D which led many people to seriously question the role or _raison d'etre_ of public R & D institutions.[20] The weak KIST-industry linkage is not a new issue, however. As early as the 1970s policy-makers and the KIST management have openly acknowledged it as problematic. KIST managers often said that local industry's lack of interest in KIST R & D, particularly the commercialization of KIST's inventions, is the most difficult problem to be overcome.[21]

From the policy analyst standpoint, this phenomenon poses very interesting questions regarding what sort of R & D is performed by KIST and why? _If_ the results of KIST R & D are not valued by local industry, an initial beneficiary, why then does the Korean government continue to stress public R & D in its technology development policy? A more fundamental, related question then arises: What functions does public R & D perform in Korea? These are major questions raised in this study.

This study also attempts to inquire into the importance of policy environment in the workings of KIST. The world-wide issue of development, as pointed out earlier, has invited social scientists as well as practitioners in the S & T fields to pay attention to the technological issue. However, most inquiries approached the issue from a rather limited perspective by defining technology as an independent variable in the development process. This perspective is widely held by analysts regardless of whether the concept of "development" is interpreted as "industrialization," "social development," or even as "liberation" as some people claim. By contrast, little attention has been paid to such a question as how development processes *per se* may serve as important factors in the technological development efforts of the developing countries.

Particularly, the policy analysis literature in political science has so far failed to deal with the issue as its primary research focus. There is a limited number of studies available in the area of multidisciplinary-oriented development research which attempt to analyze what functions national R & D centers in developing countries perform and why do they perform unsatisfactory R & D activities. The structuralist view of the so-called "marginalization theory"[22] is a case in point. It argues that the success or failure of the developing country's public R & D policy is not determined by implementation but by other factors residing in the policy environment. These factors demonstrate a particular pattern of industrialization of developing countries, as well as the world political economy manifested by the current international technology transfer mechanism.

From a policy analyst's point of view, this thesis is provocative because it suggests consideration of policy environment variables in the policy analysis and because it suggests how to identify those variables which have yet to be fully developed in policy analysis research.[23] However, from the policy analysis standpoint the structuralist's analysis also has shortcomings. What has been much overlooked seems to be the implementation process of the public R & D policy in a given country.

The structuralist's argument is drawn primarily from Latin American experiences. How are the Latin American experiences applicable to the Korean case? Like some Latin American countries, Korea has also pursued a pattern of industrialization in which imported foreign technologies have played a major role. However, although Korea's rapid industrialization process during the 1960s and 1970s was noted as record breaking, Korea's technological dependence was often viewed as relatively low by world standards.[24] It was only during the past decade that some observers began to seriously worry about Korea's technology dependence, particularly on Japan in such key export fields as electronics/electrical and automobiles.[25]

What then made Korea's technology policy different from that of Latin American experiences in the 1960s and 1970s? These countries shared similar economic development policies and shared a common technological world wherein the first world-based transnational corporations (TNCs) played major roles in the international circulation of industrial technologies. What specific roles were then played by the Korean government in facilitating relatively low-level inflow of foreign technologies into the country? And how important were Korea's public R & D institutions (like KIST) in this process? These questions have yet to be studied by social scientists and policy analysis seems to be an appropriate tool.

Particularly, a close look at the implementation process of Korea's public R & D policy seems to be important, for it provides not only information about implementation as an important variable in the understanding of policy outcomes, but also information about the political system of Korea which frames policy implementation. Korea's political system is in fact often characterized as bureaucratic-authoritarian,[26] where power is centered around the top political leader, and professional expertise is highly valued in bureaucracy. How does this model inform us in understanding Korea's public R & D process? Any student of comparative policy analysis who has so far uncritically utilized the American liberal-pluralist model of policy process needs a closer look at the Korean case.

Scope and Method of Research

My policy focus is on the Korean government's actions in the creation of and supports for KIST primarily from its pre-inception period of the early 1960s to early 1981 when

KIST was merged with KAIS.[27] However, whenever necessary, KIST's operation in the 1980s will be also analyzed. The analysis involves a series of "explicit" policy actions in the investment in national resources such as land, finance, manpower, and legal action to establish KIST.

But other "implicit" technology policies which deal directly or indirectly with technological development of the country will be also included in the analysis. These parallel ("implicit") policies refer to the Korean government's efforts to stimulate local industry to use KIST in solving their technological problems, either as a technological problem shooter, as a place for the development of new technologies or processes, as an information center for technology transfer or as a center for the adaptation of imported technologies. These policy actions include various forms of incentive systems such as financial aid to industry in its local R & D investment, restrictions on the importation of foreign technology in favor of KIST-developed technologies or processes, and market guarantees when local R & D is used for production. Also included are the Korean government's policy towards technology transfer, and economic development policies in general.

The key questions raised in this research will include the analysis of KIST's performance in meeting its manifest policy goals, unintended consequences, and the latent function of KIST in Korean politics. Also included is the analysis of "why" KIST has performed in such ways? In the analysis of these questions, both implementation process as well as policy environment within which KIST operations take place will be inquired into. Specifically, these questions will be broken down into the four components described below:

1. What are the objectives, rationale, and instruments of the policy?

This inquiry serves as background information to identify the manifest goals of the policy, and the nature of the technological problems Korea faces. The inquiry will also provide information about the nature of government involvement in S & T, and, at a deeper level, of Korea's political system within which framework policy goals are carried out.

2. What has been the performance of KIST?

This question includes an examination of both intended goal-attainment and unintended consequences of the Korean government's policy towards public R & D. The intended goal-attainment will be analyzed from the standpoint of KIST's contribution to local technological adaptation and innovation, and its function as a midwife in the technology transfer process in Korea. Particularly, my interest is who are the major clients of KIST (government vis-a-vis business corporations, and which sector of industry?) and whether there are any differences in the nature of KIST services (basic research, applied research, and development) among these different client groups. KIST's R & D will be analyzed in time sequence, by specific fields (chemistry/ chemical engineering, food/biology, electric/electronics, metallurgy/material science, mechanics, and computer), and by types of research (basic research, applied research, development, survey research, and techno-economic research). Unintended consequences will be evaluated from the criteria of the so-called brain drain issue, the rise of technostructure, strengthening of national autonomy in international technology transfer, and building up self-reliant confidence in S & T. This question also includes an examination of the spillover effects of KIST on other organizations in Korea. Intended and unintended policy consequences will be explained in both tangible and symbolic terms.

3. Why has KIST performed in such ways?

This is an attempt to trace causalities of the policy outcome in question. In tracing causalities, both internal and external environmental factors will be analyzed. KIST's management system, Korea's R & D policy-making and implementation structures, the effects of the national policies of economic development and technology transfer, and the international technological order[28] will be investigated. My policy question centers on how local business firms (the initial beneficiaries of KIST) perceived KIST as a source of industrial technologies in Korea, and why? The underlying assumption is that due to Korea's particular path of industrialization, policies made and administered by the Economic Planning Board (EPB) and the Ministry of Trade and Industry (MTI), for example, created a particular business environment in Korea, in which local firms show little interest in KIST's R & D vis-a-vis technology importation. And local firm's pro-technology importation position was also an outcome of the particular form of global production system and global technology transfer system.

4. What is the political meaning of the operation of KIST in Korea?

The political meaning will be interpreted particularly from the standpoint of the rise of technostructure in Korea and the national autonomy in international technology transfer.

The analysis in this study will adapt a middle road approach which combines a normative interpretation with empirical evidence when deemed appropriate.

Data Collection

This research is primarily based upon data collected from written documents about KIST, personal interviews, and case studies on KIST projects done during my field research in Korea during the period of late Fall 1980 to Summer 1981. In Fall 1989 I went back to Korea and collected additional data. My work experience at KIST during 1971-1976 also provided useful information about KIST.

The written documents published both in and outside Korea provide information on the background of the Korean government's intentional goal of public R & D policy, its institutionalization process, as well as quantitative information on KIST's R & D outputs. During my field research in Korea, 65 personal interviews were conducted with a wide range of people such as public bureaucrats who are in charge of technology policy-making and Korea's economic development planning, top managers and researchers at KIST, entrepreneurs, and professionals in the science and technology community. Inasmuch as KIST is a joint project between the governments of Korea and the U. S., some interviews were also conducted with American officials involved in the institutionalization process of KIST. They are ex-officials of the United States Agency for International Development (USAID), the Korean government's counterpart, and the Battelle Memorial Institute (BMI) which, as an USAID contractor, provided technical consultations to KIST. These interviews were done before and after my field research in Korea in 1981.

Personal interviews aimed at investigating the following questions. First, why and how KIST was established? Second, what is the nature of problems involved in the creation of KIST and what measures have been taken to solve these problems. Third, how did KIST's management carry out intended goals and what problems arose as the organization evolved over a period of time? Fourth, in dealing with these problems, what measures have been taken, by KIST management and the Korean government, particularly policy measures employed in dealing with conflicts between KIST and TNCs?

A number of case studies of KIST projects in the specialty chemistry field were also investigated during the field research. KIST projects on specialty chemistry were chosen for two reasons. First, specialty chemistry is one of the most productive R & D fields at KIST. Second, compared to other fields, technologies in this particular field are highly controlled by a few TNCs and raw materials for those technologies are often manufactured by special order which is, again, highly controlled by TNCs.

Research Outline

Chapter two begins with an analysis of the dual structure of public policy. Policy analysis is then defined as multiple causal ("output" policy variables and other environmental variables) and multiple effects analysis, and the methodological significance of this definition to my research will be discussed. In order to conceptualize external contextual variables, discussions on the bureaucratic-authoritarian nature of Korea's policy process, the dual structure of technology policy in developing countries and the nature of technological problems developing countries have will be presented with reference to the Korean case.

An historical review of Korea's R & D system and an analysis of the Korean government's public R & D policy towards KIST will be presented in Chapter three. The rationale, policy goals and policy-making process in the creation of KIST, will be analyzed in this chapter. Of particular interest in this chapter is how S & T is viewed by policy-makers in relation to the nation's industrialization and political legitimacy of the Park regime. And finally, how such perceptions have contributed to empowering technocratic power in Korea.

Chapter four discusses the implementation process of KIST. By examining various dimensions of the Korean government supports offered during the institutionalization of KIST, the nature of state power and intervention in public R & D will be closely examined.

The analysis of KIST R & D performance is done in Chapter five. This chapter begins with the selection of evaluation criteria of KIST's R & D performance. Also included are discussions on: What the nature of KIST R & D outputs are as the organization evolves over time; what constraints inform KIST R & D activities; and what spin-off effects KIST has brought to Korean society. Special attention is given to KIST's linkage problem with local production systems, and the roles KIST has played on reversing the brain drain, and the development of an R & D infrastructure, as well as technostructure.

Chapter six analyzes a number of issues. An analysis focuses on what approaches were taken by both KIST and MOST to cope with the KIST-industry weak linkage problem. Also analyzed are the mode of MOST's technology financing policy and Korea's policies of industrialization and technology transfer which are largely planned and administered outside MOST's policy domain. Two case studies, the HOP case and the polyester film case, will also be presented in this chapter to find out: What problems KIST has in the commercialization of its R & D outputs to local industry; the nature of limits systematically imposed to local R & D; and how a president-centered policy process may function as an intervening variable in resolving the conflicts of interest among KIST, TNCs, local business, and government offices, as well.

Based upon research findings concerning the KIST experience, the significance of contextual variables such as influences of other economic development policies, TNC-channeled technologies, and Korea's bureaucratic-authoritarian policy processes on KIST R & D will be drawn out in Chapter seven. In addition, the latent function of KIST in Korean politics will also be discussed. A summary of research findings and conclusion of this study will also be presented in this chapter.

Notes

1. This refers to the national government of the Republic of Korea.

2. Due to the close interrelationship between science and technology public policy concerning science and technology has been conventionally called "science policy" without making any distinction between the two dimensions. However, in recent years policy-oriented literature in this area tends to separate "technology" policy from "science" policy because of the different goals, characteristics and policy instrument attached to "science" policy and "technology" policy respectively. The distinction between the two policies are well discussed in Francisco Sagasti, Technology, Planning, and Self-Reliant Development: A Latin American View (New York: Praeger Publishers, 1979), Ch. 5.

3. On January 5, 1981 KIST had merged with KAIS, a graduate engineering school thus becoming the Korea Advanced Institute of Science & Technology (KAIST). But the two institutions got separated and as of June 12, 1989 KIST regained its independent organizational status with its original name (KIST).

4. Here "development" referrs to economic, political, social, cultural and ethical dimensions. For reviews, see Charles Wilber, ed., Political Economy of Development and Underdevelopment, 4th ed. (New York: Random House, 1988); and Denis Goulet, The Cruel Choice (New York: Atheneum, 1975).

5. Refer to Richard J. Barnet & Ronald E. Müller, Global Reach (New York: Simon & Schuster, 1974); Denis Goulet, The Uncertain Promise (New York: IDOC/North America, 1977); George Modelski, ed., Transnational Corporation and World Order (San Francisco: W. H. Freeman & Co., 1979); Volker Rittberger, ed., Science and Technology in a Changing International Order (Boulder: Westview Press, 1982); Martin Fransman & Kenneth King, ed., Technological Capability in the Third World (New York: St. Martin's Press, 1984); and Christopher Freeman, & al., "Policies for Technical Change" in Christopher Freeman & Marie Jahoda, ed., World Futures (New York: Universe Books, 1978).

   A recent study which worries about the diminishing technological supremacy of the U. S. in the global market also confirms this view. Refer to National

Academy of Engineering, National Interests in An Age of Global Technology (Washington, D. C.: National Academy Press, 1991).

6. This view is well presented in United Nations Economic & Social Council, Advisory Committee on the Application of Science & Technology to Development, World Plans of Action for the Application of Science & Technology to Development (New York: United Nations, 1971).

7. Refer to the development model of the U. N. as well as that of the U. S. technical assistance to developing countries.

8. This referrs to the situation of a country's technological reliance upon exogenous sources while lacking indigenous capacity to develop new technology or adapt imported technology suitable to its own society.

9. Charles Cooper, "Science Policy & Technological Change in Underdeveloped Economies," World Development, Vol. 2, No. 3 (1974), p. 58.

10. Before the Korean government launched public R & D infrastructure building efforts in the mid-1960s, the Atomic Energy Research Institute (which was later reorganized as KAERI) and KORSTIC were created with modern equipment in the late 1950s and in the early 1960s respectively. However, these institutes limited their activities to basic research and information services rather than applied research and engineering fields.

11. Bello and Rosenfeld note that Korea's R & D spending at 2% of GNP is "probably inflated" and 0.4% of GNP in 1988 may be more realistic figure. They also argue that R & D in the 1980s were "a lost decades for Korean industry" with negligence in R & D investment. However, their arguments need further explanation with supporting data. Refer to Walden Bello and Stephanie Rosenfeld, Dragons in Distress: Asia's Miracle Economies in Crisis (San Francisco: The Institute for Food and Development Policy, 1990), p. 115.

12. Public sector R & D institutes refer to publicly funded R & D institutions regardless of their organizational characteristics whether they be lodged within the formal organizational structure of the national and local government, in non-profit R & D institutes which are publicly funded but independent from the government

organization, or lodged in the publicly funded colleges and universities.

13. Although a large portion of this R & D spending was for the completion of the construction and procurement of physical equipment, etc. for some newly created institutes, it clearly indicates how much emphasis is placed on these institutes by the Korean government. Refer to Center for Policy Alternatives at the Massachusetts Institute of Technology (CPAMIT) & KIST, Public Industrial Research & Development Institutes in Korea (Boston: CPAMIT, September 1980, draft).

14. MOST, Daeduck Kwahak Moonwha Doshi Wankong (The Completion of Science & Culture Town in Daeduck) (Seoul: MOST, 1990. 7), p. 9; and The Korea Times, Seattle Edition, July 11 & 12, 1990.

15. The Chun regime's policy intervention was like a major earthquake in Korea's public R & D system by which KIST was also forced to merge with KAIS. The mergers of public R & D institutions received much criticism for its "irrational" decision and its direct challenge to research autonomy.

16. "Think-tank" is different from "R & D" for the former has a linkage function to government policy. Refer to Paul Dickson, Think Tanks (New York: Atheneum, 1971).

17. Hahn-Been Lee, "Appropriate Specification of Development Technology Center," Natural Science (Seoul: Soong-Jun University Themes & Essays), Vol. 4, 1973; Hahn-Been Lee, The Experience of the East-West Technology & Development Institute in Promoting Institutional Cooperation in Adaptive Technology (Honolulu: The East-West Center Technology & Development Institute, 1972) Working Paper Series No. 32, p. 11; KIST, Proceedings of the 7th ASCA Conference Pre-Seminar I on the Role of Local R & D for Industrialization (Seoul: KIST, 1976); KIST, Proceedings of the International Seminar on Dissemination of Technology held under the Co-sponsorship by KIST, Illinois Institute of Technology Research Institute & USAID (Seoul: KIST, 1973); KIST, Proceedings of the Colloquium Commemorating the 10th Anniversary of KIST Foundation (Seoul: KIST, 1976); U. S. Government Printing Office, Joint Seminars on the UN Conference on Science & Technology for Development, Joint Hearings before the Committee on Science & Technology and the Committee on Foreign Affairs, U. S. House of Representatives, 96th Congress, First Session,

February. 13-15, 1979, No. 13 (Washington, D. C.: U. S. Government Printing Office, 1979), p. 20; John V. Granger, Technology & International Relations (San Francisco: W. H. Freeman & Co., 1979); and Richard A. Goodman & Julian Pavon, eds., Planning for National Technology Policy (New York: Praeger, 1984). Also refer to various forms of publications written by Choi Hyung-Sup.

18. This is primarily based upon my observation during my field research and my work experience at KIST during 1971-1976. But also refer to Ka-Jong Lee, "Technology Transfer and Development Strategies: The Role of Large Firms in Korea," Ph.D. Diss. from the University of Hawaii (1977), Ch. 4.

19. CPAMIT & KIST (1980); Michael J. Moravcsik, Science Development: The Building of Science in Less Developed Countries (Bloomington, Indiana: PASITAM, 1976). Also refer to Center for Science & Technology Policy (CSTP), KAIST, Chulyun Yunkukikwan e Kinung mit Yukwhal Jeongnip e Kwanhan Yunku (Research on the Function and Role-Defining of the Public Sector Endowed Research Institutes) (Seoul: CSTP, KAIST, 1988. 12).

20. CSTP, KAIST, Ibid. Also my field study data of 1989.

21. This is based on my field study and work experience at KIST. Also refer to K. Lee (1977). Further discussion is presented in Chapter two.

22. Refer to Chapter Two for a full discussion.

23. This view is not shared by all policy analysts, but an increasing body of literature emphasizes the importance of policy environment. For a full discussion, refer to Chapter two.

24. Lawrence R. Alschuler, "Multinationals and Development in the Semi-Periphery: The Case of Korea (1960-1976)," (Mimeo draft, August, 1982), p. 62; Granger (1979), pp. 119-120; Yung Whee Rhee & al., Korea's Competitive Edge (Baltimore: The Johns Hopkins University Press for the International Bank for Reconstruction and Development/The World Bank, 1984), Ch. 4.; and Fransman & King (1984).

25. Refer to Bello and Rosenfeld (1990), chapters 6, 8, and 9; and Yoo Young-Ul, "Churak Wigi, Hankuk e Jeonja Sanup (The Crisis of Fall, Korea's Electronics

Industry)," in Shin Dong A, 1991 July issue, pp. 428-441.

26. Refer to Chapter two for a full discussion of this model of political system.

27. While KIST merged with KAIS, KIST was allowed to continue applied industrial research. However, KIST's functions under the organizational structure of KAIST blurred the original purposes and functions of public R & D policy in Korea. For this reason, this study limits the analysis of KIST's operation to the period before its merger in early 1981.

28. This referrs to both the current global technological map in which production technologies are highly concentrated in the hand of a few First World-based TNCs and the system of international technology transfer from the industrial societies to developing societies in which TNCs exercise great power over the types of technology transferred, transfer prices, raw materials, markets, and finance. Further discussion is presented in the following chapter.

However, a recent study of the National Academy of Engineering (1991) challenges this view. The argument is that during the past decade and half, "a new model of internationalization" has emerged in which TNC R & D has decentralized at the global level, and the active R & D done by industrialized (other than the U. S.) and industrializing countries also diluted the power of those few TNCs controlling global technological system.

CHAPTER TWO

TECHNOLOGY POLICY & POLICY ENVIRONMENT: A SEARCH FOR AN ANALYTICAL FRAMEWORK

American literature on public policy enjoys a wide scope of research covering issues such as agenda building, policy-making, implementation, and policy impact studies.[1] Each of these policy processes can be broken down into a single phase and may receive a primary research focus. However, my study of Korea's technology policy will cover the whole range of policy processes, for by doing this we can better comprehend the politics involved in technology development issues.

Policy analysis is also the study of political interactions between the policy under investigation and its surrounding environment.[2] Policy environment can be conceptualized as factors internal or external to a given society. They can be conceptualized as the political system within which policy processes take place, or what Dolbeare calls "fundamental policy,"[3] or global politico-economic system. Integration of policy environmental factors into the analysis of Korea's technology policy on public R & D is very important for it informs us of the nature of state and technocratic power involved in policy processes. It also informs us of the nature of the interrelationship between public R & D, Korea's industrialization policies and the global technological order.

This chapter attempts to inquire into a theoretical explanation of policy environment variables, and the reasons why they are important in understanding Korea's public R & D policy.

Environmental Factors in Policy Analysis: Conceptualization

Defining Public Policy: A Structural Analysis of Public Policy

The term public policy has broad and diverse meanings. A brief review of the literature informs us that public policy is what government does. To Easton, public policy means "the authoritative allocation of values for the whole society."[4] Lasswell and Kaplan expand the conception beyond the scope of the allocation of values and define it as a "projected program of goals, values, and practices."[5] Analysis of the government's role in commercial R & D, for example, clearly defines public policy as government action.[6] Public policy also refers to government's inaction or nondecision as well, although as Heidenheimer, Heclo and Adams said "it would be absurd to think that everything a government does not do is *ipso facto* a policy."[7]

For Dolbeare, defining public policy in terms of action or inaction is too simplistic a view because it provides only one level of understanding of the complex nature of public policy.[8] The essence of his argument is that public policies are composed of two different levels of policies: The "fundamental" policy level and "output" policy level. The former policy refers to "a set of priorities and directions, themselves grounded in basic societal values, ideology, and the basic elements of our economic and societal system" which have "relatively less specifiable goals, contents, or object - more intervening factors, and less researchable consequences" but which play a significant role in shaping public policies.[9] The latter (output policy) is the one that "fully assumes the basic propriety and/or continuity of existing systems, structures and directions, and essentially involves only accommodations or adjustments within that (fundamental policy) framework."[10] Output policy has relatively more specifiable goals and objects through which goals and directions of fundamental policies are reflected.

Despite the dependent nature of output policy upon the premises of fundamental policy, however, to date policy studies usually concern output policy with little explicit reference to fundamental policy. In policy impact studies, according to Dolbeare, the artificial isolation of output policy from fundamental policy leads to insufficient research results. This may be the case particularly when the scope of research is broadened to cover both intended/unintended policy outcomes and both manifest/latent functions of a policy under investigation.

Policy Impact Analysis: Purposes, Scope & Nature

It may be proper to define the meaning and methodology of policy impact analysis within which framework a significant portion of my policy questions of Korea's R & D will be raised. Simply stated, policy impact analysis investigates the relationship between government action and its consequences for people/problems in the society in terms of some set of values.[11] What distinguishes policy impact research from policy-making research is that impact research defines public policy as an independent variable and tries to understand who actually gets what from public policy within the larger social framework (dependent variable). Policy impact analysis, therefore, is characterized as having a specific target situation (i. e., technological backwardness) or population (i. e., individuals, groups, or region) to whom the policy in question might have brought changes. At the same time, it is also concerned with "spillover effects" which refer to policy impacts on situations or groups other than those targeted.[12] This definition of the policy impact study is generally accepted as a basic ground rule among analysts in political science, but there is as yet no universal definition as to what policy impact analysis is, nor is there common agreement on methodology.

The initial confusion comes from the different definitions employed by policy analysts as to the purpose of inquiry. The differences lead them to develop their research in varying fashions. Broadly speaking, the purpose of policy impact analysis is perceived by analysts in two different ways.[13] One is rather practitioner-oriented. It provides policy-makers and implementers with evaluations of the extent of policy goal attainment and with information to help solve policy problems. The other is a rather scholarly attempt, to quote Dolbeare, to "fill out empirical theories of politics by coming to understand the effects of policies as they diffuse into the social system and processes."[14] In the former case the research focus is placed on the analysis of direct and intended policy goal attainment levels accompanied by policy recommendations to immediately diagnose and resolve policy problems. When a researcher adopts the latter definition as his/her research purpose, however, the analysis stresses the causes of policy problems rather than the cures. The scope of the research thus extends to include an assessment of intended goal attainment, an examination of unintended, indirect consequences brought to the society, as well as latent functions of the policy.

The central part of the confusion in studying policy impact arises when a researcher adopts the latter definition. In tracing the causes and effects of policy, policy impact studies have conventionally stressed the dependent variable side (policy consequences in society) while the independent variable was uncritically assumed only as a given policy under investigation. Thus policy inquiry has looked at the effects of given policy on the target groups or situations in society. But studies often find that it is very difficult to detect that a given policy is the only causal variable.[15] A policy in question is often deeply interwoven with other policies, or public policies may often be in conflict with each other (i. e., anti-smoking program vs. government subsidy to tobacco growers). Also there are sometimes certain situations that go beyond the control of a given policy which seems to be influential on policy outcomes.[16] These diverse factors, whether they be conceptualized as other public policies, events, or situations, have not yet received adequate attention from policy analysts as a primary research focus.

Methodological Problems

To date, policy impact studies have been approached through experiment-oriented research assumptions where the analysis is centered on two discreet variables, an independent variable (an output policy) and a dependent variable (policy output and/or policy outcome). This methodology requires of a researcher that every possible step be taken to isolate the policy under study and analyze its effects with all other variables being rigorously controlled. Empirically-oriented research thus tends toward the study of only the most immediate and tangible impacts of limited forms of explicitly framed output policies in confirmed social settings. But when the fundamental policy is included in impact analysis, a researcher must adopt a method that includes more variables and possibilities. This creates a dilemma.

> The dilemma is acutely focused when we imagine attempting research into the consequences of fundamental policies: by the time such policies are disaggregated into specific researchable components, and the direct tangible impacts compiled with the precision demanded by empirical research, the quality and character of fundamental policy itself has been lost. The concepts and methods of empirical social science force particularism upon us, and particularism prevents true-wholistic-social understanding. ...In order to understand some aspect of...system and process, our social science tells us to abstract it from the larger context which is essential to its meaning, and what we then come to 'understand' is something different from what actually exists.17

My definition of policy study is an analysis of government actions/inactions on a society. The focal point of the inquiry is not a simple description of what the policy is about in terms of goal attainment. My foremost important goals are to analyze and interpret such actions/ inactions and to ask what differences they make in society. I wish to develop an encompassing understanding of politics, a general explanation of politics involved in both a substantive policy under investigation itself and the surrounding environmental context by using the policy analysis tool. The environmental context may be very difficult to identify and actualize, but this context should not be ignored in the analytical process. This then requires the broadening of my research framework - a holistic approach that does not narrow the research focus by using only empirically measurable indicators as evidence of policy consequences.

The conceptualization of the environmental variable and methodological problem raised by Dolbeare has been recognized by some other scholars in the field although their discussions do not refer directly to him, nor specifically deal with the "fundamental" policy issues. By defining the policy impact study as an analysis of multiple-causes and multiple-effects, Suchman is particularly interested in the causal structure of policy impact.[18] To Coleman, policy impact analysis is the analysis of the two different kinds of independent variables: The "policy variable" and "situational variables." The former can be controlled by policy manipulation while the latter can not, but they "play a part in the causal structure which leads to the outcome variables."[19]

Dolbeare's concept of "fundamental" policy is certainly not synonymous with Coleman's "situational" variable because the latter does not necessarily refer to policy _per se_, nor is it synonymous with Suchman's "intervening" variable because Suchman does not refer to it directly as "fundamental" policy. However, these arguments are similar conceptually and methodologically. Conceptual significance is found in their emphasis on the consideration of the environmental context in which the "output" policy is lodged and which is not subject to policy manipulation but is linked to policy outcomes in a society. From the methodological standpoint, they have a shared view in terms of the treatment of these variables as causal variables, thus multiplying the independent variables.

These studies provide students in policy analysis with insightful guidance as to what to look at or where to begin in their research. But how does one translate these concepts into an actual research project has yet to be elaborated. To clarify these concepts, the characteristics of Korea's political system, and the dual structure of technology policy in developing countries will be discussed in the following section.

Korean Model of Political System and Policy Process: Bureaucratic-Authoritarianism

The analysis of political interactions between political system and policy processes is a not an uncommon approach in scholarly literature on policy studies. What is at issue, however, is how to conceptualize political system. Most American policy studies literature assumes liberal-pluralism in the analyses.[20] In this model, political power is assumed to be competitive, fragmented and diffused among special-interest groups in society. Within the formal structure of government, the same characteristics are also assumed. The principles of "separation of powers" among branches of government, and federalism, reinforced by the liberal tradition of "limited government" diffuse power centers within the formal institutions of government. The division of authority and powers in the government system then allows more public access to the political game as often exemplified in lobbying practices known as an "Iron Triangle." Under the liberal-pluralist notion, politics is a process of "bargaining" and political "maneuvering" between autonomous interest groups in society and formal political institutions whether they are lodged within the formal structure of government (the three branches of government) or outside of it (i. e., political parties).

The implication of this model of political system to American public policy process is significant: Voices of autonomous special-interest representation are channeled into various government institutions and function as an important demand-maker in policy processes by raising social problems as policy agendas, promoting specific policies and so forth. Liberal-pluralism therefore defines the role of the state as minimal--as an arbiter or an umpire in group struggles for political gains. The state in this model is viewed as the object of group politics. Simply stated, policy decision-making is then nothing but the state's response to diverse group pressures.

The Korean model of political system is vastly different from liberal-pluralism. And the liberal-pluralist policy framework, often taken for granted in American policy literature, is rather inappropriate in understanding Korea's technology policies and politics. Korea's policy process is often described as reflecting the bureaucratic-authoritarian model of politics[21] which is a particular modern variant of corporatism, an alternative paradigm to liberal-pluralism.

The attributes of the bureaucratic-authoritarian model and their policy implications, noted in the literature, are as follows. First, state power is enormous, and policies tend to be state-centric. The state acts with relative autonomy in its policy processes with little or no interference from public pressures which may be represented by special-interest groups in society. Inversely, the state has power and authority to manipulate special-interest group activities in society (i. e., endorsement, encouragement or suppression of certain group activities) in order to make policies in the direction that it wants. To quote from Skocpol, "states...(are) taking weighty, autonomous initiatives...going beyond the demands or interests of social groups...to promote social change, manage economic crises, or develop innovative public policies."[22] Often cited as examples of such state actions are repressive labor policies and big business-oriented industrial policies.[23] In sum, the Korean government, being relatively insulated from politics of group pressure, serves as an initiator, planner, manager, and evaluator of public policies in Korea.

Second, within the state apparatus, the executive branch of the government is the central focus of state power whereas the legislative and judiciary power remain as minimal. In particular, political power is hierarchically structured and centers around the chief executive. The President of Korea thus plays a pivotal role in policy processes. His wishes literally become policy and his occasional and spontaneous comments can easily alter the course of policy implementation. The concept of presidential power refers to not only that of the president himself, but also that of his aides working in the Blue House. Significantly, the centralized and strong power of the president is not perceived by advocates of bureaucratic-authoritarianism as something coming from personal authoritarianism such as charisma and leadership style. Rather, the powerful presidency became possible by establishing what Cardoso calls a "pact of domination," or symbiotic alliances among different sub-groups in the elite circle (i. e., military, technocrats, big-business, etc.) centering around the president.[24] The relationships of this kind of coalition are not on an equal basis but hierarchically structured with military elites occupying the apex of the power pyramid. In whatever form the symbiotic relationship has taken (such as the military-civilian alliance, government-business alliance, professional-bureaucrat alliance, bureaucrat-legislator alliance), this coalition not only provides a solid foundation for the president's power but also has allowed Korea's public policies to be elite-serving in nature.

Third, technocrats[25] play an important but limited role in Korea's policy processes. The emergence of the bureaucratic-authoritarian state is closely linked with the particular mode of industrialization strategy Korea adopted since the 1960s. By naming Korea's political system (as well as that of Taiwan) as Bureaucratic-Authoritarian Industrializing Regimes (BAIRs), Cumings notes:

> These states (Korea & Taiwan) are ubiquitous in economy and society: penetrating, comprehensive, highly articulated, and relatively autonomous of particular groups and classes. Furthermore, especially in Korea, state power accumulated considerably just as the ROK began a deepening industrialization program in steel, chemicals, ships, and automobiles.26

Like many other "late" or "late-late" industrializing countries (in an effort to catch up with the West and/or to survive in the contemporary world system of political economy) technocratic inputs have been increasingly valued in Korea. And yet, due to the particular form of the "pact of domination" discussed above, technocrats' major role in Korea's policy processes is not found in what Straussman calls "strategic decision making."[27] Rather, with its expert-orientation, they can competently perform given tasks, i. e., rationalization of policy issues, implementation, etc. In other words, Korea's technocrats are "task-elites," and their role seem to be mainly confined to "tactical decision making." Technocratic power, therefore, may be considered an outcome, and also an important element of bureaucratic-authoritarianism.

Finally, exogenous forces also serve as important factors in Korea's policy processes. These forces can be understood as political and/or economic supports from foreign countries, or particular international security situations by which Korea's domestic policies on economy or national defense are affected. As a matter of fact, Korea has been a cockpit of super power rivalry for the past century, and the outside politico-economic situation has always been a factor in domestic policies and politics although with varying degree.

How informative is this bureaucratic-authoritarian model in understanding Korea's public R & D policy-making and its implementation process? Was the centralized, strong power of the Park regime instrumental in the growth and expansion of the public R & D infrastructure? What are the scope and nature of government intervention in R & D? What specific roles have KIST researchers played in Korea's rapidly changing society? A researcher of Korea's technology policy should seriously inquire into such questions.

Dual Structure of Technology Policy & Technological Problems in Developing Countries

Explicit Technology Policy Vs. Implicit Technology Policy

Herrera's analysis of the dual structure of technology policy in developing countries is particularly useful. Herrera distinguishes between "explicit policy" and "implicit policy."[28] The explicit technology policy refers to public policy expressed in laws and regulations which directly deal with technological activities with specific goals. Often explicit policies are made and administered by a government agency with formal organizational structure. Such an example as the building up of S & T infrastructure (i. e., national R & D centers) belongs to this policy category. Implicit technology policy does not have a formal structure for coherent decision-making, nor does it explicitly spell out functions and activities for technological development. Thus implicit policy is difficult to indentify. It refers to many public policies which aim at meeting the general development goals of the country such as policies for import-substitution or export promotion. This dual structure is rather a unique phenomenon in the developing countries. And the significance of this dual structure, as Herrera claims, is that the implicit technology policy hidden in various policies serves as a "blind force" for the technological development of a country. Furthermore, implicit technology policy frequently "runs against" the objectives pursued by explicit technology policy.[29]

The history of R & D in the industrialized West reveals that it has traditionally been an arena of private sector economy largely determined by market forces, or social forces in general.[30] In other words, technological progress was made without a formal structure for an "explicit" technology policy. Situations have somewhat changed during the wartime period of the 1940s, particularly after World War II. In the industrialized West, the role of government in R & D during the past decades has increased both financially and institutionally.[31] Under the increasingly competitive current international market situation, government's role in R & D is likely to expand.[32]

Nevertheless R & D in the U. S. has never forced any dramatic changes on the traditional laissez faire approach, and the conventional wisdom that government "plays the role of umpire and game keeper while private industry plays the game" seems to still apply.[33] The U. S. government's involvement in R & D is centered in basic research or such areas as defense, space, the environment, etc., in which private industrial firms are unlikely to invest their resources unless their economic interests are met. In applied research and development, industry has always been the "predominant performer" although much of their funding was provided by the federal government.[34] From the institutional standpoint, a number of offices have been created since World War II: the National Science Foundation (NSF), White House Office of Science & Technology, Office of Technology Assessment in Congress as well as organizational changes in Pentagon, NASA, and so forth. But the U. S. lacks a formal structure for the planning and implementation of technological activities at the national level, and there has been no public policy which can be labeled as national S & T policy until quite recently.[35] In fact, what seems to be functionally called S & T policy is hidden in many other policy areas such as patent policy, industrial policy, etc. and it is characterized as like a "patchwork policy" ... a policy of "reacting rather than anticipating" to solve social problems using scientific knowledge on an ad hoc basis.[36]

The situation is somewhat different in developing countries where S & T is a concerted state activity and government-supported R & D often substitutes for industry's in-house R & D functions. Developing country government's direct involvement is a relatively new phenomenon which began to emerge in the early 1960s. The idea of state intervention in R & D was stimulated by the "late-comer" thesis[37]

To the advocates of this perspective, technologically backward developing countries have an optimistic future in moving toward the status of modern industrialized countries by borrowing foreign technologies. This argument is based on the historical experiences of the U. S., Russia, Japan, and so forth which began to industrialize later than the Western European countries but have achieved remarkable technological progress. Convinced by this argument, development planners identified the main problem of developing societies as internal to these countries and a purely technical one: Lack of local capacity in S & T.

Thus strategies for solving these problems were also approached internally and technically: S & T problems of the developing countries can be coped with by planning S & T, namely by creating an "explicit" policy. Thus foreign advisors advocated the creation of a national planning body for S & T and the establishment of a few national "centres of excellence." Particularly, national R & D centers were highly valued for they would substitute for industry's role in R & D and might hopefully become a stepping stone in building up national S & T capacities. Parallel to this S & T infrastructure building strategy, developing countries were also urged to take advantage of international technology transfer. This was because foreign technologies available in the industrialized countries are not only "ready-to use" and often "proven" in the First World market but also have demonstration effects of "learning by doing."[38] A national R & D center was therefore expected to perform dual functions, serving as a center for the development of indigenous technology and as the adaptation center for imported technologies. The U. S. technical assistance programs and the United Nations (U. N.) development model during the "First Development Decade" of the 1960s were all based upon this view.[39] This S & T planning approach was very persuasive in Korea in consideration of the technological vacuum in the early 1960s which led to the birth of KIST in 1966.

But the optimism of the 1960s was soon challenged by the pessimism of the 1970s when some development theorists as well as practitioners began to see the continuing technological gap between technological "haves" and "have-not," as well as the technological dependence problems of developing countries. Thus began a search for a new order in the international circulation of technology.[40] This new order, an alternative structuralist perspective is deeply rooted in the theories of dependency and underdevelopment, and international political economy.[41] The central difference between the structuralist perspective and the late-comer thesis is found in the former's position which understands that the developing country's technological development is deeply interwoven with external forces of control in a given country. The problem experienced by R & D communities in Latin America is the so-called "marginalization" or alienation of valuable national R & D centers from the local production system.[42] From the structuralist point of view, this problem was explained not by ineffective public R & D policy *per se*. Rather, its causes were understood as the result of the "underdeveloped" economic conditions of developing countries and the powerful role played by TNCs in the international circulation of technology. In structuralist analyses, the dynamism of global political economy, or the inner workings of government and R & D policies in country-specific settings have not been fully explored. The role of the state, in this analytical framework, in the international transaction of technology or in economic relations in general has often been perceived as being co-opted by the common interests shared between local ruling elites and TNCs.

Macro-level and historical analyses of the development process pursued in Latin American countries find that the implicit technology policy embedded in import-substitution industrialization has had effects on both the demand side (i. e., industry) and the supply side of technology (public R & D institutions). These effects show technological dependence problems:

> ...the elite consumers demand the same kinds of goods as consumers in the industrialized countries. The technologies required to manufacture these goods are in existence already and many of them are owned by enterprises in the industrialized countries. The new enterprises which have grown up in Latin America have...made use of these technologies. Consequently, foreign technology has tended to be a substitute for technologies that might have been developed by local scientific research and development. Even in those rare cases where local laboratories have successfully

> developed the types of technology which local enterprises might want, there is a strong tendency to use a foreign version of the technology instead - usually on the grounds that it is more likely to work. This is one reason why the local scientific system is cut off from production. ...The result is that the scientific institutions are alienated from production activities or 'marginalized' because there is no demand for locally developed technologies from the productive sectors.[43]

The types of specific policies (import-substitution vs. export-promotion) pursued seem to be less important, however. The key argument of the technological dependence perspective is that simply the availability of technologies in the industrialized countries and the nature of private proprietary ownership of technology caused developing countries' marginalization problem. The marginalization of public R & D institutions of the region forces local R & D centers to function as "outposts" of advanced country science with little contribution to their own societies's technological needs. In other words, public R & D in developing countries is a "consumption item" contrary to that R & D in industrialized countries where it is an "investment item."[44]

Developing country R & D institute's engagement in scientific activities <u>per</u> <u>se</u> should not be blamed, though. What seems to be at issue is the balance between pure scientific research, and applied research and development for industrial production. As a matter of fact, science and technology are deeply interrelated, and modern technologies are products of scientific knowledge. In the words of D. J. de Solla Price, "science without the byplay of technology becomes sterile, technology without science becomes moribund."[45] The concept of R & D itself also includes both scientific and technological dimensions of human activities. The widely accepted definition of R & D refers to three different types of activities, basic research, applied research, and development. According to the NSF,

> Basic research is directed toward increase of knowledge; it is a research where the primary aim of the investigator is a fuller understanding of the subject under study rather than a practical application thereof. Applied research is directed toward practical application of knowledge... Development is the systematic use of scientific knowledge directed toward the production of useful materials, devices, systems, methods...processes, design and development of prototypes (excluding) quality control or routine product testing.[46]

But the problem faced by many developing countries seems to be the imbalance in the scientific activities vis-a-vis technological activities. Particularly, when local R & D centers limit their R & D to basic research and leave applied research and development efforts to foreigners, the impact of such R & D on the local society seems to be negative. This is quite true because as Goulet reminds us the social functions of technology are a "two-edged sword."[47] Technology is a value-laden human activity, the application of which requires a careful consideration of local conditions in a given society (such as resources: natural, human, finance, organizational, and so forth) which may be very specific to each society whereas science _per se_ seems to be rather value-neutral and can be utilized in rather universal terms.[48] This may explain why it is rather easy to obtain scientific knowledge through academic communities whereas technology is not: Technology is highly protected under the patent system, thus it may be naive to see technology as a freely transferable good in the current technological world. Some development theorists' criticism of current international technology transfer stems from this reasoning.

Furthermore, the link between science and technology is highly uncertain and it takes a long lead time for a scientific discovery or invention to be fully developed into a technological innovation. To quote from Freeman,

> An invention is a novel idea, sketch or model for a new or improved product, process or system. It may never actually be used outside the laboratory or the inventor's workshop or proverbial attic. It need not necessarily imply any empirical test of feasibility but...it normally does convey the first confidence that something should work and the first rough test that it will in fact work.49

One study shows that it took non-mission-oriented scientific discoveries 2-65 years to lead to technological innovations.[50] Another study of 30 technological innovations reveals that the lag time between invention and innovation was 13.6 years.[51] For these reasons, what seems to be a more urgent task for any developing country public R & D institute is not to concentrate in scientific research *per se*, but to apply scientific knowledge, perhaps available somewhere in the world, through technological activities tailored to the specific needs of a given society. The reason the structuralists worry about science-oriented R & D seems to arise from this reasoning.

Problems of marginalization and technological dependence seem to continue even if developing countries shift their development strategies from import-substitution to export-led industrialization, because commodity export also requires foreign technology. Some studies on Korean development support this view: Korea's technological dependence has been relatively low by world standards but increasing technological dependence in recent years is the consequence of the country's industrialization policies centered on export and the heavy and chemical industry.[52]

In fact, local industry's lack of demand for public R & D seems to be a serious problem in Korea. But this phenomenon was often ascribed to the short-sighted entrepreneurship that is either ignorant of the economic values of R & D or hesitant to invest in such a "risk venture." One of my interviewees during my field research pointed out that the Korean entrepreneurs' traditional perception of R & D makes KIST's work difficult and told a local joke popular in the business community: "There are three types of crazy people in Korea; those who indulge in alcohol and women, those who gamble, and those who gamble with R & D." Another interviewee, Dr. Hahn Sang-Joon, President of KIST during 1972-1978, mentioned that "our economy has grown bigger and faster than we expected." No studies are as yet available as to whether KIST's problem is the result of the Korean government's industrialization policies, or the "underdeveloped economy" created as the result of a particular industrialization process as the marginalization theories argue. But this is an interesting thesis which raises an issue which the policy analyst should be aware; the influence of other policies (policy environment) in causal analysis.

<u>International Technology Transfer & Public R & D</u>

Another policy environment variable suggested by the development literature is international technology transfer. To many development theorists holding the structuralist perspective, the marginalization problems in developing countries' public R & D have been aggravated by the current system of international technology transfer which runs against the interests of developing countries and in favor of the self-interests of TNCs.[53]

Debates about international circulation of production technologies have in fact been recurring during the last few decades and are still raging hot and heavy. From the liberal economist point of view, technology transfer brings many special advantages to developing society whose views are expressed in the late-comer thesis. But to many structuralists, the practices of TNC-channeled international technology transfer reveal that a TNC maximizes its quasi-monopolistic (or monopsonistic) power over technology through its transfer mechanisms. The conventional wisdom of technology as a public good or freely transferable property seems no longer to be true in today's international economic transactions. More and more, technology is an important source of power in international relations. The technology market is clearly a seller's market. Newly developed technologies are often not obtainable by developing countries.[54] When TNCs export technologies, they take full advantage of the "ignorance" of developing countries as technology importers. A study of technology transfer in Korea notes that "the (technology) exporter does not disclose the scope and characteristics of the technology when he signs a contract."[55] Nor is the price for technology fixed in the international market: the price differs according to who wants it and how badly. Besides, when a TNC transfers technology, this technology does not come by itself but in a package which includes arrangements on markets, raw and intermediate materials, capital, and so forth. This package deal of "take this technology and we will do the rest" seems to appeal to many industrial firms in developing countries in consideration of their shortage in factor endowments for R & D (such as finance, equipment, brain power, time, etc.). Added to this is the reduction of information costs in marketing for technology and necessary materials.[56] But the so-called "tie-in" clauses seem to impose severe constraints on the developing countries, particularly, when a developing country has little knowledge or experience in technology transfer and/or when its economy is based upon export-led industrialization. Then market constraints seem to become a serious barrier to the economy of these countries.

These problems are not unique to Latin America. They also are prevalent in Korea as indicated by the popular usage of the term "poisonous clauses" used by Koreans when referring to what the literature usually calls "tie-in clauses." A study of the 63 technology import contracts in Korea between February and July, 1979 reveals the nature of "poisons" as Table 2.1 shows. The contracts surveyed in this study were made after Korea's technology importation policy changed from its restrictive position toward liberalization in 1978 by which technology transfer was encouraged. After the liberalization policy was pursued, importation of low-level technology increased in Korea.[57] This implies that when we analyze the technology importation contracts covering a longer period time, for example between 1960-1980, the negative impacts of the poisonous clauses on the Korean economy may be more significant.

Table 2.1

Poisonous Clauses in Technology Transfer Contracts

	February - July 1979 Period	
Poisonous Clauses	# of Contracts	%
Tie-in clause[a]	10	16
Export restriction or ban clause	9	14
Clause banning licensee's modification, improvement of licensed technology	4	6
Clauses avoiding quality assurance	24	38
Hold harmless clause[b]	41	65
Clause banning import of similar technology during contract period	3	5

a. This study does not make it clear what this means. My understanding is that it referrs to arrangements such as raw or intermediate materials, finance, etc.

b. "Hold harmless clause" avoids guarantee against infringement on the licensed patent rights by a third party.

Source: Technology Transfer Center, KIST, The Comparative Studies of National Experience in Technology Policies, The Case of the Republic of Korea (Seoul: KIST, 1980), pp. 49-50.

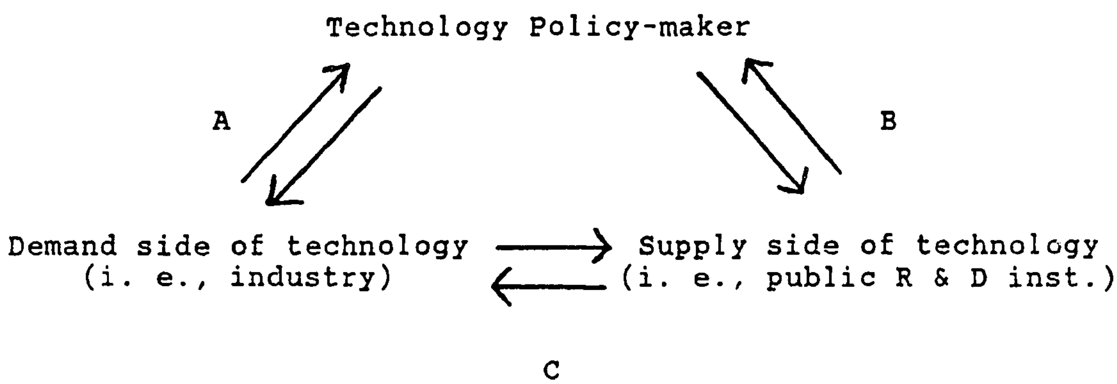
The centralized R & D system in the TNC's home country has little effect on "learning by doing." Observers particularly worry about the long term effects of TNC technology which would perform a substitute function for local R & D. This is a vicious cycle: Aggravated marginalization problems of developing countries will lead to ever more serious technological dependence upon exogenous sources of technology which then leads to lesser demands for local R & D. Studies on the effects of international technology transfer on Korea show ambivalent views. One study points out that the "learning by doing" effect is positive in Korea.[58] But another study on business corporations' R & D spending in Korea reveals that multinational joint venture firms in Korea spend little money on local R & D whereas locally owned firms are big spenders on local R & D.[59] What seems to be clear is that international technology transfer is deeply related to local R & D in Korea.

Scope of Public R & D Policy

What seems to be much overlooked by the structuralist view are the internal dynamics of public R & D policy and the specific roles played by the government of a given country in the technology transfer process. In fact, some studies on S & T policy in developing countries claim that public R & D policy is too narrowly defined by developing countries.[60] This perspective urges a policy researcher to look for imperfections in the public R & D policy system *per se*.[61] To Jorge Sabato, who devised the triangular model of technology policy in developing countries, the definition of explicit technology policy is the one which links three vertexes, research, production, and policy-making body, in a triangular manner.[62] This is diagramed in Figure 2.1.

Figure 2.1

Sabato Model of Technology Policy



Source: Denis Goulet, "Can Values Shape Third World Technology Policy?" in *Journal of International Affairs*, Vol. 33, No. 1 (Spring/Summer, 1979), pp. 100-102

The policy problem, stressed in this view, is that the public R & D policy as an explicit technology policy has been largely limited to dealing with the supply side of technology (R & D institutions) while the demand side of technology (industry or society as a whole) is left untouched or left to the jurisdiction of the implicit technology policies. But inasmuch as explicit technology policy for public R & D of developing countries is rather artificially created and aims for the quick promotion of technological development, explicit technology policy in itself should have a parallel policy instrument to link public R & D outputs to the production system of local industry. But this important component seems to have been missing in many developing countries' explicit technology policy.

To put it another way, a government's creation/support of national R & D centers alone is not a sufficient form of public R & D policy if it lacks parallel programs to link circulatory flows in A and C. However, the scope of public R & D policy to date is largely limited to B whereas A and C are left untouched. The marginalization problems of the valuable local R & D facilities may then be explained in terms of the following two conditions: First, when there is no or a weak linkage in A; and second, when C is either nonexistent or is weak. To strengthen the linkages A and C, suggested policy instruments include devising incentive systems by negative and positive means such as restrictions on the importation of technology, financial aids to industry in local R & D, or market guarantees when local R & D is used for production, and so forth.

The strength of Sabato's model of technology policy lies in the internal structure, complex in nature, of the explicit technology policy *per se* which is much overlooked by the structuralists. It is particularly persuasive when we consider the S & T system of some Latin American countries. Mexico and Colombia, often cited by literature as having a serious technological dependence problem (more than that of Korea),[63] did not have an appropriate national level technology policy-making body which could function as an important coordinator of both the supply and demand sides of technology.[64] The national R & D centers of Mexico have been left alone without any systematic supports from the government on the assumption that the creation of such entities will work all by itself. It was not until early 1970 that the National Council for Science & Technology (CONACTY) was created for the first time as a central technology policy-making body. Is there any relationship between the science-oriented research trend of the Mexican R & D institutes, as the structuralists claim, and the lack of systematic technology policy-making body? If the technology policy-making body, as Sabato's model argues, is an essential element in linking local R & D centers with production system, to what extent should government get involved? Particularly, what specific roles should government play to promote local R & D vis-a-vis technology transfer? These questions are yet to be investigated using Sabato's model of technology policy.

From the beginning of its industrialization, the

Korean government emphasized infrastructure building in the S & T system, including both the development of a S & T policy-making body (MOST) and R & D institutes. In the area of international technology transfer, the Korean government adopted a protectionist technology policy against the importation of foreign technologies. This restrictive policy position was altered in 1978 thus allowing more foreign technology inflow. In 1980, the Korean government substantially liberalized regulations on foreign licensing (FL) and direct foreign investment (DFI). When we compare the level of technology inflow from foreign countries to Korea before and after 1978 and 1980, there has been an increasing flow of foreign technologies[65] (Chapter six). Besides, the Korean government promulgated a series of laws to protect locally developed R & D (such as KIST-developed technologies or processes) by not allowing similar kinds of technologies to be imported from foreign countries. Added to this is the financial incentive system to encourage local firms to engage in local R & D. May the relatively low level of technological dependence of Korea in the 1960s and 1970s be attributed to the Korean government's protectionist technology policy? How have Korea's technology policies, both explicit and implicit, affected local firms in their choice of technologies (local vs. foreign)? And what have been the effects of these policies on the KIST's R & D? On the other hand, what sort of efforts have been pursued by

KIST to attract local firms? These questions will be analyzed in the following chapters.

In sum, the structuralists' development literature on S & T clearly indicates that analysis of a technology policy to create/support public R & D institutions (output policy or explicit technology policy) is not enough in terms of understanding the complicated technological development issues of developing countries. The strength of these arguments as well as Dolbeare's lie in their suggestion that one must inquire into the policy environment: Effects of various development policies and the international context of technology where TNCs play a major role. Furthermore, we should also broaden our meaning of technology policy as Sabato's model suggests. It should not only include government actions in the area of the supply side of technology but also those of the demand side of technology as well as the linkage area between R & D institutions and industry. And yet, both the structuralist and Sabato's model fail to inquire into the internal dynamics of government power involved in the issue of local R & D vis-a-vis technology transfer. With reference to these issues and problems raised in literature, the following chapters discuss public R & D policy in Korea: The dual structure of technology policy, technology transfer, and the nature of government involvement in technology development issues.

Notes

1. Nelson W. Polsby, Political Innovation in America (New Haven: Yale University Press, 1984); Deborah A. Stone, Policy Paradox and Political Reason (Glenview, Ill.: Scott, Foresman and Co., 1988); John W. Kingdon, Agenda, Alternatives, and Public Policies (Boston: Little, Brown, 1984); Roger W. Cobb & Charles D. Elder, "The Politics of Agenda-Building: An Alternative Perspective for Modern Democratic Theory," The Journal of Politics Vol. 33 (1971) pp. 892-915.; Mark E. Rushefsky, Public Policy in the United States (Pacific Grove, CA.: Brooks/Cole Publishing Co., 1990); James E. Anderson, Public Policy-Making, 3rd ed. (New York: Holt, Rinehart and Winston, 1984); Malcolm L. Goggin & al., Implementation Theory and Practice (Glenview, Ill.: Scott, Foresman and Co., 1990); Randall B. Ripley & Grace A. Franklin, Policy Implementation and Bureaucracy, 2nd ed. (Chicago: The Dorsey Press, 1986); Linda R. Cohen & Roger G. Noll, The Technology Pork Barrel (Washington, D. C.: The Brookings Institution, 1991); Jeffrey L. Pressman & Aaron B. Wildavsky, Implementation (Berkeley: University of California Press, 1973); Robert T. Nakamura & Frank Smallwood, The Politics of Policy Implementation (New York: St. Martin's Press, 1980); Eugene Bardach, The Implementation Game: What Happens After a Bill Becomes a Law (Cambridge, Mass.: The MIT Press, 1982); Randall B. Ripley, Policy Analysis in Political Science (Chicago: Nelson-Hall Publishers, 1985); Kenneth M. Dolbeare, ed., Public Policy Evaluation (Beverly Hills, CA.: Sage Publications, 1975); and Lawrence B. Mohr, Impact Analysis for Program Evaluation (Pacific Grove, CA.: Brooks/Cole Publishing Co., 1988).

2. Most books listed above assume this perspective. Also refer to Kenneth M. Dolbeare, "The Impact of Public Policy," in Cornelius P. Cotter, ed., Political Science Annual, Vol. 5 (Indianapolis & New York: Bobbs-Merrill, 1974); and Arnold J. Heidenheimer, Hugh Heclo, & Carolyn T. Adams, Comparative Public Policy, 3rd ed. (New York: St. Martins Press, 1990).

3. Dolbere, ibid.

4. David Easton, The Political System (New York: Knopf, 1953) p. 129. Also, Dorothy M. Stetson's book on Women's Rights in the U.S.A.: Policy Debates & Gender Roles (Pacific Grove, CA.: Brooks/Cole Publishing Co., 1991) clearly points out how the gender-specific social

values affected government's decision-making and implementation.

5. Harold D. Lasswell & Abraham Kaplan, Power & Society (New Heaven: Yale University Press, 1970), p. 71.

6. Cohen & Noll.

7. According to them, government nonaction "becomes a policy when it is pursued over time in a fairly consistent way against pressures to the contrary." Heidenheimer, Heclo & Adams, p. 5.

8. Dolbeare (1974 & 1982).

9. Ibid. (1974), pp. 91-93.

10. Ibid., p. 94.

11. Refer to, for example, Dolbeare (1974) and Kenneth M. Dolbeare, American Public Policy (New York: McGraw-Hill Book Co., 1983); James E. Anderson, "The Logic of Public Problems: Evaluation in Comparative Policy Research," in Douglas E. Ashford, ed., Comparing Public Policies: New Concepts and Methods (Beverly Hills, CA.: SAGE Publications, 1978); Nakamura & Smallwood; William N. Dunn, Public Policy Analysis (Englewood Cliffs, NJ.: Prentice-Hall, Inc., 1981); Thomas R. Dye, Understanding Public Policy, 2nd ed. (Englewood Cliffs, NJ.: Prentice-Hall, Inc., 1975; Anderson (1984); Ripley (1985); and Mohr.

12. Dye, Ibid., p. 331.

13. Fred M. Frohock, Public Policy: Scope and Logic (Englewood Cliffs, NJ.: Prentice-Hall, Inc., 1979), pp. 184-188.

14. Dolbeare (1975), p. 14.

15. Dolbeare (1982); Anderson (1984); Edward S. Greenberg, American Political System, 5th ed. (Boston: Little, Brown & Co., 1989)); and Heidenheimer, Heclo & Adams.

16. Refer to studies done from political economy perspectives such as Greenberg (1989), James O'Connor, The Fiscal Crisis of the State (New York: St. Martins Press, 1973); and Barnet & Muller, Ch. 10.

17. Dolbeare (1974), pp. 122 - 123. The term "wholistic" in

this quotation seems to mean what we usually understand as "holistic."

18. The causes of policy impact are viewed as being multiple in nature and consisting of two separate variables: The independent variable (a given policy/program under investigation) and intervening variables (intervening events occurring before or while policy is being implemented). These intervening variables are not structured as parts of the independent variable, but play significant roles in policy outcomes. Refer to Edward A. Suchman, Evaluative Research (New York: Russell Sage Foundation, 1967).

19. James Coleman, "Problems of Conceptualization and Measurement in Studying Policy Impact" in Dolbeare (1975), pp. 19-40.

20. Some may feel uncomfortable to define American political system as the liberal-pluralist model. In fact, new labelings have emerged. Lowi calls the modern American political system as "clientelism" while a neo-Marxist scholar like Greenberg goes even further to apply the Marxist interpretation of the role of state. To Schmitter, both America and the Western European countries are grouped together under the single name of "societal corporatism." But these names are no more than modern variants of the liberal-pluralist model of the state and they should be distinguished from other models, such as authoritarian corporatism. Neither Lowi, Greenberg, nor Schmitter denies the very existence of free, voluntary, autonomous interest groups in America. Rather, their arguments are focused on the uneven distribution of power across the diverse interest groups, particularly the super powerfulness of some corporate organizations and the meanings of their weight in government policy areas. Refer to Theodore J. Lowi, The End of Liberalism, 2nd ed. (New York: W. W. Norton & Co., 1979); Edward S. Greenberg, Understanding Modern Government: The Rise & Decline of the American Political Economy (New York: John Wiley & Sons, 1979); Greenberg (1989); Kenneth M. Dolbeare & Murray J. Edelman, American Politics: Policies, Power & Change, 5th ed. (Lexington, Mass.: D. C. Heath & Co., 1985); and Philippe C. Schmitter, "Still the Century of Corporatism?" in Frederick B. Pike & Thomas Stritch, eds., The New Corporatism: Social-Political Structures in the Iberian World (Notre Dame, Ind.: University of Notre Dame Press, 1974).

21. Michael A. Launius, "The State and Industrial Labor: Bureaucratic-Authoritarianism and Corporatism in Korea's Fifth Republic," Ph.D. Diss. University of Hawaii at Manoa, 1990; Chong-Sik Lee, "South Korea in 1980: The Emergence of a New Authoritarian Order," Asian Survey, Vol. XXI, No. 1 (January, 1981), pp. 125-143; Sung Chul Yang, Korea and Two Regimes (Cambridge, Mass.: Schenkman Publishing Co., Inc., 1981), Ch. 9.; Hyung-Baeg Im, "The Rise of Bureaucratic Authoritarianism in South Korea," mimeo (1985); and Michael A. Launius, "The State and Industrial Labor in South Korea," Bulletin of Concerned Asian Scholars, Vol. 16, No. 4 (October-December, 1984).

    Studies of Korean politics or public policies in general (at least until late 1980s) do not explicitly label Korea's political system as an "bureaucratic-authoritarian" model. But what they usually explain is that the political system is identical to the characteristics attributed to the model. For this, refer to Young Whan Kihl & Dong Suh Bark, "Food Policies in a Rapidly Developing Country: The Case of South Korea (1960-1978)," The Journal of Developing Areas, Vol. 16 (October, 1981), pp. 47-70.

22. Theda Skocpol, "Bringing the State Back In," ITEM: Bulletin of the Social Science Research Council, Vol. 1 (1982), p. 1.

23. Launius (1984 & 1990).

24. Fernando H. Cardoso, "On the Characterization of Authoritarian Regimes in Latin America, in David Collier, The New Authoritarianism in Latin America (Princeton, NJ.: Princeton University Press, 1979).

25. "Technocrats" in this study is loosely defined referring to professionals working within and outside bureaucracy.

26. Bruce Cumings, "The Origin and Development of the Northeast Asian Political Economy: Industrial Sectors, Product Cycles, and Political Consequences," in International Organization, Vol. 38, No. 1 (Winter, 1984), p. 28.

27. Jeffrey D. Straussman, The Limits of Technocratic Politics (New Brunswick, NJ.: Transaction Books, 1978). For discussions on "strategic" vs. "tactical" decision making, refer to Ch. 3 of this dissertation.

28. Amilcar Herrera, "Social Determinants of Science Policy in Latin America: Explicit Science Policy & Implicit Science Policy," The Journal of Development Studies, Vol. 9, No. 1 (October, 1972).

    Herrera did not distinguish "science" policy from "technology policy" in an explicit way in his analysis. However, what he calls "science policy" seems to fall under what other call "technology policy" category.

29. Ibid.

30. The industry-led technological change of the West can be explained in many ways: The influence of the ideological foundations of capitalism and liberalism; to promote efficiency in the allocation of scarce natural resources; to reduce labor costs by mechanization; and technological innovation to create new products to win a competitive edge in a market, especially by monopolistic/oligopolistic industries.

31. For the S & T institutional development in the U. S., refer to the following: Donald Schon, "The National Climate for Technological Innovation" in Thomas J. Kuehn & Alan L. Porter, eds., Science, Technology & National Policy (Ithaca: Cornell University Press, 1981); Polsby; Don Fugua, "Science Policy: The Evolution of Anticipation," Technology in Society, Vol. 2 (1980), pp. 365-373; James Everett Katz, "Planning and Legislating Technical Services," Technology in Society, Vol. 4 (1982), pp. 51-56; Herbert F. York & G. Allen Greb, "Military Research and Development: A Postwar History," in Kuehn & Porter, pp. 190-215; Granger (1979); and Claude E. Barfield, Science Policy From Ford to Reagan (Washington, D. C.: American Enterprise Institute for Public Policy Research, 1982).

    For recent publications, refer to Richard R. Nelson, High-Technology Policies: A Five-Nation Comparison (Washington, D.C.: American Enterprise Institute for Public Policy Research, 1984); Anne L. Hiskes & Richard P. Hiskes, Science, Technology and Policy Decisions (Boulder: Westview Press, 1986); Bruce L. R. Smith, American Science Policy Since World War II (Washington, D. C.: The Brookings Institution, 1990); and Cohen & Noll.

32. Refer to National Academy of Engineering; and Jeffrey James & Susumu Watanabe, eds., Technology, Institutions and Government Policies (New York: St. Martin's Press, 1985), Ch. 8.

33. Schon, p. 150.

34. In the fiscal year 1974, for example, when both federal and corporate R & D expenditures are combined, more than 80% of total industrial R & D came from five U. S. industrial sectors whereas in fiscal year 1976, of the total R & D performed about 70% was done by industry. Industrial policy advocates worry about the U. S. government's basic research centered funding policies and strongly urge expanding its role in down stream technical activities. Refer to National Academy of Engineering. Also refer to Barfield.

35. In 1976 for the first time in U. S. history a public law, the National Science & Technology Policy, Organization & Priorities Act has passed which became the first national S & T policy of its kind. The purpose of the promulgation of this law is to direct S & T activities towards meeting of national goals.

36. Fugua, p. 371.

37. UN Economic & Social Council.

38. The uncertainty problems (both in technique uncertainty and market uncertainty) are inherent barriers to the technological innovation process. R & D is therefore often defined as a "risk venture." Refer to Granger; and Freeman.

39. Moravcsik; and UN Economic & Social Council.

40. There is too large a literature to list here. As basic references, refer to the following: Barnet & Müller; Goulet (1977); Lynn K. Mytelka, "Technological Dependence in the Andean Group," International Organization, Vol. 32, No. 1 (Winter 1978); Journal of International Affairs (Special issue on Technology & New International Order), Vol. 33, No. 1 (Spring/Summer, 1979); Robert Girling, "Dependency, Technology & Development" in Frank Bonilla & Robert Girling, eds., Structures of Dependency (California: Stanford University, 1973); Johan Galtung, "A Structural Theory of Imperialism," Journal of Peace Research, Vol. 8, No. 2 (1971), pp. 81-118; Johan Galtung, "Towards a New International Technological Order?" (Geneva: U. N. University, Goals, Processes and Indicators of Development Project, 1978), mimeo; Helge Hveem, "The Global Dominance System," Journal of Peace Research (1973); and Wilber.

41. Wilber's book provides a good review of these theories.

42. Charles Cooper, "Science, Technology and Production in the Underdeveloped Countries: Introduction," The Journal of Development Studies, Vol. 9, No. 1 (1972), pp. 5-6. Also refer to Cooper (1974), pp.55-64; Charles Cooper, "Choice of Techniques and Technological Change as Problems in Political Economy," International Social Science Journal, Vol. 2, No.3 (1973); Freeman & al. (1978); and Herrera, pp. 19-37.

43. Quoted from Cooper (1972), p. 5.

44. Ibid., pp. 5-6.

45. D. J. de Solla Price, "The Structures of Publication in Science & Technology," in MIT Press, Factors in the Transfer of Technology (Cambridge, Mass.: MIT Press, 1969) quoted from Choi Hyung-Sup, Kebal Dosang Kuk e Kwahak Kisul Kebal Yunkoo Jaenryak: Hankuk e Baljeon Kwachung ul Jungsim e ro (Science & Technology Development Strategies of Developing Countries: With a Primary Research Focus on the Korean Case), Vol. 1 (Seoul: KIST, 1980), p. 5. Also refer to Sheridan M. Tatsuno, Created in Japan: From Imitators to World-Class Innovators (New York: Harper Business, 1990).

46. Quoted from Tuvia Blumenthal, "Japan's Technological Strategy," Journal of Development Economics, Vol. 3 (1976), p. 246. Also refer to Granger, pp. 12-13; Harvey Brooks, "Technology, Evolution, and Purpose," in Kuehn & Porter, pp. 35-56.

Often there are no clear cut boundaries between these activities as the same activity may be regarded as basic research by some while others consider it as applied research. Nevertheless, "research" is investigative in character whereas "development" is associated with production, a process to meet practical economic or social objectives.

47. Goulet (1977). Also refer to Denis Goulet, Technology, the Two-Edged Sword (Honolulu: East-West Technology and Development Institute, East-West Center, 1976); Denis Goulet, "Development or Liberation," in Wilber; and Denis Goulet, "Can Values Shape Technology Policy in the Third World?" in Journal of International Affairs, Vol. 33, No. 1 (1979).

48. This does not mean that science is totally value-free. What I want to emphasize is that in comparison,

technology is more value-embedded than scientific knowledge per se. A recent book is useful to refer to: Chalmers Johnson & al. eds., Politics and Productivity (New York: Harper Business, 1989), Ch. 1.

49. Chris Freeman, "Economics of Research and Development," in Ina Spegel-Rosing & Derek de Solla Price, eds., Science, Technology and Society, A Cross-Disciplinary Perspective (London & Beverly Hills: SAGE Publications, 1977), p. 229.

50. H. Choi (1980), p. 5.

51. Keith Norris & John Vaizey, The Economics of Research & Technology (London: George Allen & Unwin Ltd., 1973), pp. 76-85 & p. 77.

52. Alschuler, p. 63.

53. Refer to footnote number 40.

54. In addition to evidence appearing in the development literature, my field research in Korea also substantiates this.

55. Technology Transfer Center, KIST (TTCKIST), The Comparative Studies of National Experience in Technology Policies, The Case of the Republic of Korea (Seoul: KIST, 1980), p. 46.

56. Perhaps the heavy reliance of Korean entrepreneurs on the importation of Japanese technology explains this.

57. TTCKIST (1980), p.46.

58. Alschuler.

59. K. Lee.

60. Goulet (1977), pp. 81-83; Goulet (1979), pp. 100-102; and Sagasti. Goulet's concept of the "vital nexus" is primarily focused on the need of mass input, not elite-domination, in the developing country's technology policy. Also he emphasizes the role of technology policy in the preservation of the indigenous social values of a given society. However, his argument, as well as Sabato's model of technology policy can also be interpreted in these terms.

61. Ibid.

62. Quoted from Goulet, ibid.

63. Granger, pp. 119-120.

64. A. Araoz, <u>Science and Technology for Development, STPI Module 5: Policy Instruments to Build Up an Infrastructures for the Generation of Technology</u> (Ottawa, Canada: International Development Research Center, 1980), pp. 24-25 & p. 32.

65. TTCKIST (1980), p. 46.; Linsu Kim, "Science and Technology Policies for Industrialization in Korea," reprint from <u>Strategies for Industrial Development</u> edited by Jangwon Suh (Kuala Lumpur, Malaysia: Asia and Pacific Development Council, 1989); and Linsu Kim, "Technology Transfer & R & D in Korea: National Policies & the U. S. - Korea Link" A paper presented at the Conference on National Policies for Technology Transfer: The U. S. - Korea Link in Makaha, Hawaii (1984).

CHAPTER THREE

THE DECISION TO CREATE KIST: A NEW MODEL OF PUBLIC R & D

The Korean government's massive-scale industrialization policy launched in the early 1960s gave great momentum to the institutionalization of Korea's S & T system. KIST was created within these time and policy frameworks. However, without political support from both Presidents Lyndon B. Johnson and Park Chung-Hee (Park in particular), the creation as well as the development of KIST would have been very much delayed if not impossible.

This chapter attempts to investigate the process of decision-making concerning the establishment of KIST. The primary emphasis in this chapter will be placed on what the evolution of KIST, from its inception to decision-making, informs us about 1) the R & D policy-making process in Korea, 2) the relationship between KIST and the industrialization plan of Korea, and 3) the implication of the "KIST model" for Korea's political power structure. Before turning to these issues, however, this chapter begins with a general overview of Korea's R & D system in the pre-KIST era, hoping that it will enhance our understanding of the political significance of KIST in Korean politics.

An Overview of the R & D System in the Pre-KIST Era: Characteristics & Explanation

Centripetal Tendency

Korea has historically enjoyed a relatively advanced level of S & T. Although the S & T of traditional Korea was under the influence of China, the history of S & T in Korea reveals that an indigenous capacity had been an equally important factor, which allowed traditional Korea to enjoy a great deal of originality and independence in S & T.[1] This is evidenced by achievements in astronomy, metallurgy, printing, textiles, ceramics, architecture, iron-clad shipbuilding, and so forth. In the 15th century, particularly during the reign of the great King Sejong (1418-1450) of the Yi Dynasty (1392-1910), Korea reached a renaissance of S & T, which not only contributed to Korean civilization *per se* but also to the world history of S & T. Such achievements, however, went unmatched after the 15th century and independence and indigenous creativity were gradually lost.

This early history indicates that such high level accomplishments were the product of organized and centralized efforts on the part of the national government.[2] During the Koryo Dynasty (918-1392) and in the early Yi Dynasty, most craftsmen and artisans were mobilized by government to manufacture goods and services primarily for government consumption such as weapons, paper, kitchen utensils for the royal table, etc. The political leadership in particular, served as an important factor in the advancement of S & T in traditional Korea. This is evidenced by the fact that S & T flourished most under the patronage of the great King Sejong, who had vigorously sought to organize scholars into the Chiphyonjon (Hall of Worthies or an academy of scholars) system, whereas it stagnated under other monarchs of the Yi Dynasty. The issue gets even clearer when we note the highly stratified caste system of traditional Korea, under which craftsmen and artisans (those who worked with their hands) were classified into a lower social class, just above slavery.[3] Without government intervention, therefore, it must have been very difficult for craftsmen and artisans to initiate technological progress in a society where social rewards were lacking.

This centralized character of S & T in traditional Korea has carried over to modern Korea. In 1883, the National Industrial Research Institute (NIRI) was created under the sponsorship of a Yi Dynasty monarch as the first modern science based R & D institute of its kind in Korea. No published information is available about the rate of growth in R & D institutions afterwards, but by 1963, the total number of R & D institutes had reached 83: Most of them (71) were run directly by government, and only 12 run by industry. The government-led R & D pattern has changed in the past decade. Table 3.1 shows (also Table 1.1 and

Table 1.2 of Chapter one) the remarkable growth of private sector R & D in the 1980s in terms of the number of organizations, the number of researchers, and the size of R & D budgets.[4] Since 1981 R & D expenditures financed by the private sector have steadily exceeded that of publicly funded. Still, Table 3.1 clearly indicates the significance of public R & D in Korea: Government initiation and intervention in R & D. When we compare government R & D institutes to those of industry, the size of the former is much greater than the latter. In 1980, for example, the average number of researchers per organization was 37 in public R & D institutes whereas that of private industry was only 16. In terms of budget, public R & D institutes spent an average of W842.5 million per institute in 1980, whereas those in the business community spent an average of W253.4 million per institute in the same year. The largeness of public R & D institutes continued into the late 1980s: In 1988 the average number of researchers in public R & D institutes was 58.7 compare to 17.2 in the private sector; on average, public R & D institute's spending was W2,952.9 million whereas that of private sector R & D institutes was W1,000 million.

Lack of R & D and Explanations

In spite of the increasing number of R & D institutes, however, R & D in Korea was rather inactive in the early

Table 3.1

Trend of R & D by Organization.

Unit of Budget: One Billion Won [a]
Unit of Researchers: 1,000 persons

Organization by nature	'65	'70	'75	'80	'85	'88
	year					
Public[b]						
# of Organizations	65	105	104	124	119	163
# of Researchers	2.1	2.5	3.1	4.6	7.2	9.6
R & D Budget	1.8	8.9	28.1	104.5	280.2	481.3
Univ. & Colleges						
# of Organizations	18	85	146	202	217	1,025
# of Researchers	0.5	2	4.5	8.7	15	19
R & D Budget	0.1	0.4	2.2	25.9	118.8	232.8
Companies						
# of Organizations	22	107	303	321	928	1,633
# of Researchers	0.2	1.2	1.7	5.1	19	29
R & D Budget	0.2	1.3	12.3	81.4	751	1,633.3

Note: a. Both budget and researcher figures are rounded off. Budget refers to intramural R & D expenditure. Since 1983 R & D expenditure includes medical institutes R & D expenditure. Beginning from 1987, medical institutes' R & D expenditure has been included in non-profit public sector R & D expenditure. Exchange rate between US$1 and Won (W) in 1965 and 1988 was 1:271.78 and 1:684.10 respectively.

b. This includes both government owned R & D institute and government-endowed non-profit R & D institutes.

Source: MOST, _Science & Technology Annual 1980_, p. 352; _Science & Technology Annual 1981_, p. 298; MOST, _'89 Science & Technology Annual_, pp. 446-447 & p. 451; and EPB, _Major Statistics of Korean Economy 1979_, p. 486 & _Major Statistics of Korean Economy 1990_, p. 244 (Seoul: EPB, 1979 & 1990).

1960s. This was acknowledged by the Korean government itself. One study describes government research institutes in the early 1960s in the following manner:

> ...project targets are usually not clear, 40% of the units have more than 100 researchers, they often overlap (for instance, 8 institutes are engaged in food research), there is a ratio of four researchers to six administrative staff, outstanding research workers are rare, and cooperation with universities is also rare.5

Another government document compiled by the Economic Planning Board (EPB)[6] confirmed this weakness: EPB's survey of S & T notes Korea as "technologically underdeveloped" and was characterized in the following terms:[7]

1. Key industries depend primarily on foreign resources for required technical services.

2. There is almost no production of industrial products which can be successfully marketed on a competitive world-wide basis.

3. There is a lack of comprehensive administrative system through which technical administration can be successfully implemented.

4. Government and private scientific and technical research agencies are more or less inactive, private research institutes are few in number, and agencies for the advancement and promotion of scientific technology are nonexistent.

5. There is a fundamental lack of preparedness (preparation) to carry out research in basic scientific technology, as well as of creative initiative to promote technical development.

6. Educational facilities are inadequate for supplying competent scientists and engineers to educational and research institutions and productive industries.

7. The 1:1.3:33 ratio of engineers to technicians to craftsmen is extremely out of balance in comparison with the ideal ratio of 1:5:15.

8. The public is extremely deficient in its

understanding of scientific techniques, businessmen and entrepreneurs lack the willingness to rationalize their management through technical improvements in their operations, and in general the foundation for carrying out scientific and technological activities is insecure.

9. An effective and comprehensive policy for the development and promotion of science and technology does not exist.

Reasons for the inactivity of R & D institutes at that time stemmed from economic, political, as well as cultural factors. From the economic standpoint, there were several factors which seemed to have constrained R & D institutes. First of all, R & D institutes had scarce resource bases to reach so-called critical mass. As Table 3.2 shows, each organization had an average of 21 research staff members[8] with an average annual R & D budget per organization of W6.8 million (or $52,500). Particularly, R & D resources in the private sector of the economy were extremely small: There were only 12 R & D institutes which had an average of 6 researchers per organization, with an average of W516,583 ($3,974) annually assigned R & D budget to each organization. More significantly, the administrative budget (W287 million) for public sector R & D institutions took a large share: 30.5% of the total budget whereas the R & D budget (W513.5 million) accounted for 54.5% of the total budget. This implies that the latent function of public R & D in the early 1960s was to solve the high unemployment problems of Korea rather than research *per se*. In terms of the magnitude of the R & D budget at the national level, a total

Table 3.2

State-of-the-Art in R & D Institutions in Korea

Unit of Budget: million Won As of 1963

	Organization				Total
	Public sector	College/ University	Private sector	Others[a]	
#of R & D Institutions	58	9	12	4	83
Total # of Employees	2,637	162	157	116	3,072
# of Researchers[b]	1,468	132	70	80	1,750
Total budget	941.3	198.3	32.1	60.9	1,232.6
R & D budget[c]	513.5	32.5	6.2	13.8	566.1
Facilities budget[d]	140.6	146.9	4.31	33.1	333.9
Administrative budget[e]	287.2	18.9	11.6	14.0	331.7

Notes: a. This refers to nonprofit corporate R & D institutes and public enterprise affiliated R & D institutes.

b. Those who are engaged directly in R & D with college diploma or above.

c. All the expenditures related to R & D activities such as costs for laboratory testing, survey research, other supporting expenditures for those activities.

d. Construction and/or equipment costs for both laboratories and administration.

e. Wages and salaries of all employees and other management costs.

Source: EPB, Chonkuk Kwahak Kisul Yonku Kikwan Shiltae Josa (National Survey of R & D Institutes of Korea) (Seoul: EPB, 1964), quoted from KIST, Hankuk Kwahak Kisul Yunkuso Shipnyun Sa (The Ten Year History of KIST) (Seoul: KIST, 1977), p. 24.

of W520 million was spent in 1961 which accounted for only 0.25% of the nation's GNP.[9] By 1965, a total of W2,040 million was spent by the national government in the field of S & T, but this amount accounted for only 0.23% of the total national budget of the year.[10]

Furthermore, R & D institutes suffered from a lack of qualified manpower. There are no statistics available which inform us exactly what was the educational level of R & D staffs across institutes in the early 1960s. However, a comparison of two R & D institutes, the Research Institute of Mining and Metallurgy (RIMM) and NIRI is interesting.[11] RIMM, which was created under the joint sponsorship of major public enterprises in Korea, was known in the mid-1960s as the most active and perhaps the only R & D institute really engaged in the development of industrial technology possessing the best equipped manpower. As of 1964 the total size of the research staff (43) at RIMM was relatively small, but the staff were well educated: Ph.D. holders accounted for 30.2%, M.S. holders 20.9%, and B.S. degree holders 48.9%. On the other hand, NIRI, the largest and oldest national R & D institute, had a total of 150 researchers as of 1964, but their educational level was very low: Only one researcher had a Ph.D., seven researchers had received Master's degrees, and the rest (94.6%) of the total number of researchers had Bachelor's degrees.

Perhaps a more general idea about the overall qualification of R & D staffs can be drawn from a Korean government report on the level of technical manpower. As shown in Table 3.3, there was a total of 298,614 people employed as technical staff in various organizations as of mid-1961, but only 3.23% (9,632) had completed their college level science and engineering training either in Korea or abroad. There was a large pool of technical manpower resources in industry as the table shows, but their educational level was extremely low. Only 2.57% (7,211) of them had college level training whereas the majority of them (77.02% or 216,471) had either only 6 year elementary school backgrounds (66.90%) or had no formal educational background at all (10.12%). In terms of occupational break down, only 2.9% (8,616) of the total number in the technical manpower pool were categorized as engineers, and 3.7% (11,128) as technicians, whereas the rest, 93.4% (279,670), were listed as craftsmen.[12] This manpower configuration clearly indicates a great shortage of qualified technical manpower as well as the very low technological competency of Korea in the early 1960s.

The nature of the tasks carried out by these institutions was hardly "R & D" by conventional wisdom. The term R & D in the early 1960s Korean context was used interchangeably with "experiment," or "test."[13] The function of these R & D institutes, therefore, was simply to assist bureaucratic procedures rather than to perform

Table 3.3

Technical Manpower Resources by Education & Organization.

As of August, 1961

Organization	Educational level College	High/Middle School	Primary School/ No Education
Gov't Agency			
16,350 (5.48%)	1,343	4,237	10,630
Science & Engineering School			
1,211 (0.41%)	1,028	135	48
Enterprise			
281,053 (94.12%)	7,211	57,371	216,471
Total			
298,614 (100%)	9,632 (3.23%)	61,833 (20.71%)	227,419 (76.16%)

Note: % figures are rounded off. This table is primarily drawn from the EPB's Table 4.5 (p. 13) but the total number of technical manpower employed by industry is drawn from Table 4.4 (p. 12) because of an erroneous figure found in Table 4.5. EPB's statistics on the industry's manpower breakdown by educational level show a computation error. Also, the total manpower shown in EPB Tables 4.4 & 4.5 show computation error.

Source: EPB, First Five-Year Plan for Technical Development - Supplement to First Five-Year Economic Plan (Seoul: EPB, 1962), pp.12-13.

creative activities for production. The only R & D institution that qualifies by world standards was the Atomic Energy Research Institute (AERI), which was created in 1959 with U. S. foreign aid.[14] AERI, equipped with modern laboratory facilities and other resources, was the first attempt in Korea to develop a new discipline in Korea's R & D system. However, its R & D was limited to basic research. It was in fact very difficult to find R & D institutes designed to solve the practical technological problems of industry.

Another constraint came from the weak and unstable Korean economy. This economic situation is in fact deeply associated with the unfortunate events in Korean history of the past century or so, and it is a product of multiple causes which may be explained both in economic and non-economic terms. Also, it is subject not only to the internal politics of Korea, but also, perhaps more significantly, to external factors coming from the international politics of the Far East in the past century. An in-depth analysis of the causes of this political-economic situation goes beyond the scope of this study.[15] Nevertheless, to state briefly, we may trace the historical roots to the late Yi Dynasty which failed to develop a solid political-economic base. During the colonial period (1909-1945), Japan began to industrialize Korea, but Japan's colonial policies failed to develop a balanced economic structure in

Korea. The primary interest of the colonial government was to develop the Korean economy as a sub-unit of Imperial Japan's economic system, a typical example of the so-called "center-periphery" economic relationship. The particular nature of the industrial policies pursued by the colonial government prevented Korea from building up a solid and autonomous economic base.[16]

The end of World War II liberated Korea from Japanese colonialism, but the 1945-1961 period also witnessed widespread political turmoil and social chaos, beginning with the *de facto* division of the nation in 1945. The Korean War (1950-1953) was followed by sporadic communist attempts to subvert the South in the 1950s. The economic effect of such political events on the South was tremendous: The South lost access to most of the Korean peninsula's industrial base as a result of the partition, and furthermore the Korean War brought additional destruction to its economic infrastructure. In 1960 there was a student uprising which eventually overthrew the corrupt Syngman Rhee regime while giving birth to the reformist Chang Myun regime. But Chang's parliamentary regime was short-lived, overthrown by a military *coup d'etat* (May 1961) led by an army general, Park Chung-Hee. During such chaotic periods, nation-building and political stability, rather than economic wellbeing, were the primary concerns of policy-makers.

The Korean economy in the early 1960s was too weak to generate significant demand for technological inputs in production. The post-war period of the Korean economy was, in fact, largely sustained by foreign aid and left in the hands of foreign advisors from the U. S. and other international organizations such as the U. N. Total foreign aid reached $2,390 million during the 1945-1959 period.[17] However, the consumer goods-oriented foreign aid program,[18] and scarce domestic capital[19] failed to stimulate the positive development of the Korean economy. The annual growth rate of GNP (at 1970 constant prices) during the 1954-1960 period was 4.3%, and GNP per capita was $82 in 1961. The manufacturing sector, particularly, was very weak: Although its average growth rate during 1953-1961 was as high as 11.2%, the manufacturing sector's contribution to GNP in 1961 was only 13.5%.[20]

Under the various foreign economic aid programs, a few factories were built in the 1950s in some light industries such as cement, textiles, and fertilizer. But the technological components of these factories were almost entirely imported from foreign countries on a turn-key basis because foreign aid/loans were provided in package deals which included both capital goods and technology. This situation continued into the 1960s. In 1962, Korea for the first time began to import technologies separately from foreign capital and/or technical aid. But only 15 cases of technology importation occurred during the 1962-1965 period, for most technologies were still transferred to the country through foreign capital packages.[21] Under this arrangement, local entrepreneurs were more interested in playing politics with government officials influential in obtaining foreign loans or foreign aid grants than they were in meaningful technology importation, much less in domestic R & D.[22] An economist commented that R & D in Korea in the early 1960s was even considered by local business circles as a consumption item rather than an investment item.[23]

Most of the R & D institutes, under the direct control of the Korean government had little autonomy both in the management of research organization and in the direction of research. As Table 3.2 indicates, R & D institutes lodged within the formal government organizational structure accounted for 70% of the total number of organizations, 83% of the total number of researchers, and 91% of the total R & D expenditures of the nation. In addition, since most R & D institutes under the "others" category in Table 3.2 are those affiliated with public enterprises, the government's involvement in R & D becomes even more significant in terms of both the number of R & D organizations (75%), the total number of researchers (89%), and of the total amount of R & D spending (93%). Furthermore, when we consider that many of the research facilities are affiliated with public universities, Korea's R & D activities in the early 1960s were virtually all state activities.

This near monopolization of R & D by government resulted in the heavy bureaucratization of R & D institutes. Rigidity in R & D management as well as formality in the organizational structure were often noted as serious barriers to R & D performance in the early 1960s.[24] Furthermore, there developed a certain political culture that worked against the organizational growth of R & D institutes. Public R & D institutes, as sub-units of government organizations and/or subject to public finance were perceived by government as something that <u>can</u> and <u>ought</u> to be controlled. In other words, neither the value of autonomy in research organizations nor respect for professionalism were recognized by power holders. These tendencies toward bureaucratic control and anti-professionalism are in fact what characterize Korean bureaucracy in general.[25] With their lack of authority and status, technicians and engineers were seen as symbols of powerlessness in Korean politics. Accordingly, R & D institute positions were very unpopular among bureaucrats, and these positions were even perceived as posts for "political exiles" by appointees themselves and others as well.[26] The private business community felt much the same way.[27]

More seriously, most government officials who were in positions of control over R & D organizations had little knowledge about the concept of R & D, not to mention the value of R & D to society. This situation did not change even after MOST was created in 1967 as a cabinet level top policy-making body for S & T: Roughly 98% of MOST bureaucrats in the late 1960s were non-science/engineering majors.[28]

Status quo, rather than innovation, seemed to be the watchword in the management of public research organizations. Inasmuch as the operational costs of these institutes were guaranteed by the national government's annual budget, it seemed to be quite logical for public institutes to pursue the status quo as an organizational goal. Under such circumstances where the survival of institutes depends upon politics in budgeting, not upon pressure coming from clients in the market, it was very difficult for a researcher in the public R & D sector to find incentives to work harder. Added to this was a certain bureaucratic culture which discouraged institutional development. Studies of Korean bureaucracy often note that the "submissive authoritarian political culture" is deeply embedded in Korean bureaucracy. This leads bureaucrats to prefer top-down decision-making and implementation processes to the bottom-up approach in order to minimize official responsibilities and at the same time show full personal loyalty to the boss.[29] Personal ties and seniority were traditionally more important than productivity and professional expertise in the maintenance of job security.[30] This bureaucratic culture was not an exception in R & D institute circles.[31]

This bureaucratic culture stems from the political and cultural heritage of Confucianism,[32] which justified rule by the scholar-bureaucrats, and in which technicians have been traditionally denigrated. This literati-first-and-technician-second mentality is deeply embedded in many aspects of Korean politics. The wage structure of employees in the early 1960s, for example, revealed that production workers both in the mining and manufacturing sectors of industry received far less than non-production employees and administrative staff.[33] Lack of social respect for technicians is also reflected in the R & D staff's income level. As Table 3.4 shows, 26% of the R & D staff in 1964 received less than W5,000 ($20) a month, 52% received between W5,000-10,000 ($20-39), and 17% between W10,000-15,000 ($39-59), whereas only 4% received more than W15,000 ($59) per month. When we break down the salary scale by organization, at least 60% of the total R & D manpower of each organization, except at universities, were paid less than W10,000 per month.

Low wages for R & D personnel were strikingly prevalent in the public sector. Perhaps the researcher's low income was deeply associated with the low level of industrialization of the Korean economy in the early 1960s, as indicated by Korea's GNP per capita which was only $103 in

Table 3.4

Monthly Income Level of R & D Staff in Korea.

Unit: # of R & D Staff As of 1964

Organization	Income Level Below W5,000	W5,000- W10,000	W10,000- W15,000	Above W15,000	Total
Public Sector	439	810	194	17	1,460
University	38	51	81	42	212
Private Sector	6	57	29	13	105
Others	10	53	23	10	96
Total	493	971	327	82	1,873

Note: Public sector R & D institutions include both national and regional government supported R & D organizations.

Source: EPB, Chonkuk Kwahak Kisul Yonku Kikwan Shiltae Josa (National Survey of the R & D Institutes of Korea), op. cit., quoted from KIST (1977), Hankuk Kwahak Kisul Yonkuso Shipnyun Sa), p. 25.

1964. On the other hand, such an income level may also be associated with the low level of education, as discussed previously. However, it is not deniable that such a phenomenon also seemed to be a manifestation of the political and cultural heritage of Korea, which has traditionally looked down upon technicians in favor of literati, for technicians' and engineers' qualifications are not only derived from formal education but also from accumulated field experience.

Another political factor associated with the disappointing performance of the R & D sector was a weak "explicit S & T policy" system. Until the early 1960s, S & T issues had never been considered by local politicians as a policy agenda item. The words "science and technology" had never even appeared in political rhetoric, nor in electoral candidates' political campaigns.[34] Nor were there any government offices at the national level solely in charge of S & T policy-making as well as implementation.[35] Prior to 1962, a technical management division at the Ministry of Construction (MOC)[36] was the main office in the national government in charge of overall S & T affairs. In addition, several other middle level offices lodged in different ministries, such as the Ministry of Education (MOE), the Ministry of Trade and Industry (MTI, then the Ministry of Commerce and Industry, MCI), and the Ministry of Communication were also engaged in S & T matters. But most of their tasks were limited to science education or management of government R & D centers, hardly national level S & T policies.

Korea witnessed remarkable institutional development in science education in the 1950s. Nevertheless, the establishment of a science and engineering school system was not a result of national government S & T policy measures. Rather it simply was a reaction to the local academic community's demand for it.[37] When the EPB was created by the Park regime in 1961, the Technical Management Division at EPB (TMD) took over MOC's duties, but EPB's major job was limited to management of the USAID-sponsored science training programs overseas.[38] It was, in fact, not until early 1962 that S & T became a topic for public debate. The issue arose in relation to the nation's industrialization plans, and it was initiated by President Park himself. Park's personal interest in technology development resulted in the expansion of the EPB's role in S & T affairs, thus giving birth to the Technical Development Bureau at EPB (<u>Kisul Kwanri Kuk</u>) in June 1962.[39] It also resulted in the formulation of the First Five-Year Plan for Technical Development: Supplement to First Five-Year Economic Plan (FFPTD, 1962-1966), Korea's first <u>bona fide</u> national level S & T policy.

Economic Development Plan and S & T Policy

President: Policy Initiator

Because this national level S & T plan was launched together with the nation's economic development plan, one might think that S & T development was a highly valued issue by policy-makers in Korea during its early industrialization process. In fact, at first the development of S & T was not a policy issue at all, even to the economic development planners at EPB who orchestrated the "Korean miracle."

An episode which took place during the formulation of Korea's first economic development plan reveals how S & T became a policy agenda item in Korea and who played what role in Korea's S & T policy processes. At a deeper level, it reveals Korea's power structure and political system in general. In early January 1962, the EPB had a briefing session to present the draft of the First Five-Year Economic Development Plan (FFEDP, 1962-1966) to President Park, who was then the Chairman of the Supreme Council for National Reconstruction, the transitional top policy-making body of the revolutionary government which followed the 1961 military *coup d'etat*. This session was a historical moment for the institutionalization of S & T in Korea. The FFEDP set an ambitiously high annual growth rate target of 7.1% which would be accomplished through the development of export-oriented industries. After the EPB's presentation was over, Park suddenly asked: "But don't we have any problems in the technology areas? In building new factories, are our current technological level and technical manpower enough, or if not, are there any plans how to solve these problems?..."[40] Chun Sang-Kun, an ex-EPB official, who attended the briefing session and later played a key role in making the First Five-Year Plan for Technical Development (FFSTDP) at the working group level, recalls that EPB officials were very much "embarrassed" by such "unexpected questions." He further revealed that nobody in the briefing room could answer Park because the economic development planners at EPB, mostly economists, had conceived technology as no more than a part of labor, without knowing its importance as an independent factor in industrialization.[41] EPB officials' understanding of S & T was in fact a good indication of the general level of understanding of S & T in the early 1960s, both by policy-makers and intellectuals. The "unexpected question" in the briefing room was answered by Song Jung-Bum, then EPB's Deputy Minister, who cleverly told Park that "a plan on the supply of technology will be soon reported in a separate session."[42] EPB had never had such a plan. Song's answer was extemporaneous simply to get out of the embarrassment, but it worked. Park seemed to be content with such an answer. He did not pursue any further questions about it.

As soon as the briefing session was over, Song gave the EPB's TMD the task of working on a technology supply plan. Chun, Sang-Kun (then the TMD chief) felt that such a task should be assigned to the EPB's Office of Planning Coordination (OPC, Chonghap Kyhoek Guk) rather than his own office because such long-term national development plans are normally carried out by OPC, which is equipped with jurisdictional power of planning, budgeting, and with a large pool of manpower. However, under Song's insistence that most TMD staff had science/engineering educational backgrounds, the TMD took the task.[43]

Developing a technical supply plan from scratch was not an easy task for the EPB team. They did not know where and how to start. They had never considered such an issue before, particularly in relation to the just proposed FFEDP. Neither was there much information about the nation's technological level, nor were there technological forecast studies available. After a rough preliminary study, Chun concluded that it was impossible to develop such a plan when so little information was available. Instead, he strongly felt that a more comprehensive study should be done which would cover broad issues of S & T rather than limiting itself to such a specific issue as technology supply. Such an idea seemed to be very reasonable to Chun when no previous studies had been done at the national government level. Having conferred with Chun on this idea, Song approved it but with reservations: Regardless of the contents, the plan should be developed as a supplement to

FFEDP; and the word "science" should not appear in the title of the plan because it sounded purely academic whereas Park wanted something pragmatic about technology.[44]

Emergence of Technostructure

A forty member consultative group, representing industry, academics and national R & D institutions, was organized by TMD. The consultative group members were eager to participate in the project, and their inputs were valuable to EPB for gathering information about what Korean society wanted from the government in S & T fields. The local S & T community was delighted to participate in the project because its participation served as an excellent opportunity to voice as yet underrepresented demands to the government. There was a good reason for this feeling. Beginning in the late 1950s, there was a growing concern among intellectuals in Korea's S & T community about upgrading the technological level of the country. This concern was highlighted at the conference on atomic energy held in 1959 in commemoration of the creation of AERI. In addition, some young professors in the natural sciences had attempted to organize an R & D institute for the development of industrial technologies[45] though efforts led by academics in the S & T community were never successful due to a lack of financial resources and political rapport with the Korean government, especially with the President.[46] Perhaps due to these experiences, there was a consensus among the consultative group members and EPB officials that government, especially the President, should play a leading role in the development of S & T.[47] The chief executive's involvement was particularly important given Korea's political context of executive-centered policy processes.

Four months later, the EPB's study was completed in the form of FFTDP. This was the formal answer to Park's question raised during the aforementioned briefing session. The major emphasis of the plan was the development of manpower in S & T but also included: The importation of foreign technology; enhancement of public understanding of modern technology; institution or reinstitution of laws pertinent to S & T activities; and organization of an R & D system. FFTDP later served as the basic framework of Korea's S & T policy.

This episode provides us with some important information about Korea's S & T policy-making processes. First of all, President Park played the role of policy-initiator. If he had not made such a comment on the technological component of the nation's industrialization, systematic S & T development in Korea might have been much delayed. Secondly, while Park played a central role in initiating the policy, he did not seem to have a clear idea of the concept or how to implement or direct it. It was rather the EPB, with consultation with its specially formed advisory group, which articulated the issue by setting up specific policy goals, and devised the policy means to solve S & T problems through FFTDP. This observation leads us to conclude that both Park, the EPB, and the consultative group members jointly made significant inputs to the policy-making process. Thirdly, professionalism played a role in the policy-making process. Particularly, scientists' knowledge was acknowledged by EPB, which was a significant step forward in Korea's policy-making tradition. Fourthly, when we look closely at the nature of inputs made by those actors involved, it is noticeable that there was a clear division of labor between Park and the EPB/consultative group. Park's input was so-called "strategic" decision-making whereas that of the technocrats (EPB/the consultative group) was rather "tactical" in nature because the latter's major function was to articulate Park's intention and put it into the language of policy goals and means. At the same time, we can also observe that the technocrats played another important role by legitimizing what Park wanted to pursue.

The emergence of professionals in modern society has attracted social scientists to analyze the political roles professionals play in policy-making processes. Such views are diverse. One perspective notes that the power of technocrats in policy-making has risen enormously and eroded the politician's traditional power base. It is even argued that the politician's role is to ratify what policy-decisions are made by technocrats.[48] Another perspective emphasizes that no matter what significant roles technocrats appear to play, their role is basically limited to no more than "advice" or "counsel," whereas policy decision-making power still remains in the hands of politicians.[49] To those who advocate the latter view, it is technocrats who ratify the policy-decisions of the real power holders, not the reverse.

What Hahn-Been Lee[50] found in his analysis of the power structure in the early Park regime was that the high economic growth goal of the Park regime inevitably drafted professionals into public policy areas. Those professionals in the early Park regime included civilians working both within and outside bureaucracy, and military officers (both retired or active). Those military officers who filled senior posts in bureaucracy were relatively young, and most of them were drawn into the government not on the merit of their direct participation in the coup d'etat but, primarily, for their (potential) expertise in chosen fields. Replacing civilians with military officers in important government posts was crucial for Park to solidify the military power base of his new regime, but at the same time economic necessity also played a role. Because Park's political legitimacy was seen as depending on his economic accomplishments, the mobilization of brain power in support of industrialization was vitally important. Creation of the EPB, and the empowering of technocrats at the EPB were prime examples of this effort.

The EPB provided an avenue for the rise of technocratic power for the first time in modern Korean politics. In return, Park wanted technocrats to carry out efficiently and legitimately his industrialization plans. However, the nature of technocratic power facilitated by Park was limited and quite different from other sub-groups of the power elite in Korean politics. Since the 1961 coup d'etat, it had been these military officers who had real power ("power elite"), at the top of Korea's power pyramid. Technocratic power stands below that level. The political function of the technocrats is to efficiently carry out what the "power elite" decides. An equally important function of the former is rationalization of policy choices made by the latter. In other words, technocrats in Korea's power structure are characterized as what Lee calls a "managerial task elite" to serve the interests of the "power elite." Clearly, there was a hierarchical ordering of those two elite groups and their functional roles in policy processes are also different.

The Creation of KIST: Decision-Making Process

KIST is a product of a political decision made by President Park and Johnson. A direct and decisive impetus for the birth of KIST came from President Johnson's decision to aid Korea in the field of S & T,[51] however, Korea had also developed a certain political climate, searching for such institution-building both in the political arena and in the S & T community as well. Besides, if Park, in particular, had not fully committed himself to work as a guardian of KIST, and if Korea did not have a particular form of policy-making process that allowed the centralization of power by Park, KIST's birth would have been very much delayed.

This section focuses on how the birth of KIST was made possible by identifying both internal and external factors; the roles played by top politicians in the decision-making process and how S & T has been politicized; identification of policy goals as well as policy instruments; and the significance of policy-making on KIST.

<u>Conception of KIST: Internal Process</u>

In following up on Park's expression of interest, MOE was ordered to study Korea's S & T system. In 1962, MOE submitted a plan to Park for the creation of a new, integrated research organization in Korea. But this plan was not put into immediate effect for financial reasons.[52] Separately from MOE, EPB also conducted a series of survey studies in 1962 and 1963 to ascertain the technological level of Korea. The results of EPB's study was so disappointing, as noted in the previous section, that it attracted the attentions of certain policy-makers. EPB's solution to these problems, laid out in FFTDP, was to organize the nation's resources in the field of S & T. Within this framework, EPB's major concern in the area of R & D was to activate R & D institutes through reorganization of existing institutes.

EPB's original approach was to reorganize NIRI, which was then under the control of MCI (currently MTI), as a corporate entity independent from government control and to shift administrative authority from MCI to EPB. However, this plan was aborted because of conflicts within the bureaucracy.[53] Bureaucrats working at NIRI themselves opposed the plan because they wanted to preserve their social status as government officials rather than to become civilians who would work in the newly created corporate entity. Considering Korea's bureaucratic culture, that is not surprising since power and authority have traditionally adhered to bureaucratic position.[54] In fact, as Korea moved into industrialization, the growth of the private sector required new skills and thus this sector offered better salaries and benefits than did the public bureaucracy. Still, bureaucratic careers appeal to Koreans, for government positions with titles symbolize authority, power as well as social status. Besides, MCI wanted to continue its power over the institute rather than yielding it to EPB.

The unresolved conflict of interests between MCI and EPB invited intervention from Park in favor of EPB's plan. However, Park sought an alternative approach by merging three public R & D institutes, NIRI, AERI and RIMM, into a single organization. Planners at EPB did not think Park's idea was feasible for the three institutes had sharply different goals and functions. Nevertheless, EPB officials were "deeply impressed with the top political leader's unusual concern over R & D institutes."[55] The EPB study, which came out in late 1964, proposed a new plan under which a new research institute would be created through expansion and modification of RIMM's function, whereas NIRI and AERI would remain unchanged. The plan also suggested that the new institute should be under the administrative aegis of EPB rather than MCI (which was then in control of RIMM), because EPB had power both over national budget allocations and planning of the nation's economic development plan.[56] Consequently S & T activities under the guidance of EPB would be more directly integrated into the nation's industrialization efforts. While this new plan was under review by both EPB and MCI, the "big news" came from the U. S. that the U. S. government would assist Korea in the establishment of an industrial technology research institute.

This new development aborted EPB's plan, and EPB started to make an another plan which enabled KIST to be born.[57] Nevertheless, a series of efforts both in the Korean government and in the local scientific community, as noted in the previous section, aroused increasing concern over R & D institution-building, and EPB's aborted plan in particular provided an important frame of reference in the development of an operational philosophy as well as organizational structure for KIST.

Park-Johnson Summit Meeting: External Factor

In May 1965 in the midst of the Vietnam war, Johnson invited Park to Washington, D. C. to encourage Korea's participation in the war. In return, Johnson was considering some sort of "incentive" to Korea in compensation, which later turned out to include the U. S. government's joint sponsorship of KIST.[58] Johnson's idea to assist Korea in the field of S & T was an unexpected surprise to government officials both in the U. S. and in Korea. Dr. Donald Hornig, Johnson's Special Assistant for Science and Technology in the White House, recalls that even he himself did not expect the possible involvement of his office in Park's visit.[59] In Korea, government officials found the "news" from local newspapers issued while Park was in Washington, D. C.[60]

Hornig, an ex-professor of chemistry at Princeton, did not have much knowledge about Korea except his experience in teaching some Korean students. However, upon the request of

Johnson to think about some "gift ideas" in the S & T field, he proposed a plan just a few days before Park's arrival, to assist Korea in building a local scientific community, specifically by setting up an R & D institute for industrial technology.[61] Hornig's proposal was based on two assumptions. First, although Korea lacked natural resources, it had a relatively large pool of qualified, but under-utilized manpower in the field of S & T both at home and abroad. Hornig seemed to be concerned particularly about the so-called "brain drainees" who remained in the U. S. after their academic training was over. In fact, aggregate overseas Korean brains outnumbered those in Korea: As of 1965, the number of Ph.D.s at home in all fields was 79 whereas overseas Korean scientists and engineers in the U. S. alone (although not all of them had Ph.D.s) numbered 869.[62] He viewed the development of a scientific community through the creation of an industrial research institute in Korea as an excellent outlet for those overseas graduates. Furthermore, Hornig felt strongly that in the process of the development of Korea, as well as developing countries in general, technology transfer would be an essential ingredient, depending, however, upon the local society's adaptive capacity. Scientific community-building, as he proposed, was thus meant as an important instrument in strengthening local adaptive capacity. Hornig's approach reflects the popular S & T development model suggested to developing countries during the First Development Decade by the U. S. government and the U. N., in which pursuit of the parallel goals of technology transfer and S & T infrastructure-building policies were strongly emphasized.[63]

Hornig's idea was a "ten-strike." Johnson really liked it because it fitted well with what he was thinking about--the one ("gift') by which the U. S. could "show its support for Korea,...worthwhile and at the same time noncontroversial"[64] in consideration of Park's stance on domestic Korean politics.[65] Hornig's proposal was also very much favored by Park. The Park-Johnson summit meeting resulted in the U. S. government's commitment to cooperate with the Korean government in the establishment of a new R & D institute. A joint communique released during the summit meeting between the two presidents reads as follows:

> ...President Park welcomed President Johnson's offer to send his scientific advisors to Korea for the purpose of exploring with industrial, scientific, and education leaders the possibilities for USA cooperation in establishing there an institute for industrial technology and applied science.66

Politicization of S & T

To follow up the joint communique, a series of separate feasibility studies were conducted by both the Korean and American governments. In Korea, EPB was chosen to do the study because Korea did not as yet have any integrated S & T policy-making body at the national level. EPB's task was to develop the basic organizational framework of the proposed institute and the way the American government would collaborate in the establishment of the institute.

EPB's report to Park in late June 1965[67] has several features which are innovative as well as significant in a number of ways. First of all, though EPB emphasized that the proposed institute would be financed by both governments, there was also an emphasis that the proposed institute should be a non-profit organization independent from the government in order to provide the institute with autonomy in personnel and accounting. This was rather a provocative approach to the management of public enterprise in Korea in which government control was prevalent.[68] This approach in fact caused heated debate later on in Korea when such autonomy was given to KIST. A more in-depth discussion of this issue will occur in the next chapter.

Second, the proposed institute was designated to engage in applied research for the development of industrial technology. This also posed an interesting contrast to most of the existing research organizations in Korea which limited their research scope, as has been noted, to rudimentary laboratory tasks such as testing, chemical analysis and so forth.

Third, the proposed institute was to earn its own operational funds although costs arising from the initial setup would be financed by both governments and any financial shortage in operation would also be supplemented by two governments. This form of financial independence would force the institute to work closely with local industry for survival. This was also a new approach to Korea's public R & D tradition under which public research institutes' operational costs had been fully guaranteed by annual government budget allocations regardless of their performances.

Fourth, the so-called "reverse brain drain" (RBD), bringing Korean scientists and engineers back home, also became a policy issue for the first time in Korean politics.

Apart from EPB's move, a feasibility study team was also formed in the U. S. government headed by Hornig. The members of this group, consisting of both government and non-government officials,[69] visited Korea for an eight-day field research beginning July 7, 1965. While staying in Korea, Hornig's team met with representatives of Korean industry, education, government, and the S & T community. Some field tours to Korean industrial sites and research institutes were also made. Hornig's field study findings were in full support of the proposed institution-building project and urged Johnson to order AID to enter into the project "as promptly as possible." The "Report to President Johnson on August 5, 1965" by the Hornig team emphasized: Financial security supported by both governments and additionally by private industrial sources in Korea; an independent, non-profit organization provided with an autonomous administrative atmosphere in order to maximize organizational growth and to attract the best qualified Korean scientists and engineers; and the proposed institute to become the foundation of new industrial activities in Korea through close interaction with local industry.[70]

Additionally, Hornig's report pointed out that the proposed institute in Korea should serve as a "prototype" institute for future institution-building in developing countries. Added to that was the "desirability of establishing a long-term relationship" between the proposed institute and institutes of a similar nature outside of Korea. These were new suggestions which were not found in the EPB plan.

Regardless of the Hornig feasibility study result, KIST was going to be created with financial aid from the U. S. government because the KIST-building project had symbolic value to the Johnson administration--a payoff for Korea's military involvement in the Vietnam war. However, Johnson seemed to be genuinely satisfied with Hornig's report, not only for how such an institution would help Korea *per se* and for its symbolic value in the US-Korea relation, but also for its symbolic function in dealing with developing countries. To quote Lambright, "Johnson believed that S & T was a useful instrument in his dealings with developing countries. The United States was perceived as being the world's leading nation in science & technology; developing countries wanted to be in a position to utilize whatever science and technology the United States had to offer."[71] Johnson's approach to S & T as a diplomatic tool was well reflected in his comment made upon the Hornig team's feasibility study report which reads as follows:

> I believe the Institute idea...can set an example of excellence in Korea and in the world. It will provide opportunities at home for an able young generation of Korean engineers and scientists. Also, it will be a model for constructive cooperation with other developing countries. ...We will work together with the Korean Government and Korean industry to build up the new Institute as rapidly as talented people can be assembled for the task. I have asked the Director of the Agency for International Development in consultation with Dr. Hornig, to proceed as rapidly as possible with concrete steps to accomplish this goal.72

In fact, the KIST experience became a precedent for the Johnson administration's technoscience diplomacy in developing countries[73] Also, KIST has been often cited as a "model institute" by the U. S. government, as well as by others, from its establishment, and that U. S. position has continued.[74]

In Korea, Park was very pleased about the EPB's study as well as the progress made in the U. S. He was determined to act as a guardian of KIST. Jeon Sang-Kun, who played a key role in the creation of KIST at the working group level in the government, recalls that when EPB reported on its study result to Park, Park told him that "...if you have any problems in this project, don't hesitate to report <u>directly</u>

to me." He also recalls that Park then turned around to face Lee Hu-Rak, his chief secretary in the Blue House[75] (one of the most powerful men in the government, who later became the director of the Korea Central Intelligence Agency), and said, "I, myself, should take care of this project!"[76] Such a commitment by Park was not simply lip-service. He in fact substantiated his words later on as the project proceeded.

The reasons for Park's support of KIST stemmed from political calculations. He was very happy about the fact that it was he who received such aid from the top executive of the U. S. government. He felt that this would be considered by Koreans as an important accomplishment of his administration. Particularly, since U. S. aid in the creation of KIST was part of the U. S. government's compensation in order to bring Korea into the Vietnam war, Park seemed to have felt that he was in a good bargaining position to get as much aid from the U. S. as he wished.[78] Such guaranteed financial resources would allow his administration to successfully accomplish its KIST-building project. Considering that the U. S. foreign aid declined, from a total of $383 million in 1957 to $177 million in 1965,[78] the U. S. government commitment to the KIST project must have meant a lot to Park.

KIST symbolized the improved relationship between his regime and the U. S. government. Park's revolution was, in fact, not welcomed by the U. S. government which supported Chang's liberal government. Furthermore, Park had been under strong pressure from the Kennedy administration to return Korea to civilian rule. The Korea-U. S. relationship during the early period of Park's regime was very tenuous.[79] Domestically, Park faced strong opposition from the public in the mid-1960s on his Korea-Japan normalization policy. KIST, therefore must have been interpreted by Park as the U. S. government's endorsement of his legitimacy.

KIST's development cannot be understood without reference to the "modernization" programs that Park had vigorously pursued. The industrialization of Korea, equated to "modernization," was in fact a <u>raison</u> <u>d'etre</u> of his revolutionary government as he asserted over and over: "I want to emphasize, and re-emphasize, that the key factor of the May 16 Military Revolution was to effect an industrial revolution in Korea."[80] Setting up a modern R & D institute like KIST therefore must have provided him with an important symbolic value in showing Koreans something visible in his industrialization effort--an instrumentalization of S & T for his political legitimacy! Particularly, when we are reminded that Korea had a general election in 1967, the KIST-building project must have had some showcase value. It must also have had some value as a demonstration effect to other sectors in Korean society.[81] The industrialization goal was so important to Park and his regime that it even allowed KIST an organizational independence and research autonomy in the name of efficiency. These operational principles of KIST are significant enough to break the traditional, state model of public R & D in Korea. A discussion on this issue will be presented later in the chapter.

A question then arises as to why Park himself (rather than others in his administration, in the National Assembly, or in political parties) was concerned so much about technology in relation to the nation's industrialization? Perhaps Park's military training background (majored in engineering in the army) may explain it. At the same time, the Korean bureaucracy at that time (even nowadays) was run by economists or non-science/engineering-major bureaucrats, whose level of understanding of S & T was very marginal, as discussed previously. Furthermore, it reflects Korea's political situation in which S & T issues have never been a political "item" by members of the National Assembly: Throughout Korea's modern history, S & T has never been a subject of pork barrel politics. Lack of understanding and interest in S & T by legislative members, added to the weak industrial structure in the 1960s have contributed to this. Interestingly, legislators as well as other politicians' indifference to S & T continued in the 1980s: In the 1988 general elections for the president and the National Assembly members, not a single candidate, nor any political party brought S & T issues to their campaigns. Under such condition where competing pressure is lacking, it was inevitable that the president of Korea play a role as an important policy agenda-builder and implementer in S & T.[82]

Following up on the Hornig Report, and at the request of the Korean government, AID entered into a contract with the Battelle Memorial Institute (BMI, a multi-disciplinary contract research organization located in Columbus, Ohio) for an in-depth study on the creation as well as the development of the organizational structure of the proposed institute. This third feasibility study was conducted in Korea during the period of late September to early December 1965 by a team of five senior members of BMI.

BMI's study initially stressed an assessment of whether or not such a proposed applied research institute was actually needed in Korea then or in the near future. BMI was very concerned with the marketability of an R & D institute such as KIST in Korea. Donald Evans, a member of BMI's feasibility research team who later served as BMI's project manager in the KIST-building project, recalls that his team was very much concerned with "attitude and receptivity" towards such an institute on the part of Korean industry, government and the academic community. He further emphasized that "...although it can be generalized that some amount of research is <u>always</u> desirable in any problem area, ...it is fallacious to <u>a priori</u> decide that the institutionalization of applied research in a given economy is, *per se*, good."[83]

The BMI feasibility report submitted to AID not only recommended the "desirability" of the creation of the proposed institute, but also detailed measures to be taken in the development of the organization as well as actual construction plans.[84] As far as the organizational framework is concerned, much of BMI's approach corresponded with those ideas already suggested by the previous studies done by EPB and the White House. Nevertheless, BMI's report was very important for KIST in its organizational development for it amplified ideas and principles expressed in the previous feasibility studies with the actual means of accomplishing the goals and ideals. BMI's report was in fact accepted shortly afterwards by both governments and served as the basic framework in the establishment of KIST.

BMI stressed that the organization's finance was to be secured by both governments, particularly for the first five years (and hopefully for the first ten years) for this was the start-up period during which time actual research might not be carried out, or during which research would be very marginal. BMI also emphasized that the proposed institute be created as a not-for-profit juridical person by special legislation by the Korean government and that there be a "self-perpetuating" Board of Trustees (BOT) which, together with the head of the institute, would serve as the top decision-making body of the institute. The purpose of this organizational form was to avoid political influence and control from the government. As to the membership on the BOT, BMI suggested that representation be balanced from both governments, from local industry, and from local S & T circles. Thus, the marketability of KIST to local industry was carefully considered by KIST-builders from the very outset. The Report also foresaw that Korean scientists and engineers abroad could be repatriated to work at the institute if a new wage scale was introduced. In other words, the study highlighted both the issues of the RBD and wage reform for R & D staff. BMI suggested that the institute engage in applied research in various fields of S & T, and engineering economics. Suggested functions of the institute were to serve as a center for technology importation and adaptation. These functions would be carried out by providing local industry with scientific and technological information, techno-economic services (such as conducting feasibility studies), and laboratory work. The proposed institute would also serve as a "center of excellence" in the nation's S & T community by developing collaborative relationships with universities and other existing S & T organizations. Lastly, an idea of developing a "sister institute" relationship outside Korea was introduced which would not only train the proposed institute's staff in R & D management, but would also function as "open channels of communication" with world technology.

Goals of KIST

Based upon the recommendations made by these feasibility studies, KIST was founded on February 2, 1966. KIST was defined as an independent, non-profit organization with a self-perpetuating Board of Trustees responsible for the operation of the institute. BOT membership went to officials from both governments, representatives of the local industry and the S & T community, and BMI.[85]

President Park was credited (by EPB and the feasibility studies team) as the founder of KIST in order that KIST would be fully supported by the Korean government then and in the future. The EPB's approach of naming him as the founder of KIST was a well-calculated political decision and a pragmatic approach for, without dropping the President's name, successful implementation of the policy would have been highly unlikely given Korea's political system. EPB officials were very concerned that emphasis on KIST's autonomy, independence from government interference, would jeopardize KIST's ability to secure financial support from the Korean government.[86] At the theoretical level, EPB officials were influenced by the technology development model, much advocated during the First Development Decade, which emphasized the important role of the state in S & T development of the developing societies.[87] Particularly, Steven Dedijer's emphasis on the vital importance of the top political leadership's involvement in a developing country's S & T development was very appealing to the EPB planners who advocated that:

> ...in the underdeveloped countries, it is difficult for special interest groups in the S & T area to exist. ...under this circumstance, in order to maximize a nation's efforts in S & T development, it is of the utmost important for the president or the prime minister of a nation to initiate/demonstrate his/her concerns over S & T matters.88

Broadly speaking, the goal of KIST was to organize Korea's S & T manpower resources to be fully utilized for the nation's industrialization efforts. In view of the weakness of Korea's R & D system, both in the public and private sectors, KIST was expected by policy-makers to serve as an example of institutionalized R & D for which government vigorously pushed in the name of "modernization" in the 1960s.

More specifically, the primary objective of KIST is to assist local industry to solve its technological problems:

> The purpose of the Institute is to carry out scientific, technological, and engineering economics research, to conduct technical investigation and examinations, and to disseminate knowledge for the development of industrial technology. Directly linked to the industrial community of Korea, it will serve scientific and technical needs of the country.89

It was seen as important by KIST planners in order for local industry to compete in the international market as the Korean economy was moving in an export-oriented direction.

This, a sort of hospital function for local industry, would be done either through the development of new industrial technologies/processes, by helping industry in the importation of foreign technologies, or through adaptation of imported technologies. In other words, KIST would perform dual functions as the nation's center for indigenous technological development, and as a center for technology transfer. This objective is indicated in a KIST document which reads as follows:

> For Korean industry to compete successfully with other nations on the world market, it must implement technological innovations, including the development of new products and processes based on the importation and application of foreign technology. For a technologically underdeveloped country like Korea, it is essential to import advanced technology to narrow the technological gulf which separates it from developed countries. It is equally essential for such a country to develop its own research and development capability, for without it imported technology remains merely foreign and is not effective and reliance on foreign technology will continue to increase. If, however, there is a solid research and development capability, imported technology can be fully digested, developed, and improved even further for re-export. In view of costs and manpower, it has been, and still is, almost impossible for Korean industries to carry on their own research and development activities with their own research facilities and manpower. ...To meet this need of the nation and times the Korea Institute of Science and Technology was set up as a joint venture between the Korean and U. S. A. governments.[90]

In the process of the establishment of KIST, there were no major disputes over the principle idea of creating such an institution. KIST-building received favorable encouragement not only from the local industrial and S & T communities but also from the local press as well. However, when KIST's function was defined as a "center for excellence" of the nation in the field of S & T, some opposition arose within the local S & T community. To these opponents, Korea would need more small-scale, and more mass-oriented technologies than capital-intensive R & D from the "ivory tower."[91] Particularly, when KIST introduced a new wage and fringe benefits system which was exceptionally higher than the conventional wage scale, strong opposition arose within the local S & T community. This opposition was not strong enough to get policy-makers to change their original plans for KIST.

KIST Model: Departure from tradition

The decision-making process of KIST clearly reveals the important roles played by top politicians (Park and Johnson). At a glance, stress on government leadership appears to reflect Korean traditions, as discussed earlier. Yet, when we look closely at the KIST case, it clearly departs from the traditional model in a number of ways. First, government intervention was justified by the technology development model, much advocated during the 1960s at the global level. Concepts of national planning of S & T, R & D infrastructure-building, and maximization of international technology transfer are essential components of this model. President Park's involvement, formation of EPB task team to work on the KIST-building project, organization of high-level manpower through KIST, defining KIST as a center for indigenous R & D, adaptation and technology transfer, and U. S. involvement--all these are nothing but an operationalization of these concepts.

Second, the creation of KIST as an independent corporation, and the value of autonomy embedded in KIST significantly distinguish KIST from the traditional model of public R & D in Korea. Why then did the Korean government take a seemingly conflicting approach, "government-sponsorship-but-organizational-independence/autonomy" in the KIST project? Interestingly, the Korean government did not perceive that notions of government sponsorship and independence/autonomy may be conflictual. The KIST case affirms that the government even felt them necessary. Why? U. S. involvement, particularly the feasibility studies, might have played a role. Because in the U. S., where private sector-led R & D is characteristic, organizational independence/research autonomy is the norm.[92] American experts' inputs in the KIST-building process, therefore, must have been persuasive to the Korean government. Local scientists' inputs might have also influenced the Korean government to stress independence/autonomy at KIST. From the scientists' perspective, government involvement is a necessary evil. When Korea's R & D programs were so weak, government's support (financial, legal and other administrative) was viewed as crucial means in launching bona fide R

& D programs. At the same time, they experienced what went wrong in the past when government controlled R & D institutes. From political, psychological, and professional standpoints too, government control was undesirable, for it jeopardized scientists' pursuit of "truth," productivity, and professionalism as they perceive themselves as being "politically neutral."[93]

No matter how appealing was the technology development model, and no matter how those experts' (both American and Korean) recommendations sounded rational, the Korean government could have created KIST along the same lines as the traditional R & D institute model, in which government control was characteristic. However, the Park regime seemed to take the KIST project seriously because of R & D's relationship with the economic development plan of the nation. What characterizes the Park regime is its emphasis on "national security" and industrialization as the most important or fundamental policy goals of the nation. These two policy goals are deeply inter-related and compatible with one other. The Korean public would often hear the government saying that "to protect ourselves from the communist threat of the North (The Democratic People's Republic of Korea, DPRK), we should build a strong economic base", or "national security is a necessary condition to successfully accomplish our industrialization plans." The economic development value, for its own sake, or for "security" reasons, therefore served as what Dolbeare calls a "fundamental policy" goal of the Park regime. And all the government policy programs were developed and implemented within this framework.

KIST did not seem to be an exception. What characterized FFEDP was the high target growth rate that would be achieved through the "leading-sector approach" and "guided capitalism" in which both government and private sectors play roles in the economy. Within this development plan framework, KIST was considered by government as a leading sector which government should support. At the same time, inasmuch as the high target growth rate required highly competent management of government programs, the research autonomy of KIST, in the name of efficiency, seemed to be quite a logical approach for the government.

Furthermore, power elites in the government did not think that the scientists' autonomy at KIST would threaten their own power basis at all. Because within the particular form of power structure in Korea in the 1960s, as discussed earlier, the "strategic decision-making" elites saw KIST scientists as no more than a "managerial task-force" which would perform specific missions assigned within the nation's industrialization framework. Scientists too did not seem to be bothered by this definition of their role in Korean politics. In 1980, during my field research, KIST scientists assured me that KIST functions as an instrument of the nation's industrialization. They also told me that they "do not know anything about politics, nor are they interested in it either."

In sum, from the outset of the establishment of KIST, there seemed to be a shared value between scientists and power elites in Korea that industrialization is a supreme goal of the nation for which KIST functions as a scientific & technological arm. Within this value framework, KIST autonomy was quite logical to the Korean government.

Notes

1. Jeon Sang-Woon, Science and Technology in Korea (Cambridge, Mass.: The MIT Press, 1974); and H. Choi (1980), pp. 132-133.

2. Ibid. Also refer to Lee Ki-baik, A New History of Korea, trans. Edward Wagner & Edward J. Shultz (Cambridge, Mass.: Harvard Univ. Press, 1984), p. 186.

3. Confucianism which served as the orthodox political ideology of the Yi Dynasty justified a vertically stratified social class system. At the top of the social strata was the Yangban (literati, landed aristocracy) which was considered to be superior to the other three social classes; Chungin (intermediary men), Sangin (commoners) and Chonin (such as slaves, actors, etc.). Craftsmen, farmers as well as merchants belonged to the Sangin class. Although government artisans and craftsmen were technically "government slaves" their actual social status was compatible with commoner artisans for the former were also allowed to hold/manage independent household economy. Refer to K. Lee, Ibid.

4. The R & D budget in Korea includes administrative costs such as wages and construction costs. The real size of the R & D budget therefore will be much smaller than what the figures show. Refer to K. Lee (1977), pp. 33-34; and The Dae-Han Il Bo (The Dae-Han Daily Newspaper, Seoul), May 15, 1972.

5. Quoted from Program on Science, Technology and Society, KAIS, Science and Technology and the Development of Korea: Phase One Report, Korean Science Technology Policy Instruments Project (Seoul: KAIS, 1973), p. 54. Also refer to Jeon Sang-Kun, Hankuk Ui Kwahak Kisul Jeongchaek (Science and Technology Policy in Korea) (Seoul: Jeong Woo Sa, 1982), p. 61.

6. EPB was created in 1961 by the revolutionary government as the central administration for national development plans in order to mobilize the nation's administrative resources more efficiently. Prior to the Park regime, MOR was in charge of national development programs. But Park's military government changed its name to the Ministry of Construction (MOC) and much of MOC's job was transferred to the newly created EPB.

7. EPB (1962), pp. 14-15.

8. This pattern has not improved afterwards. In 1973, for example, there were a total of 92 government R & D institutes, of which 50% had less than 10 researchers per organization and only five R & D institutes had more than 100 researchers. Refer to MOST, Science and Technology Annual 1973 (Seoul: MOST, 1973), p. 36.

9. EPB (1962), p. 42.

10. EPB, Science & Technology Annual 1965 (Seoul: EPB, 1965), p. 9.

11. S. K. Jeon, p. 61.

12. EPB (1962), pp. 10-13. Definitions of engineers, technicians and craftsmen employed by EPB are somewhat vague in terms of lack of information about educational level: "Engineers" refer to graduates of science and engineering schools who are engaged in fields of chosen specialities; "technicians" refer to persons of long experience who are acquainted with the technical theories applied to their present occupations, and who are highly skilled in technical application; and "craftsmen" refer to persons other than engineers and technicians (except physical laborers) who are employed in technical capacities.

13. The Chung-Ang Il Bo (The Chung-Ang Daily Newspaper, Seoul), September 5, 1968.

14. This institute was later merged with the Radiation Research Institute and the Radiological Research Institute under a new name: The Korea Atomic Energy Research Institute.

15. For this subject, refer to the following literature: Edward S. Mason & al., The economic and Social Modernization of the Republic of Korea (Cambridge, Mass.: Harvard Univ. Press, 1980); Kwang Suk Kim & Michael Roemer, Growth and Structural Transformation (Cambridge, Mass.: Harvard Univ. Press, 1979); Sang-Chul Suh, Growth and Structural Changes in the Korean Economy, 1910-1940 (Cambridge, Mass.: Council on East Asian Studies, Harvard Univ., 1978); Ki-Zun Zo, "Korean Industry under the Japanese Colonial Rule," in Shin-Yong Chun, ed., Economic Life in Korea (Seoul: International Cultural Foundation, 1978); John Chay & al., ed., US-Korean Relations 1882-1982 (The Institute for Far Eastern Studies, Kyung Nam Univ. Press, 1982); and Edward R. Wright, ed., Korean Politics in

Transition (Seattle, WA: Univ. of Washington Press, 1975).

16. The Korean economy, under the direct control of the Colonial Government established in Korea by the totalitarian military regime of Japan, was in fact subject to the changing needs of Japan's economy. This is shown throughout the period of colonial rule. During the first two decades of colonial rule, the Colonial Government's policies were focused on increasing the agricultural productivity of Korea to solve rice shortage problems in Japan. In the later period (1930-1945), the Colonial Government shifted its policy focus from the development of the agricultural sector to that of the industrial sector which led to the expansion of mining and manufacturing industries in Korea. But this industrial policy was aimed at meeting the changing needs of Japan's war economy rather than the industrialization of the Korean economy _per se_.

    In the field of S & T, the Colonial Government introduced a formal education system to Korea which contributed to the institutionalization of science education. However, opportunities for Koreans in both enrollment and employment were highly restrictive. As of 1944, for example, there were about 1,600 Korean technicians in the various industrial sectors. But this number accounted for only 19% of all the technical manpower in the manufacturing and construction sectors, while the rest, 81% was supplied by Japan. The Japanese proportion rose to 89% in the more technology-intensive industrial areas such as the metal and chemical industries. For details, refer to Kim & Roemer, Ch. 1.

17. As of early 1961, for example, Korea's national budget totaled 608,800 million Hwan of which only 48% came from domestic revenues whereas 52% was financed by the U. S. government through various foreign aid programs. Quoted from Park Chung-Hee, _Hyukmyung Kwa Na_ (_Revolution And I_), 2nd ed., trans. Leon Sinder (Seoul: Hollym Corporation, 1970), pp. 27-28.

18. When we break down the U. S. International Cooperation Administration's (ICA) aid to Korea during the 1955-1959 period, for example, aid in consumer goods (such as surplus agricultural products, gasoline, etc.) accounted for an average of 69.3% of the total aid, whereas only 30.7% was represented by capital goods. By 1959, the proportion of consumer goods to total ICA

aid in the form of capital goods reached 78%! Ibid., p. 31.

19. For example, the domestic savings rates in percent of GNP, based on the 1977 price data, during the periods of 1953-1955 and 1960-1962 were 6.9% and 3% respectively. Also, gross domestic investment in percent of GNP prior to 1962 was 10%, whereas foreign savings accounted for 70% of GNP. Refer to Mason & al., p. 103 & 107.

20. Ibid., p. 98; EPB, Handbook of Korean Economy 1980 (Seoul: EPB, 1980), p. 3.; and Hak Chung Choo, Pattern of Growth and Changes in Industrial Structure of Korea 1953-1973, Korea Development Institute (KDI) Working Paper No. 7506 (Seoul: KDI, 1975).

21. Hahn Sang-Joon, Kisul Doip E Kwanhan Yonku: 1959-1968. (Survey Research on Technology Transfer 1959-1968) (Seoul: KIST, 1970); Han Woong Park, Uoikuk Kisul Ui Kuknae Whalyong E Kwanhan Kicho Chosa Yonku (Basic Survey Research on the Utilization of Foreign Technology to Korea) (Seoul: KIST, 1974); The Hyun-Dai Kyung Je (The Hyun-Dai Economic Newspaper, Seoul), January 29, 1974.; and The Dai Han Sang Yi Bo (Bulletin of the Korea Chamber of Commerce & Industry), May 11, 1970.

22. The Mai-Il Kyung Je Shin Moon (The Mai-Il Daily Economic Newspaper, Seoul), January 12, 1972.; and S. K. Jeon, p. 76.

23. The Seoul Kyung Je Shin Moon (The Seoul Daily Economic Newspaper, Seoul), August 1, 1972.

24. H. Choi (1980).

25. Woo Kon Yoon, "Korean Bureaucrats' Behavior: The Effect of Personality on Behavior," in Bun Woong Kim & Wha Joon Rho, Korean Public Bureaucracy (Seoul: Kyobo Publishing Co., 1982). Also refer to Bun Woong Kim & al., Administrative Dynamics and Development: The Korean Experience (Seoul: Kyobo Publishing, Inc., 1985).

26. S. K. Jeon, p. 58.

27. It is no secret in Korea's business circles that a technical director's rank within an organization is lower than that of non-technical directors who are in charge of general administrative affairs, finance, etc.

28. Pan Suk Kim, "In Search of Government Efficiency: Educational Backgrounds of Korean Bureaucrats." (a paper presented at the Annual Conference of the Midwest Political Science Association in Chicago, April 19, 1991); and The Chung-Ang Il Bo (The Chung-Ang Daily Newspaper, Seoul), December 12, 1967.

29. Wan Ki Paik, "Public Administrative Process in Korea," in Woon Tae Kim & al., Hankuk Chungchi Ron (Korean Politics) (Seoul: Bakyoung-Sa, 1976); W. Yoon; and Bun Woong Kim, "Confucianism and Administrative Development Interventionism," in Kim & Rho (1982).

30. What Fred Riggs calls "primary group politics" works well in Korean bureaucracy. Refer to Fred Riggs, Administration in Developing Countries (Boston, Mass.: Houghton Mifflin, 1964), p. 166; & Paik, ibid.

31. The Kyung-Hyang Shin Moon (The Kyung-Hyang Daily Newspaper, Seoul), June 18, 1970.

32. Confucianism in this context is limited to the Korean experience. In the case of Japan, traditional Chinese Confucianism seems to be well integrated with "Samurai" culture, leading to respect for technicians' and engineers' professional expertise. For the Japan's case, refer to Masanori Moritani, A Comparative Study on Industrial Technology: Japan, China & Korea, trans. Sang Young Kim (Seoul: Kyung-Yong Moon Wha Won, 1980); and The Han-Kuk Kyung Je Shin Moon (The Han-Kuk Economic Newspaper, Seoul), September 13, 1981.

33. Bank of Korea, Economic Statistics Yearbook 1968 (Seoul: Bank of Korea, 1968), pp. 400-401.

34. The Chung-Ang Il Bo, op. cit.

35. EPB (1965), pp. 6-7.; MOST, The Ministry of Science and Technology: An Introduction to Its Organization and Functions (Seoul: MOST, August 1975); & Sang-Woon Jeon, "Changes in Scientific and Technological Policy," Korea Journal (September 1982).

36. During 1959-May 1961 period, a temporary office in MOR was in charge of S & T matters. This temporary office status became formal when MOR changed its name to MOC in late May 1961.

37. S. W. Jeon (1982), "Changes in Scientific and Technological Policy."

38. S. K. Jeon, p. 15, p. 35, & pp. 43-44.

39. Ibid., Chapters 1 & 3.

40. Ibid., p. 9.

41. Ibid.

42. Ibid.

43. Ibid., pp. 10-11 & pp. 14-15.

44. Ibid., pp. 11-14.

45. My field study interviews with Dr. Hahn Sang-Joon & Mr. Hyun Won-Bok, ex-Spokesman of the Seoul Science Park.

46. This information is based on interviews with some leaders in Korea's S & T community done before and during my field research in 1981.

47. S. K. Jeon, p. 19.

48. Jacques Ellul, *The Technological Society* (New York: Vintage Books, 1964). Also refer to John Kenneth Galbraith, *The New Industrial State*, 3ed. rev. (New York: New American Library, 1978); and Duncan MacRae, Jr., "Science and the Formation of Policy in a Democracy," in Kuehn & Porter.

49. Straussman; and Hahn-Been Lee, *Korea: Time, Change, and Administration* (Honolulu: East-West Center Press, Univ. of Hawaii, 1968).

50. H. Lee, ibid.

51. A press release issued by the Office of the White House Secretary on August 5, 1965; KIST, *The Establishment of KIST* (Seoul: KIST, February 2, 1971); S. K, Jeon; and W. Henry Lambright, *Presidential Management of Science and Technology: The Johnson Presidency* (Austin, Texas: Univ. of Texas Press, 1985), pp. 95. This was also confirmed during my field research in Korea.

52. Refer to KIST, *The Establishment of KIST*, p. 8.

53. S. K. Jeon, p. 59.

54. Refer to references listed in endnotes numbers 25 & 29. Also refer to Mason & al., pp. 375-376.

55. S. K. Jeon, p. 60.

56. Out of these two functions, planning and budgeting, EPB's power centers on budgeting rather than planning _per se_, for the former is highly subject to power politics in Korea. EPB has literally "stolen" the national budget from the Ministry of Finance. Refer to Paik (1976).

57. Two reasons seem to explain why the Korean government abandoned the EPB's plan. First, when the plan was under review, financial factors and the conflicts among involved ministries went unsolved. Thus, when a new sponsor (the U. S. government) emerged, the Korean government wanted to start from the beginning to solve these two problems. Added to this seems to be an aspect of Korean culture deeply embedded in the bureaucracy, say, "a new wine in a new bottle" attitude.

58. Interviews with Mr. Hyun Won-Bok in 1980. Also refer to S. K. Jeon.

59. S. K. Jeon, ibid., pp. 55-57.

60. Ibid., p. 54.

61. Ibid., pp. 56-57.

62. Harriet A. Hentges, "The Repatriation and Utilization of High-level Manpower: A Case Study of the Korea Institute of Science and Technology," PH.D. Diss. Johns Hopkins University, 1975, p. 114 & p. 117.

63. Lambright, p. 95.

64. Ibid.

65. The Korean public questioned the legitimacy of Park's regime for it took over the government by military force. In addition, his Korea-Japan normalization efforts aroused strong public opposition in Korea.

66. KIST, _The Establishment of KIST_, p. 9.

67. S. K. Jeon, p. 67.

68. Yu Hoon, "Coordinating Public Enterprises in Korea," _Korean Journal of Public Administration_, Vol. XIV, No. 2 (1976), pp. 219-231; and Leroy P. Jones & Il Sakong, _Government, Business & Entrepreneurship in Economic_

<u>Development: The Korean Case</u> (Cambridge, Mass.: Council on East Asian Studies, Harvard Univ., 1980), Ch. 5.

69. Dr. Donald F. Hornig, the President's Special Advisor for Science & Technology, and Director of the Academy of Science & Technology; Dr. Lilli S. Hornig; Dr. James B. Fist, Director, Bell Telephone Laboratories; Dr. Albert H. Moseman, Agricultural Director of the Rockefeller Foundation and concurrently Deputy Director of the AID; Dr. Bertram D. Thomas, President of Battelle Memorial Institute; & Dr. Daniel E. Margolies, Assistant to the Director of the Academy of Science & Technology.

70. KIST, <u>The Establishment of KIST</u>, p. 11.

71. Lambright, P. 96.

72. Quoted from the White House Press Release on August 5, 1965.

73. Lambright, pp. 94-99.

74. Refer to publications listed in Chapter one endnote number 17.

75. The Korean equivalence to the White House of the U. S.

76. S. K. Jeon, p. 68.

77. In fact, the U. S. government at first planned to build a research institute in Korea which would cost a total of $5 million with accomomdations for a maximum staff of 200. However, upon opposition from the Korean government, which expected $20 million aid from the U. S. government for this project and manpower of 1,000, the U. S. paid a total of $8.3 million (including both grant-in-aid and loans) as of 1975. The total costs of the KIST-building project amounted to $24 million. Refer to KIST, <u>The Establishment of KIST</u>; and KIST, <u>The Ten Year History of KIST</u> (1977), p. 98.

78. Anne O. Krueger, <u>The Developmental Role of the Foreign Sector and Aid</u> (Cambridge, Mass., 1979), p. 67 & 113.

79. Wright. Also refer to <u>Jugan Hankuk</u> (<u>The Weekly Hankuk Newspaper</u>, Seoul), November 14 (pp. 4-6), November 21 (pp. 4-7) & November 27 (pp. 4-6), 1985 issues.

80. C. Park (1970), p. 173.

81. As a matter of fact, public perception, much promoted by local media, of KIST was very positive: KIST researchers as a symbol of Ph.D.s working in a "scientists' paradise" were expected to be capable of "doing everything." Such high social expectations prevailed at least until the early 1980s and KIST senior researchers often felt a psychological pressure to meet the social norm and their "showcase" role. My research data. Also refer to Young-Ok Ahn, "Hankuk Kwahak Kisulyonkuso yi whoigo" (Retrospect of the Korea Institute of Science & Technology), in Korean Future Society, Miraerul Doidol-a Bonda (Looking Back at the Future) (Seoul: Nanam, 1988), pp. 119-128.

82. Center for Science & Technology Policy, KAIST, Study on the Utilization of Experts to Effectively Promote Science & Technology Policy: Research Report No. 88-10 (Korean), (Seoul: KAIST. 1988. 6) p. 45.

83. Donald E. Evans, The Korea Institute of Science & Technology: A Brief Description and Rationale, Mimeo (Columbus, Ohio: BMI, 1971), p. 13.

84. BMI, Report on the Establishment and Organization of a Korean Institute of Industrial Technology and Applied Science to U. S. Agency for International Development by E. E. Slowter, J. L. Gray, W. J. Harries, & D. D. Evans, (Columbus, Ohio: BMI, Dec. 1965); Evans, ibid.; and KIST, The Establishment of KIST, pp. 12-15.

85. At the time of KIST's establishment, the BOT was chaired by Kim Byung-Hee (Former Dean, Inha Institute of Technology) and Chung Rak-Eun (President of the Hanguk Machine Industrial Co., Ltd.) served as the vice chairman. Trustees were: Chung In-Wook (President of the Kangwon Industrial Co., Ltd.); Lee Ryung (Dean of the College of Engineering, Seoul National University); Kim Wong-Wan (President of the Federation of Korean Industries); Choi Hyung-Sup (Director of the Atomic Energy Research Institute). Ex-officio trustees from the Korean government were: Kim Hak-Yon (Deputy Minister of EPB); Lee Chul-Seung (Deputy Minister of MCI); & Sung Dong-June (Deputy Minister of MOE). Ex-officio trustees from the U. S. side were: Roger Ernst (Deputy Director, USAID-Korea) & B. D. Thomas (BMI president). The auditor was Lee Chang-Suk (Former Deputy Minister, Ministry of Transportation) and the BOT secretary was Chun Sang-Keun (Head, Bureau of Technical Development, EPB). Refer to KIST, ibid., p. 19.

86. S. K. Jeon, pp. 80-82.

87. Ibid.

88. Quoted with translation from ibid., p. 81.

89. H. Choi, "KIST Today & Tomorrow" (1968), Mimeo., p. 7.

90. KIST, The Establishment of KIST, p. 3. Also refer to Choi Hyung-Sup, "Industrial Research in Developing Countries," Mimeo. August 10, 1975.

91. My field research data.

92. Paul I. Slee Smith, Think Tanks and Problem Solving (London: Business Books, 1971).

93. My field research data.

CHAPTER FOUR

ORGANIZATIONAL DEVELOPMENT OF KIST: AN IMPLEMENTATION MODEL

The commitment of the public-sponsorship by both the Korean and U. S. governments inevitably invited their deep involvement in the early organizational development of KIST. Their involvement was found in legal, administrative, as well as technical matters. Often, their support was highly political in nature, resulting in new traditions in the management of public enterprise systems in Korea and empowering scientists in Korean politics.

This chapter inquires about who played what roles, when, how and why in the implementation process of policy decisions on KIST. The concept of "implementation" in this study is defined by Pressman and Wildavsky as "a process of interaction between the setting of goals and actions geared to achieving them."[1] The operational definition of implementation employed in the study is that: 1) the follow-up actions taken by both Korean and the U. S. governments to develop KIST as an organization; 2) KIST management in the interpretation of the intended policy goals and in the employment of actual means; and 3) the Korean government's as well as KIST's approaches toward local industry in attempts to attract the latter to utilize KIST as a technological service center of the nation.

Analysis of the implementation process of KIST is important on several grounds. First of all, implementation is a study of the politics of diverse actors (whether referring to an individual person or agency). And yet, two competing views are prevalent over the issue of who plays what roles. The liberal-pluralist framework asserts that implementation is a policy process where power is dispersed among actors and bargaining is characteristic. In this process, as Ripley and Franklin note in the case of the U. S., government is "rarely a matter of command from the center, controlled by the center, and obedience by those commanded and controlled," and "everything is considered to be negotiable and up for grabs almost all of the time."[2] An alternative view from the standpoint of Korea's policy studies notes, as discussed earlier in Chapter two, that bargaining rarely takes place and when it does it is very limited due to the highly centralized, and powerful presidential framework. Analysis of diverse actors involved in KIST therefore informs us not only of <u>who</u> were important or powerful in the process but also <u>how useful</u> their actions were in meeting policy goals, namely identification of variables which may affect the policy outcome. Second, KIST, as the nation's first think-tank in the S & T field, provides us with important information about how scientists have consolidated their power in society, an interesting new phenomenon in Korean politics, and their relationship with government. Third, implementation proceeds within the framework of a given political system. Analysis of the implementation process of KIST, identification of key actors in particular, therefore informs us about the S & T policy model of Korea. How informative is Korea's bureaucratic-authoritarian model of policy process in understanding the KIST case? This is the central question of this chapter.

This chapter begins with discussions about the Korean government's legal, administrative, technical and political support towards KIST and local industry. Also included in the discussion is the financial, political and technical support from the U. S. government as well as from BMI. Later in the chapter, I will discuss the organizational characteristics of KIST, KIST management strategies and style in carrying out its mission as the nation's center for industrial technology and technology transfer. In the final section, the political significance of the KIST case in the study of policy implementation will be discussed.

State Power and KIST

Delegation of Power & Authority: Organizational Principle

Accepted as management principles, or management philosophy, from the outset of KIST establishment were research autonomy, financial stability, and the guarantee of sound research environment.[3] These principles were viewed as vital to attract high-level manpower and the stable growth of the institute in the future. In accepting these conceptions, Korean government authorities established a precedent for government-sponsored organizations, all of which previously had been constituted and subject to relatively close supervision by cognizant ministries, namely, delegation of authority and power to KIST.

To guarantee these principles, the Korean government's legal support was vital during the early period of KIST, for neither existing public R & D institutions, nor any other government-sponsored organizations were in operation without government intervention in their management. Particularly, when public awareness of R & D was not established, the legal device seemed to be very important. The first legal support from the Korean government was KIST's Articles of Incorporation (KISTAI, February 10, 1966). This was then followed by a more explicit legal support, the promulgation of the Assistance Act for the Korea Institute of Science & Technology (AAKIST) which passed the National Assembly in 1966 with a revision in 1967.

The significance of KISTAI is that it empowered KIST's BOT, not the Korean government, to have overall managerial control of the institute,[4] and the KIST president was given a great deal of freedom and power, being relatively insulated from the BOT's control in the management of the institute. As a matter of fact, the power of KIST's BOT is somewhat limited by Korean standards. For example, although the BOT has approval authority over the annual budget, and is entitled to a regular accounting of expenditures, the KIST president has authority to vary expenditures up to a stated percentage on his own volition. Also, even though capital expenditure items are also included within annual budget presentations, the power of the "budgetary clearance" as well as "fill-in details" rests with the administration. The Korean government had three ex-officio seats in the KIST BOT (representatives of EPB, MOST, & MCI), and potential access to influence on the KIST management if it wished. However, the history of KIST (before the merger with KAIS took place in 1981) reveals little evidence that the three government-representing trustees, or other trustees were influential in the operation of KIST. The BOT auditor too played a limited role. Often, auditors whose primary function is to oversee the KIST president were co-opted instead or "getting along" with the KIST president. A KIST president could even fire the auditor.[5]

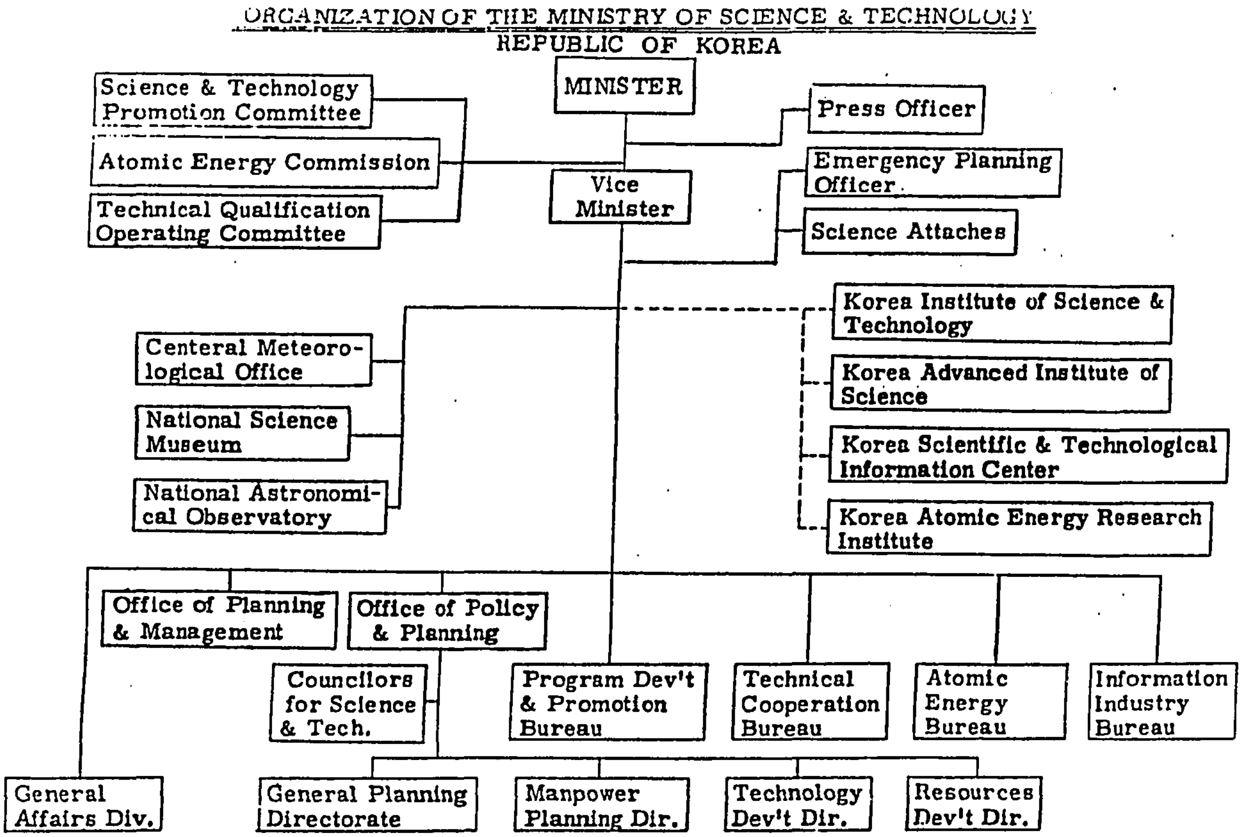
Managerial independence of KIST from government authority was a deviation from the conventional practice of public enterprise systems in Korea. So was the delegation of organizational power to the KIST president. Public bureaucracy in Korea, in fact, has enjoyed an unusual degree of autonomy and political power due partly to Korean culture which places high respect in public authority. Not only did KIST's particular form of organization represent an innovation with regard to public sector operations, it also departed from the very long-standing Korean custom of private organizations in which the chief executive officer of the organization is also the equivalent of the chairman of the board of directors whereby delegation of authority was not practical: The "head man," usually the owner or principal stockholder, was acknowledged as both the source of policy decisions and the implementer of day-to-day operations.

Such innovation, however, did not come smoothly. The early history of the unconventional nature of the KIST BOT was conflictual. It involved the elected Chairman of the Board who had been nominated as a government ex-officio trustee and who wished to assume the traditional preroga-tives of the "senior member" of the organization by taking an active role in the day-to-day operations of the Institute. This conflict of interpretations resulted in several special Board meetings (sometimes with emotion), finally resulting in recognition of the doctrine of operational control residing only with the president of KIST.[6]

In obtaining operational autonomy, KIST also experienced conflict with government authority. When MOST was created (1967), it became the administrative aegis of KIST (Figure 4.1). Not only was the Vice Minister of MOST an ex-officio member of the KIST BOT, but the Ministry had

Figure 4.1

The Organizational Chart of S & T System in Korea



Source: MOST, 1981.

the very important task of annually establishing for KIST and other R & D institutions a supporting budget. In the beginning of MOST's operation, the Minister of this newly created government entity tried to assume directory powers over KIST affairs, thereby reflecting much of the same tradition and attitude that had characterized the actions of the BOT chairman described just above. There was an assumption of direct authority over the affairs of the Institute and its management, and there followed a period of conflict between MOST and KIST involving considerable political maneuvering and intrigue.

The matter was finally resolved at the highest levels of government, reflecting the judgment and deep concern of the top political leader in Korea.[7] KIST scientists were also very much indebted to American officials, who either as BOT members or as technical advisors, would stand behind KIST scientists whenever necessary in the course of dispute.[8] As the result of this power game, MOST's role toward KIST has been defined as being supportive and advisory rather than directive and operational in nature. More or less, the KIST-MOST relationship was of two "co-equals"--a peculiar kind of relationship which is very unlikely to be found between MOST and other MOST-sponsored public R & D institutions (see Figure 4.1). In the mid 1970s, when Choi Hyung-Sup of KIST became the Minister of MOST his passion toward KIST began to erode the "co-equal" nature of the balance of power. The new KIST-MOST relationship under Choi's ministership was favorable to KIST though: He was even referred to as "the Minister of KIST" by the local S & T community.[9]

A question then arises as to why the Korean government agreed to empower KIST. Before turning to this issue, however, it may be proper to introduce AAKIST, for this law specifically define the limited role of government while giving KIST a great deal of autonomy.

Autonomy in Research and Management

At the time when the KIST-building decision was made, EPB officials and Korea's S & T community leaders worried whether KIST's emphasis on independence and autonomy would lead to negligence from the government in financially aiding KIST. This issue was also raised repeatedly by the U. S. team which got involved in the project, and EPB was advised to develop some sort of security devise which would guarantee the Korean government's financial support for KIST.[10] Two approaches were taken by EPB: Naming President Park as the founder of KIST, as discussed in the previous chapter and the introduction of a bill, drafted by EPB, known as Assistant Act for the Korea Institute of Science and Technology.

The purpose of AAKIST was to ensure KIST with research independence, autonomy and financial stability until the institute could operate independently. Specifically, major contents of the bill were such that: The Korean government may finance KIST for its endowment fund, construction, operations, and may grant government properties (such as government-owned land) to KIST; and both the Korean and U. S. governments shall finance KIST but the latter is not subject to government audit, nor required *a priori* approval from the government for its operational programs.[11]

When the EPB's bill was first introduced, it did not receive a favorable response even from the cabinet members for such concepts as "government endowment fund" and "audit-free" operation were brand new to the traditional practice of government financing. However, after EPB's and KIST's lobbying, the bill was accepted by the cabinet. But when it was sent to the National Assembly for approval, it was strongly opposed by legislators, especially by opposition political party members of the Finance and Economy Committee of the National Assembly (FECNA).[12] To those opposition political party legislators, the idea of "government-financing-but-no-control" is "ridiculous" and unacceptable in consideration of the magnitude of the government investment which would amount to 10 digit figures (in won) annually. Furthermore, they have also opposed to the idea of exempting KIST from the government's *a priori* approval over its programs. The opposition legislators' arguments, as well as the cabinet members' opposition, seem to be quite sensible when we consider two facts: Up to that point, the concept of the "government's endowment fund" had been hardly, if ever, introduced into the nation's budgeting practice, and the autonomy and independence of KIST were deviations from Korea's public enterprise tradition.

Confronted by this opposition, EPB lobbied the FECNA members but with only limited success: EPB was successful only in persuading the Committee chairman. The opposition party legislators were not moved at all by this lobbying and they passed the bill with reservations: The government's financing of KIST was allowed, but new provisions were added by which KIST was to be not only subject to *a priori* approval from the government for its annual operating programs, but also government audit of KIST accounts. This modified bill was accepted by the Executive Branch and was passed by the National Assembly in 1966 (December 17, Law No. 1857).

Not much information is available as to why EPB and the Blue House let the bill pass in such a way. They perhaps simply preferred to terminate the issue. From the KIST standpoint, however, such provisions were contradictory to the goals of the law, for they would jeopardize KIST's autonomy and independence both in its management and in research. KIST then launched a campaign demanding the elimination of such provisions, perhaps the first recognizable interest-group activity by scientists in Korea.

KIST president, Choi, who, at the time of law-passing in the National Assembly, was in the U. S. to recruit Korean scientists and engineers who would work at KIST, was especially furious when he heard about the law. Choi, who had a firm belief in the importance of the "autonomy of the recipient," and other scientists and engineers at KIST then lobbied the American Embassy and USAID in Seoul asking for their support for the revision of the law. KIST staff also lobbied the Blue House. Choi even "threatened" to resign from KIST unless the law was revised.[13] In the mean time, Choi was invited to a hearing in the National Assembly to explain KIST's position. His speech during the hearing was a milestone in the history of the National Assembly for it was the first time that the S & T issue was brought up to the legislature, and he was the first civilian to make a formal speech in the National Assembly.[14] One of my interviewees recalled that his speech was both passionate and long. Legislators finally "begged" him to stop his speech by saying that "we understood what you want."[15] KIST staff also used their personal network to persuade politicians on an individual basis seeking support.

The result was KIST's victory. With the lack of documentation on this issue, it is not clear to what extent the KIST lobbying in different offices such as the legislature, Blue House, and American embassy/USAID respectively was directly linked to KIST's success. It is obvious, however, that KIST's lobbying was successful enough to attract attention from Korean political circles and get American supporters to reconsider the issue. Particularly, President Park's full support was vital. One document reveals that President Park, through his special Executive Order, "instructed to revise the law at once" to the original EPB draft which is identical to what KIST wished.[16] His order was followed by the revision of the law by the National Assembly in 1967 (March 30, Law No. 1917). The revised law no longer required KIST's a priori government approval for its operational programs, nor government auditing. Instead, KIST was to submit to the pertinent ministry (MOST) an annual operation report, and an annual auditing report prepared by a government-designated certified public accountant.[17] This special legislation was certainly precedent setting in the country's business legislation history. In so doing, literally centuries of Confucian-based custom, relating to the place of government in the regulation of commerce, was abrogated.

Not much information is available about why and how the National Assembly agreed to revise the law against their earlier position. Perhaps this can be explained in terms of the comparative strength of President Park's power in Korea's political system of the mid 1960s in which the National Assembly was by and large under the control of the Executive branch of the government. Observers of Korean politics often note that President Park's power was even stronger at that time than under the Yushin system of 1972-1979 (in which Park's dictatorship was constitutionally guaranteed whereas the National Assembly was institutionally weakened), for Park and his junta were running the government "armed with guns" in the 1960s.[18] The significance of AAKIST then is amplified when we consider the particular context of Korean politics which still fell into the "bare-knuckles" stage, where academic freedom was virtually nonexistent. Certainly, KIST researchers enjoyed a "maximum" freedom of research available in the Korean context during Park's tenure in power.

The political significance of the AAKIST case is also found in that scientists (KIST) began to get organized to voice their demands and in President Park's pro-KIST position. The KIST case should be understood with caution however. Although KIST scientists emerged as a special interest group and were successful in their "bargaining" with the government, it is premature to assume KIST was an example of an institutionalized form of special interest group politics in Korea. On the contrary, KIST's success was based on President Park's patronage, only viable under conditions of state support rather than as an outcome of "clash" and "negotiations" among diverse actors, as often assumed in the Liberal-Pluralism model. This view is strongly supported when we analyze what happened to KIST in the post-Park era in the 1980s. Once President Park's guardianship was lost, and without paternalist support from the newly emerging power of the Chun Doo-Whan regime, KIST became a target of political manipulation: Less than 15 months after Park's death, KIST was forced to merge with KAIS. Significantly, the merger not only blurred KIST's identity as an applied research institute, but also lost its autonomy and power within the new organization (KAIST). During the Chun regime, however, KIST scientists as a group never protested their "suppressed" status or situation. It was not until a new president, Roh Tae-Woo took power in the Sixth Republic that ex-KIST scientists began to argue for increased organizational status. They were finally granted a "divorce" from KAIST in 1988. These incidents over three regime periods clearly show the strength of presidential power in Korea's policy process and the limitations an interest group (KIST) faces.

Why then did the Park regime take such innovative approaches towards KIST? Several reasons seem to explain this. First, they were political strategies carefully devised by the Korean government to develop KIST as a viable R & D center. The existence of KIST is justified by its market (i. e., industry) and its demand. However, it was viewed by KIST-builders that the birth of KIST under government sponsorship itself could jeopardize KIST's operation in its market for industry often views government actions and establishments negatively. One observer explained the reason as a universal problem of "natural antipathy" existing between the public and private sectors in all countries by which industry often views government as an "obstacle and hindrance."[19] In Korea, in particular, industry witnessed inefficient government R & D establishments in the past which suffered from delegation of authority and power from the government. From the beginning, the KIST-builders were well aware of these potential stigma which KIST might bear in the future. It was suggested to off-set this negative view on the part of industry by establishing R & D institutions as autonomously as possible...a semi-public type institution could escape the prejudice attached to purely governmental establishments.

In the process of defining KIST as an autonomous, independent, semi-public institution, experiences of the industrialized countries were carefully studied. The National Research Council of Canada was an important model to KIST for its autonomous research environment in spite of financial support from the government.[20] In addition, when the concept of "R & D" was not well understood in industry, KIST builders felt that it was necessary to artificially devise incentives to induce industry to use KIST facilities. Allowance of industry in claiming R & D cost as income tax deductible expenditure is an example of such "carrots" offered to industry. As Sabato's "triangular model of technology policy" in developing countries suggests (in Chapter two), a good public R & D policy includes policy programs to link research (KIST) and production (industry). The Korean government seems to have realized the importance of this linkage.

Second, it was the result of the active role played by KIST scientists who showed genuine interest in building a <u>bona fide</u> R & D institute in Korea. Especially, KIST president Choi's role was critically important in building a strong power base for KIST from the outset. He played a key role in setting the rules of the game between KIST and the government as well as that of KIST's management and KIST's BOT. By contrast, KIST BOT members representing Korean government and industry were rather unfamiliar with the management of an R & D institution like KIST, which in return seemed to have contributed to strengthening the power of scientists-turned-to-be KIST managers. In addition, Choi's peculiar leadership style (which emphasized rationality, hard work, a corruption-free work ethic, etc.), and his zealous enthusiasm (which was sometimes viewed as "stubborn," or even "authoritarian" where KIST's interests were concerned) also contributed toward building a good public image of KIST and KIST scientists. This strengthened its power base in society. In fact, Choi received full trust from EPB, USAID and BMI, and more importantly from President Park.[21] The continuity of organizational leadership is a crucial element in successful implementation.[22] KIST certainly met this requirement.

Third, support from American personnel, either as KIST's BOT trustees, or as technical advisors, also helped KIST obtain autonomy and managerial independence. Top managers of KIST recalled that whenever they had difficulties in BOT meetings, American trustees, especially ex-officio from BMI, were always behind them and persuaded Korean BOT members to support KIST management's plans.[23] Another interviewee, Roger Earnst (an ex-USAID/Seoul officer) recalled that his office's full support for KIST has even provoked corruption charges in the U. S. Congress.[24]

Fourth, at the deeper level, the Korean government's refraining from interference in KIST management matters reflects the Korean government's recognition of and respect for R & D professionals. This recognition was due to R & D professional's functional merits (i. e., scientific knowledge, competence), and for their political value--necessary to implement fundamental policy: national industrialization. Undoubtedly, government support in the KIST case was instrumental in facilitating the aggregation of scientists and engineers as a powerful new interest group in society. And yet, their power did not have its own strong hold, but was dependent on presidential support. In the 1960s and 1970s, as discussed earlier, KIST enjoyed its power (i. e., autonomy) under the strong guardianship of Park while experiencing a sharp decline of such "privilege" when Chun took power. A recent development under Roh (separation of KIST from KAIST) also asserts the important role the nation's president plays.

Other Legal Supports

The Korean government also promulgated new laws which directly or indirectly affected KIST's operations. The Science & Technology Advancement Law (Law No. 1864) enacted in 1967 was the first law of its kind in which the national government explicitly expressed its will and support for the promotion of S & T. This law is very broadly stated and does not specify means as to how to achieve such a goal. Nonetheless, it stresses the needs of government actions in a) making S & T policies and plans to promote them, b) establishing of a system to carry out such policies and plans, and c) allocating financial resources.

The Technical Development Promotion Law (Law No. 2399), promulgated in 1972 (revised in 1989), is very important for KIST, for it intended to encourage local R & D in the industrial sector. By providing various incentives such as financial aid and tax incentives, it encouraged local industries to engage in R & D as well as in the importation or adaptation of foreign technologies. For example, the law allowed industrial firms to claim expenditures spent on technical development as a loss on their financial statements. The government may also provide preferential financial support for those companies which budgeted or spent money on technical development from the long-term, low interest funds established for industrial development. When a local company commercializes a newly developed technology, 10% of its investment is allowed to be deducted from corporate taxes, and tariff duties are either reduced or exempted when equipment must be imported from such commercialization projects. The government has also affected a government-private industry joint investment contract research system, wherein the government invests up to 50% of the total cost to support a company's industrial R & D but may transfer to the company concerned, free of charge, its percentage of the patents, know-how, facilities, manufactured goods, and pilot plants resulting from the research project.[25] Moreover, the law stipulated that the protective measures of locally developed new technologies and processes from those of foreign. KIST became a beneficiary of this regulation. As KIST's R & D began active in the later 1970s, conflicts between technologies and processes of KIST-developed and those imported from foreign countries arose which called for settlement based upon this law. A fuller discussion of such cases will be presented in following chapters.

<u>The Engineering Services Promotion Law</u> was enacted

in 1973 (Law No. 2474) to promote or protect local engineering services by increasing local participation. For example, under this law public organizations preferentially assign local engineers in all their engineering service contracts. When local engineers are not available, it allows foreign engineering services but with governmental approval. Even in these cases, local engineers are encouraged to partici-pate in the services for training purposes. Certainly, such regulation benefited KIST and other local R & D entities.

In addition, various tax laws have been revised to exempt KIST from the burdens of corporate taxes, business taxes, registration taxes, property taxes, acquisition taxes, commodity taxes, and custom duties. Also, a law was passed to allow individuals and juridicial persons contracting with KIST to claim the cost of research as a tax-deductible operating expense from their income taxes.[26]

Finance and Construction

Financial security was greatly stressed by KIST builders. BMI even defined financial self-sufficiency as one of the ultimate objectives of KIST[27] for it not only affects the overall development of KIST, but also affects its autonomy and independence. Suggested by BMI was an adaptation of contract research as a means of financial self-sufficiency. However, since the workability of contract research in developing countries such as in Korea has not yet been proven,[28] emphasis was placed on the continuing assurance of financial support by the Korean and U. S. governments for the first few years until KIST could "walk alone" with a projection that it would diminish each year which indeed it did. In addition, BMI provided other important guidelines on sources and methods of funding, seeking KIST's financial security as well as aiming at minimizing potential pressures on KIST management.

The costs of establishing KIST totaled W7,449 million (over $24 million).[29] During the 1966-1970 period, the Korean government contributed a total of W4,652 million to finance construction of buildings, acquisition of land, operation expenditures, and endowment funds. The U. S. government's support totalled about $9.1 million of which about $7.2 million was given to KIST in the form of a grant-in-aid and $1.9 million for an AID loan with 2% annual interest rate.[30] Under a sub-loan contract, the Korean government agreed to bear the responsibility of repayment of the loan until KIST became financially self-supporting.[31] The U. S. government's grant-in-aid covered the foreign exchange costs to purchase construction materials, laboratory equipment, and technical consultant fees. The AID loan was arranged to finance the costs of procuring additional laboratory equipment and construction materials.

From the beginning, both Korean and American teams agreed that KIST should be equipped with modern facilities, and that its buildings and facilities should be sufficient to carry out a broad range of research activities and to accommodate changing research needs. Within this basic framework, the quality and other design principles of KIST's buildings and facilities were guided by BMI's own experience and standards accepted in its numerous laboratory facilities both in the U. S. and West Germany. The construction cost of KIST's laboratories, based on BMI's experience, were projected at 15-25% higher than the average construction costs of business buildings in metro areas in Korea at that time.

In consideration of Korea's weak industrial base in the 1960s, American financial support for KIST was very important and facilitated the institute's procurement of necessary scientific equipment, building facilities (i. e., passenger and cargo elevators, air control devices, etc.) and some construction materials (i. e., steel frames for window, etc.). Such procurement undoubtedly stimulated local industry, especially the construction industry, to improve the quality of its manufactured goods. The U. S. supported the payment of fees to American consultants (i. e., BMI technical advisors) and also waived the foreign exchange burdens of Korea. On the other hand, U. S. aid to KIST was a typical example of the "buy American" foreign aid orientation. Some observers questioned whether it was really necessary to decorate KIST's main administration building lobby with marble stones imported with U. S. aid. In terms of the installment of research equipment, the KIST president tried to have a highly modern, well-equipped facility, irrespective of immediate industrial needs. Perhaps the rationale was to obtain modern equipment when funds were available. However, this became a controversial issue among various reviewers of the early equipment procurement plans of KIST. Criticism was voiced as to whether a country where it was not even possible to buy a satisfactory four-inch water valve, for instance, really needed large-scale computer facilities and other highly sophisticated research equipment such as nuclear magnetic resonance equipment. Others criticized whether "it was really necessary to air condition the tool room space in a country where no public official below the rank of Minister had an air conditioned office and where virtually all living space was heated in winter by small, primitive coal stoves?"[32]

According to a source, Korea originally hoped for a $50 million contribution from the U. S., then of $30 million, and finally down to "more reasonable terms" - $9.1 million.[33] Nevertheless, the actual cost of establishing KIST was far more than the original projection of $12 million estimated by the BMI report to meet the financial requirement for the first 5 years of which supports from the Korean and the U. S. governments were expected as $5,323,000 and $6,765,000 respectively. This projection was based on, as shown in Table 4.1, an estimated staff size of 210 by 1970 and with about 30% maximum practical growth rate (professional staff) per year, thus reaching a total of 1,000 in 10 years. However, during the construction period, financial demand increased sharply due to the rapid growth of the institute, and increasing demand for research. By 1970 the staff size, for example, expanded to 573 as Table 4.1 shows. By the end of 1969 when the construction of buildings was completed, a total of 144 research projects were undertaken by KIST of which 71 were completed. This was far more productive than expected. Also, delays caused by complicated bureaucratic procedures as well as delays in ordering scientific and other building equipment from the U. S. contributed to soaring construction costs.[34]

Noteworthy at this point is that both governments willingly took responsibility to increase their financial contributions to KIST. Especially, the Korean government's support of $15 millions was remarkable (up from the projected $5 million). This figure is significant in consideration of the tight budget situation of Korea in the 1960s when economic development plans were under way. As such, KIST started with a maximum amount of financial support and minimum amount of government control. Needless

Table 4.1

Estimated & Actual Increase in Manpower

Unit: # of persons

Year	Estimation	Actual	Year	Estimation	Actual
1966	75	50	1972	350	661
1967	100	148	1973	450	767
1968	130	331	1974	580	878
1969	170	494	1975	760	984
1970	210	573	1976	1,000	
1971	270	623			

Source: KIST, _Hankuk Kwahak Kisul Yonkuso Shipnyun Sa (The Ten Year History of KIST)_, (Seoul: KIST, 1977), p. 87, Table 3.

to say, financial provisions, along with the aforementioned legal support, provided KIST with a substantial foundation.

The Korean government's full support for KIST was also exhibited when the construction of KIST facilities was under way. Construction of KIST facilities involved diverse actors working together: The Korean and U. S. governments as financial sponsors, KIST's administration as host, BMI as AID contractor. Besides, two Korean architectural firms and an American construction firm joined the project as BMI's sub-contractors. Under an agreement between the two governments, there was a well defined division of labor among the parties involved. However, the involvement of multiple parties requiring different bureaucratic procedures often created delays in construction progress.

Such delays were highly undesirable for KIST and President Park who wished to complete construction on schedule. Besides, as President Park's personality demonstrated throughout his rule, he preferred to accomplish things quickly. He often appraised highly those who completed projects ahead of schedule. The term "quick and quick" in fact became a catch-phase of his administration. The KIST construction project was not an exception. One of my American interviewees recalled that the American team was stunned to see Korean workers using torches on a cold winter night and digging the frozen earth in order to continue construction.[35] To solve the problem of delay, and to accomplish the task assigned to the Korean side more efficiently, President Park sent KIST a special task force team. The team, which worked during early 1967 and December 1969, consisted of six army officers from the Army Engineering Corps of Korea. Their mission was technical and political in nature. They were sent to KIST to technically assist KIST's construction in civil engineering works. In consideration of the low level of construction technology in the 1960s, the Army Engineering Corps officer's expertise in civil engineering, construction, mechanics, and electrical engineering was highly valued by KIST. At the same time, their task was to keep order and security in the construction site by keeping unauthorized personnel off the grounds. It was, in fact, not very unusual to see gangsters and beggars in Korea in the 1960s who would hang around construction sites causing trouble (i. e., use of violence, demanding money, etc.). President Park's approach of using a powerful public authority (presence of Army personnel) was a very effective measure to prevent such unwanted interruptions.

It is interesting to note, however, that the Army Engineering Corps' involvement in KIST was limited to those two functions unlike common practices in the Korea's public enterprise system in which ex-military personnel often took civilian posts and got deeply involved in management.[36] The Army team left KIST as soon as their tasks were over. In appraisal of their services to KIST, however, President Park promoted the team leader to brigadier general during the inauguration ceremony of KIST buildings even though he was not yet eligible for that rank.[37] Keeping ex-military personnel or ex-high ranking government officials away from KIST and other strategic R & D institutions, in favor of professionals, became a tradition during the Park regime. And these institutes have since been insulated from the politics of patronage, which is ubiquitous in the personnel management of the nation's public sector agencies.[38]

President Park's support for KIST during its construction was also found in the exemption of KIST from tariff duties on items imported via foreign capital (Presidential Order No. 3193 announced on 1967. 8. 13). By this special law, such items as construction materials, laboratory equipment, and books were exempted from custom duties,[39] and custom clearance procedures were also simplified to lessen KIST's administrative burdens.

The construction of KIST facilities included not only research and administrative buildings (25,220 square yards and 11,380 square yards respectively), but also residential areas (10,000 square yards). The residential housing included official residences for the top administrators, apartments for senior researchers, dormitories for bachelor research staff, a guest house, a recreational hall, a motor pool, and tennis courts, etc.

Including residential areas in the KIST building complex was apparently upon BMI's recommendation as a fringe benefit to senior researchers (i. e., repatriated scientists and engineers) as it had successfully experienced in its own establishment in West Germany. However, it was also very unique to KIST and to Korea, for it aimed at maximization of research productivity by reducing commuting time from home to work. KIST officials also hoped that proximity to the work place would encourage the research staff to come back to work in the evening. In fact, "hard work" and building up "laboratories that work around the clock" were Choi's slogan from the outset of KIST operations. At the same time, KIST's housing had impacts on the management of high-level manpower and the housing industry in Korea. It was not uncommon in Korea for some government officials or executives in the semi-public or private sector to be offered official residences. However, it was highly unusual for returning professionals from abroad to be offered such fringe benefits. Moreover, KIST's modern, western style housing, designed to be suitable for a nuclear family and equipped with modern facilities (i. e. central heating, kitchen appliances, coin-operated washer and dryers, etc.) became a pioneer in the development of the apartment housing industry in Korea where such a concept was very limited in the mid-1960s.

Reverse Brain Drain

With government's full support, KIST recruitment attempted for the first time in Korea to systematically bring back home Korean "brains" who had remained in industrial counties after academic training was over. The KIST case of repatriation became a model of RBD and the management of high-level manpower with wide spin-off effects both in Korea and in other developing societies.[40] In fact, the development and successful implementation of Korea's repatriation policies for the next two and a half decades was very much indebted to KIST's experience.

Since repatriation first began at KIST in 1966, MOST began to sponsor repatriation in 1968. By late 1989, a total of 1,707 (1,008 permanent repatriates and 699 temporary repatriates) had been brought back home under the MOST sponsored Repatriation programs alone.[41] Government-endowed strategic R & D institutions brought another 1,002 scientists and engineers back home under their own sponsorship during the 1981-1986 period (88 permanent and 914 temporary).[42] In addition, KIST's recruitment process of Korean scientists and engineers from foreign countries provided valuable information (i. e., personal data) to MOST when it organized the Association of Korean Scientists and Engineers in America (1971) and in Europe (1973). These organizations were created to systematically develop a communication network between the S & T communities in Korea and abroad. In the past decade, MOST expanded such professional associations into other regions, such as Japan (1983), Canada (1986), China (1989), and the Soviet Union (1991). As of 1990, nearly 10,000 Korean scientists and engineers residing in the West have joined those associations.[43]

Recruitment of KIST personnel began when the institute's first project, the "Technical Economic Survey of Korean Industries," was undertaken. This project was to obtain state-of-the-arts information for Korean industry (further discussion on the project follows later in the chapter). The importance of the project in relation to recruitment was that the research findings of the project provided basic information in determining KIST research scope within which framework recruitment of research staff took place. "High quality" manpower was a catchword in the KIST's recruitment process. The search for research personnel occurred both in and outside Korea. Particularly, extensive efforts were made in the recruitment of overseas Korean scientists and engineers in America and Western Europe.

Locating high-level Korean manpower in foreign countries was a tremendous job but it was done within an "amazingly" short period of time with successful results.[44] In the initial recruitment program, BMI's assistance was important providing the linkage between KIST and Korean professionals abroad. Diverse methods were utilized to disseminate information about KIST and to locate prospective applicants (i. e., contact with 500 universities and colleges, advertisement in Korean community newspapers and professional journals, etc.). According to a BMI report, 869 Korean scientists and engineers were identified as a result of this search.[45] BMI sent out over eight hundred letters over a period of two and a half months. About five hundred Koreans wrote to BMI inquiring about the search.

Interviewing and hiring research personnel were solely KIST's job, except that BMI assisted KIST in reviewing applicants' research proposals and BMI personnel accompanied Choi during his interviews trips in 1966 and 1967. Several criteria, both objective and subjective, were applied in the recruitment of KIST personnel. One of the objective requirements was that the applicant should be a native-born Korean, regardless of current citizenship. Whether the applicant's wife was Korean-born or not was also seriously considered to eliminate potential burdens which repatriated researchers may bear in the course of adjustment into a new environment. The area of specialty (whether or not it fit into KIST's research scope defined by technical economic surveys) was a more or less important criteria.[46]

Another significant criteria employed in recruitment was the willingness for hard work--very subjective, yet highly emphasized by KIST. Choi had a very firm belief that KIST researchers should be dedicated to hard work. They should not only have competence in a chosen specialty but also have keen interest in applying knowledge in the local industrial setting...the very demanding environment that a developing society presents.[47] Appeals to nationalism and individual persuasion, sometimes viewed as "impulsive" by some observers,[48] were the important approaches Choi often took during the recruitment interview, especially when desirable candidates deferred to a commitment to work at KIST. Nationalistic appeal was highly successful and is noted as one of the most important factors in KIST's repatriation success.[49]

KIST also took unique approaches in its repatriation attempts, characterized as the "small-but-top" approach and "researcher-first" approaches. Academic credentials as well as work experience (industrial experience in particular) were important elements in recruitment. During initial recruitment, KIST's primary concern was to attract those who had five years of work experience beyond a doctorate. An advanced degree from "prestige" universities and undergraduate training from Seoul National University (which is considered the number one university in Korea) attracted KIST recruiters' special attention. Out of about five hundred inquiries, only sixty-nine researchers at prestigious research institutes (rather than pure academics) in America and Europe were invited for personal interviews with Choi, among whom sixty-five expressed their willingness to work at KIST. Finally, eighteen were chosen to serve as the core research members at KIST (fourteen of them held doctorates, and sixteen were recruited from the U. S. and two from West Germany). They also became the pioneer RBD group in Korea. By July, 1980, the number of those permanent repatriates reached 119 of which 107 have doctorate. Between 1982 and late 1989, another 104 (14.7% of MOST-sponsored repatriation) were permanently repatriated and 57 (15.7%) were brought back to the institute on project bases in the temporary repatriation category.[50]

A domestic search was also conducted which resulted in the employment of some 70 personnel in February, 1968. They were chosen elites who passed the open, competitive examinations given by KIST to secure the best personnel in Korea. The domestic recruitment included ten scientists and engineers who had actual work experience with local industry after their academic training (seven of them held Ph.D. degrees, four had academic training in America, two in Japan, and one in West Germany). The ratio of the locally recruited personnel to the total number of research staff members was set at about 30%. The function of such personnel was important, for they were expected to fill the gap between local industry and repatriated scientists and engineers.

By the end of 1975, a total of 984 were employed at KIST which breaks down into 24.7% in research positions, 15.8% in engineering positions, 7.5% in administrative positions, 26.9% in technical positions, and 25.0% in assistant positions (i. e., clerks). Among them, 133 were listed as senior level researchers/engineers whose educational backgrounds are as follows: 52 Ph.Ds., 32 Masters, and 49 bachelors or equivalent. As of 1989, KIST employees totaled 792 among whom two were in executive positions, 455 (57.4%) in research, 17 (0.9%) in engineering, 43 (5.4%) in administration, and 277 (35%) in the supporting staff catagory.[51]

The number of the first group of repatriates may be considered relatively small in comparison to the total number of employees at KIST (494 in 1969 and 984 in 1975).

However, the significance lies in the kind of treatment, and the kind of power and status they were given in and outside KIST's organization. This had a tremendous demonstration effect for Korean society in defining the proper place of the returning "brains" in Korea's socio-political strata.[52] Another important aspect is the specific support the Korean government provided to influence decisions on homecoming, which will be discussed shortly. Within KIST's organization, they were "power elites." Some people even referred to them as "kings," with the job title of "principal investigator (researcher),"[53] especially in the initial period of KIST operation. They were assigned to key leadership posts with optimum research autonomy and given independent research laboratory facilities with supporting staff (i. e., junior researcher, technical and administrative staff). The magnitude of their power was such that the fate of laboratories depend on them: When a principal researcher left KIST for some reason, his laboratory would be closed while his staff members were transferred to other laboratories in similar lines of work. When a new researcher was repatriated, KIST would create a new laboratory or reopen one in his speciality.

These practices are a reflection of KIST's "researcher-first" (in addition to the "Ph.D.-first") management principle, established from the outset of its operations. Among its three functional categories of staff were researcher, engineer, and administrator. This principle is found in the area of personal management and includes that a) Principal researchers will be continuously recruited from abroad; b) Recruitment of research staff receives top priority with no limited ceiling number (as long as budget allows) whereas the non-research staff will be limited to a minimum.[54] The small size of KIST's administrative staff (professional administrator accounts for 7.5% of the total employees in 1975 and 5.4% in 1989) demonstrates how this principle works. Priority went to the research staff, then technical staff while administrative staff were urged to limit their function to "providing services" to researchers and technical personnel. From the standpoint of the administrative culture of Korea and conventional practices where literati-bureaucrats historically exerted power over technicians, this was certainly a significant departure. In accordance with this policy, the KIST president's office door was open to researchers first. This is a somewhat different procedure from standard organization in Korea as one of the repatriated senior researcher pointed out:

> One of the things we have here (KIST) that I feel is different is the opportunity to talk freely with our colleagues and members of top management. There's none of the structure and difference that is so common in business organizations in this country. I can speak to Dr. Hahn (the third president of KIST) openly and freely and know that he is interested in my views and

> opinions. I know this same feeling is characteristic of most of us who returned (from abroad) because we talk about it and are in agreement.[55]

Within KIST's organization, formalism, both in its organizational structure and management practices, was rejected. The first KIST President had long been convinced that a minimum of organizational structure was desirable in any research organization. Therefore, initially he instituted a "classless society" in which individual researchers were assigned to projects from a consolidated group of personnel, without the need to establish departmental lines or discipline-oriented sub-groups within the institute. In this way he hoped to emphasize the individual's contribution to the research effort and to minimize the territoriality he had observed in many research organizations. A research-task-oriented joint research system such as KIST has adapted, is a good example where "function" is highly valued rather than a "formal structure." Minimization of the power of the administrative staff, as mentioned earlier, is another example of this principle.

Staff compensation, especially the package of fringe benefits provided to returning scientists and engineers, was not only an unprecedented practice in Korea, but also defined the increased status of the returnees.[56] Staff compensation also shows the dynamics of government involvement in the process of repatriation. The idea of the package of "perks" began when KIST recruited its first group of researchers from abroad. These benefits included relocation expenses (i. e., airfares for the repatriates and the members of immediate family, and door-to-door moving expenses), free housing, overseas travel, subsidized educational costs for children, and subsidies for local transportation (i. e., free transportation, free or low-cost automobile maintenance). The KIST model of "perks" became a standard in RBD and in the management of high-level manpower with wider effects both in the public and private sectors.

Salary is another area to consider. Korea's low wage level, particularly in traditional government R & D institutions, was problematic to KIST builders. Choi believed that low salaries generally meant low quality staff. He also believed that low wages encourage researchers to "moonlight" for material compensation, which undoubtedly distracts from work achievement in home institutions. In other words, with "civil-service-type" pay scales such institutions as KIST could neither attract nor keep the level of qualified personnel needed. For under such a pay scale, the majority of R & D staff in government institutions received less than $50 per month in the mid 1960s. Even when considering relatively lower educational levels, this allowed only a sub-standard living. Consequently, with the government approval, he revolutionized wage scales for KIST staff, independent from the norm prevalent in the public sector. The monthly salary range of $250 - $400 was set for repatriated professionals, not to mention other fringe benefits (i. e., relocation expenses, housing, overseas traveling, etc.). This salary scale was by no means compatible to what they had earned in industrialized countries. As one of the repatriates from the U. S. remembers, his new job at KIST cost him a three fourths pay cut. But such a salary was exceptionally high by Korean standards of the 1960s as shown in Table 3.4 in the previous chapter. Also, it was much higher than that of members of the cabinet or National Assembly who were believed, in the eyes of the public, to have the most "prestigious" positions in society thereby "deserving" highest material compensation. KIST's senior researcher salaries were then about two and a half to three times higher than a professors's average salary.[57] Within KIST's organization, the wage scale for research personnel is higher than technical staff, and that of administrators is the lowest among the three different job categories.

In return for competitive salaries, the professional staff was expected to exhibit organizational loyalty and hard work. Moonlighting, as was the custom among many academics, was not allowed at KIST except part-time lectureship (only one course per semester) in consideration of shortage of high-level manpower in universities in the 1960s. However, incomes generated from a lectureship were to be returned to KIST's account. The low wage scale for Korean bureaucrats are frequently criticized for corruption and incompetency. KIST's high pay scale was certainly a revolution. Loyalty to organization and material compensation are closely related as McCurdy said:

> Loyalty to the organization or its mission is not a powerful ethic among bureaucrats in developing nations. Public employees receive few incentives to work hard and be loyal to the organization. ...The pay scales are pitiful, government housing is generally substandard, the employees are rarely professionalized, and the jobs lack prestige in the eyes of the public.58

From this point of view, KIST seemed to have taken a "right" approach in appealing to loyalty and hard work.

In addition, KIST also developed various training programs and a sabbatical leave system. For example, senior level researchers were sent to BMI before they resumed their responsibilities at KIST in order to learn about contract research system and to obtain advanced knowledge in the industrial technology fields. Other training programs included were : Various kinds of overseas training for researchers; junior research staff were sent to local universities for advanced degrees; and various conferences and seminars were held wherein senior staff, researchers and administrators as well, participated. In addition, a sabbatical leave system which would allow principal researchers to take a one year leave for every three years of continuous service was introduced at KIST (although its actual utility was very limited). They were also allowed foreign travel in relation to their projects and participation in professional meetings abroad. Access to foreign traveling was certainly a "privilege" many local people envied given Korea's tight foreign currency situation as well as highly restrictive passport regulations during the 1960s and 1970s.

The exceptionally generous material benefits the returning scientists and engineers received should not, however, be viewed purely from economic or material perspectives. In fact, material compensation was not an important factor for returnees in their home-coming decision-making.[59] At the deeper level, it is a reflection of a certain ideology, newly perceived by government--a recognition of the value of professionalism, and scientific knowledge as a new resource of power. Its public message was clear in defining the proper place of this new, unprecedented social group in Korea's socio-political strata. The generous package of "perks," and salary, together with research autonomy as discussed in the previous section, certainly allowed repatriated KIST researchers to quickly rise as a new power group in society. And the Korean government's intervention and full-fledged support were crucial in this process.

International networking with scientific personnel and technical information is important for the survival of research organizations in developing countries.[60] RBD is an important form of technology transfer which will provide Korea, for example, with a linkage to the world technical community as well as providing access to the latest technical information. Through repatriation, overseas training programs, its "sister-institute" relationship with BMI, and organizational development of Korean science associations abroad, KIST (as well as Korea) attempted to maximize this form of technology transfer. KIST's sabatical system was not fully utilized (as of the end of 1975, only three researchers took advantage of such system). Most researchers said that they were too much preoccupied with ongoing research projects and could hardly take a long time off from their laboratories. Instead, researchers made frequent business trips to foreign countries in relation to their research projects, and to participate in international conferences or seminars, etc. Nevertheless, the KIST sabbatical system, at least its intention, reveals how seriously the institute is concerned with not only welfare of senior researchers but also its linkage with the world community as a way to gain access to necessary technical information.

Scientists and Presidential Power

What then is the nature of KIST's power in the government and how is it related to the political power map of Korea in the 1960s? Perhaps, a special tie between KIST and President Park seems to explain it. In dealing with the Korean government, KIST management had a direct communication channel with President Park without going through formal bureaucratic channels. Although three ministries, EPB, MTI, and MOST were directly involved in KIST affairs by sending their deputy ministers to the KIST BOT, and even though EPB and MOST in particular were deeply involved in budgeting matters, KIST often contacted the Blue House directly whenever necessary. Park's support strengthened the power of KIST scientists on the one hand, and helped to protect KIST from potential government interference on the other. In fact, there was a strong personal linkage between Choi and President Park. Unlike the usual communication method in Korean politics wherein the President was contacted through his secretaries in the Blue House, Choi often had accesses to direct communication with the President and he maximized this opportunity.[61] However, the Choi-Park linkage was not based on purely personal interest (i. e., "primary group" politics or corruption, etc.). Rather, it was out of functional as well as political necessity. They both viewed S & T as a necessary tool for Korea's industrialization, and they viewed each other as political tools to maximize mutual interests---a symbiotic relationship which is an important element of bureaucratic-authoritarianism. From Park's point of view, KIST would function to accomplish his lifetime goal of industrialization. During the 1973 New Year's Press Conference President Park said:

> The growth of the heavy and chemical industries and $10 billion in exports will be possible only if the people pursue scientific and technological development. Regardless of sex, age or educational level, all of us must learn a skill so that our nation can grow rapidly.62

In the eyes of Choi, the top political leader's support was of vital importance to the development of S & T as he noted:

> Most important of all is the positive involvement of the chief executive of a nation, particularly in a developing country, in the development of science and technology. It is essential if we are to develop science and technology and apply them efficiently to development. Without such support, it would be difficult, if not impossible, to accomplish the planned role of science and technology. ...Korea is most fortunate in that there is enlightened understanding of and unqualified support and campaigning for science and technology by its President.63

However, President Park's favoritism toward KIST was costly to some members of his own bureaucracy, and normal bureaucratic procedures or political process were often sacrificed as exemplified in the case of AAKIST. This argument may be strengthened by another example drawn from an episode which took place during the KIST site selection process.

Selection of the site for KIST was a major concern for the KIST-building project. Specific criteria were set up such as: Location in the vicinity of Seoul to provide easy access to KIST's potential clients; space (an optimum size of 40 acres); easy access to social infrastructure such as water, sewage and electricity; and proximity to Kimpo Airport (Seoul's main airport for both international and domestic flights). Even an aesthetic appeal for natural beauty was considered by the BMI study on the grounds that "realizing...that the research facility will probably become an item of national pride and prestige, it should be so situated that its surroundings, both natural and man-made, are in keeping with the dignity, significance and purpose of the organization."[64]

In search of the site, KIST top managers carefully reviewed seventeen locations across the nation and finally selected two sites in the vicinity of Seoul as the most favorable sites: The boundary of the Forest Research Station (FRS) in Hong Nung as the first choice, and Donggoo Nung, as an alternate. The Hong Nung site was in fact considered by both EPB and BMI as the most favorable site from the beginning, for it met most of the criteria set by the BMI feasibility study report. In addition, KIST's president insisted on the "first choice" and lobbied for it. However, the use of the FRS land for KIST was extremely difficult due to the strong opposition by the Ministry of Agriculture and Fisheries (MAF), the administrative agencies of FRS. FRS, built in the Japanese colonial era, has been serving as the central forest research institute of the nation, and its unwillingness to yield land to KIST was quite understandable. Especially, the head of the Rural

Development Agency (RDA) which runs FRS furiously opposed the idea that its forest experiment land should be used for KIST. His opposition was so strong that even the Deputy Prime Minister (Head of EPB), who has budgetary control power over RDA, could not do much.[65]

The confrontation between EPB and MAF invited intervention from the Blue House. Chun Sang-Kun (ex-EPB official) recalls that one day he received a phone call from President Park's senior secretary to come to the Blue House immediately to report on the progress of KIST's site selection. As soon as he arrived at the Blue House, President Park asked what was wrong in the KIST's site selection matter. When President Park heard about the conflict between EPB and MAF, he himself lifted a phone and asked his switchboard to get the MAF minister on the line. When the minister was on the line, he instructed the minister to come to see him right away accompanied by the head of RDA. He then instructed his secretary to have KIST's president and the Seoul city mayor come to the Blue House immediately. Within ten minutes or so all those called upon arrived at the Blue House. President Park then led the group, along with his chief secretary, to the FRS in Hong Nung.

Surrounding FRS was a slum area filled with illegal shacks and with improper water supply and sewage system. The road in the FRS area was so narrow that it barely allowed one lane traffic. The president's car slowly drove around the boundaries of FRS and when it reached deep in the forest, President Park stopped the car and asked everybody to get out. He then asked Chun "how much do you need?" Chun replied that "about 50,000 - 60,000 pyung is enough."[66] President Park, looking at the head of RDA with smile, then said to Chun "oh yeh? O. K. ...but don't be too greedy and don't cut too many of FRS's fine trees!" While talking, President Park pointed out certain areas and drew a rough boundary which would belong to KIST. He then looked at the Seoul city mayor and asked "how come the road around here is so narrow and bad? Is the water supply system sufficient here?"[67] He also instructed the Minister of Construction (MOC), who was also on the site, to do his best to help in KIST's construction. This is how KIST obtained the land in Hong Nung, often cited as perhaps the best piece of land available in the vicinity of Seoul. After President Park's decision was made on the spot, the presidential chief secretary asked the ministers of MAF and MOC to process the paper work necessary for KIST to legally own the land. When the land was measured, it turned out to be 79,412 pyung (62 acres), at least 30% bigger than what KIST (and EPB) wished. KIST also purchased 3,502 pyung (3 acres) of privately-owned nearby land later in 1967 and the total land size became 82,644 pyung (65 acres).[68]

The land selection process is very illustrative of presidential power, and the non-interest group based top-down decision-making structure in the government. Nor was pork barrel politics found. It informs us of the relationship between KIST scientists and President Park. If normal bureaucratic procedures were sought without presidential intervention, it could have been very difficult, if not impossible, for KIST to obtain the land. Likewise, KIST's dealings with the Korean government often transcended normal bureaucratic procedures undoubtedly strengthening KIST's voice in Korean politics. This intimate and direct pattern of communication between KIST (Choi) and President Park continued. President Park, for example, called Choi to the Blue House literally every day to hear about construction progress. And the President would often visit KIST without warning throughout the construction period (some remember that his visit was as frequent as once a week!) and such abrupt visits continued into the 1970s.[69]

Contrary to FRS, RDA and MAF who vocally opposed KIST's site-selection in Hong Nung, there seemed to be no organized voices from the residents in the neighborhood. Perhaps, the poverty stricken area's residents were simply happy when they heard that government power and authority had finally reached their area. Certainly, the residents benefited from KIST by receiving better streets and improved electric systems, etc. However, the residential area adjacent to the KIST site remained one of the poorest areas in Seoul. The two communities (KIST and the poor neighbors) do not seem to have much interaction, nor any common interests. Lack of commonality has prevailed.[70]

KIST & Industry: Linkage-Building.

This section inquires about what important survival strategies KIST has adopted to link itself to its clients, particularly local industry.

KIST Organization and Industrial Need

Perhaps, the most aggressive marketing strategy KIST took toward industry was the conduct of the "Technical Economic Survey of Korean Industries" prcject. The purpose of the project was to collect basic data about local industry thereby developing a KIST organization reflective of local needs.[71] The project not only attempted to detect what local industry wants but also the survey was used to develop the scope and direction of the KIST organization during its initial period (i. e., research cope, recruitment of personnel, research facility, and financial requirements).

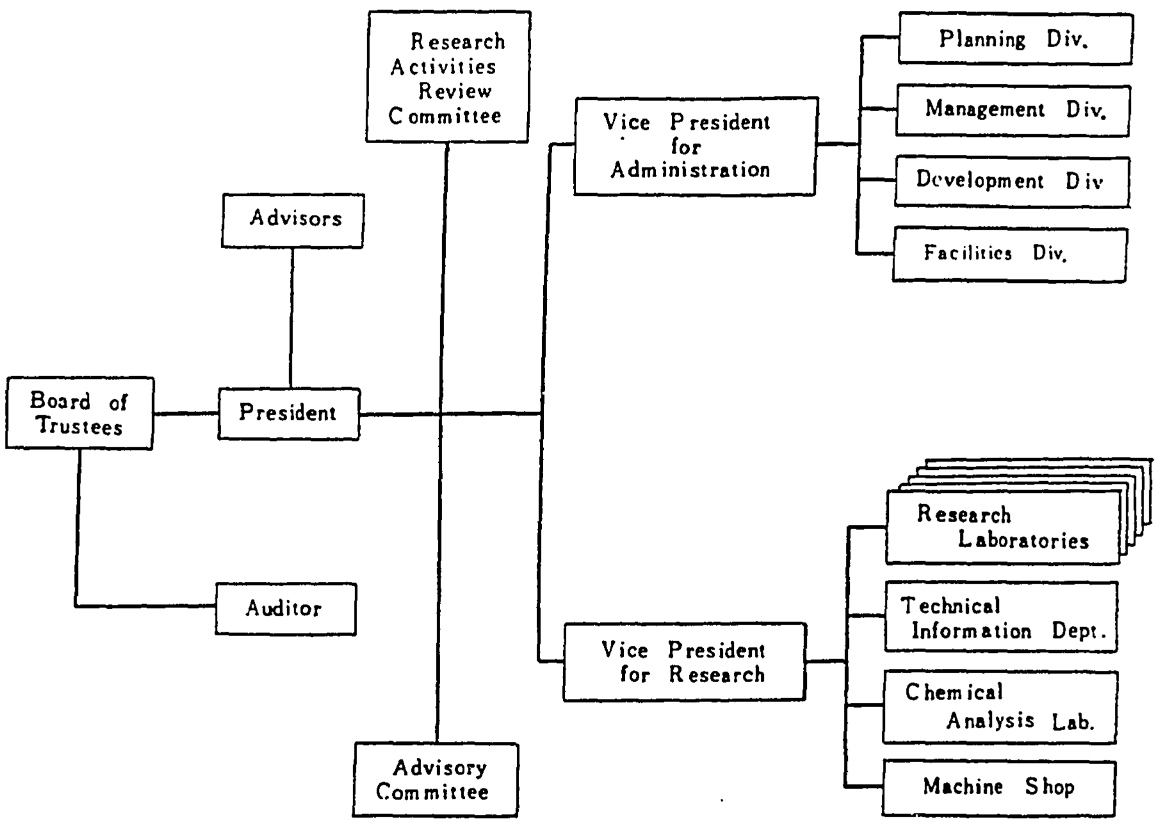
The project, conducted by a joint team of specialists from both countries (57 Koreans from KIST, local universities, industries and government offices, and 23 from BMI on the U. S. side), lasted for a 10 month period from late 1966 to mid 1967. Surveyed were about six hundred firms across the nation in 17 industrial fields through on-site visits to industrial locations, government offices, universities, and various other related institutes. As a result of these industrial surveys, it was concluded to structure the Institute initially to include the following conventional technical subject areas: Metallurgy and materials science, electronics chemistry and chemical engineering, mechanical engineering, techno-economics, and food technology. Additionally, technical subject areas were to be well supported through services such as computers, a machine shop, pilot plant fabrication facilities, materials testing labs, and extensive technical library, chemical analytic facilities, etc. Following the determination of its areas of research, the Institute began its research planning which included the selection of research themes, inducement of research staff, calculation of fund requirements, and selection of research equipment. In other words, the organizational design for KIST was not undertaken until an in-depth understanding of the "market" (industry) it was intended to serve and a comprehensive and detailed view of the market's needs were obtained.

The first organizational chart of KIST was developed in 1966 in a simple form as Figure 4.2 shows. It had soon grown into a highly complicated one by 1970 when KIST operations were in full swing (Figure 4.3). These organizational changes were KIST's attempt to adapt itself to the changing needs of its environment. During the 1966

Figure 4. 2

KIST's Organization Chart (1966)

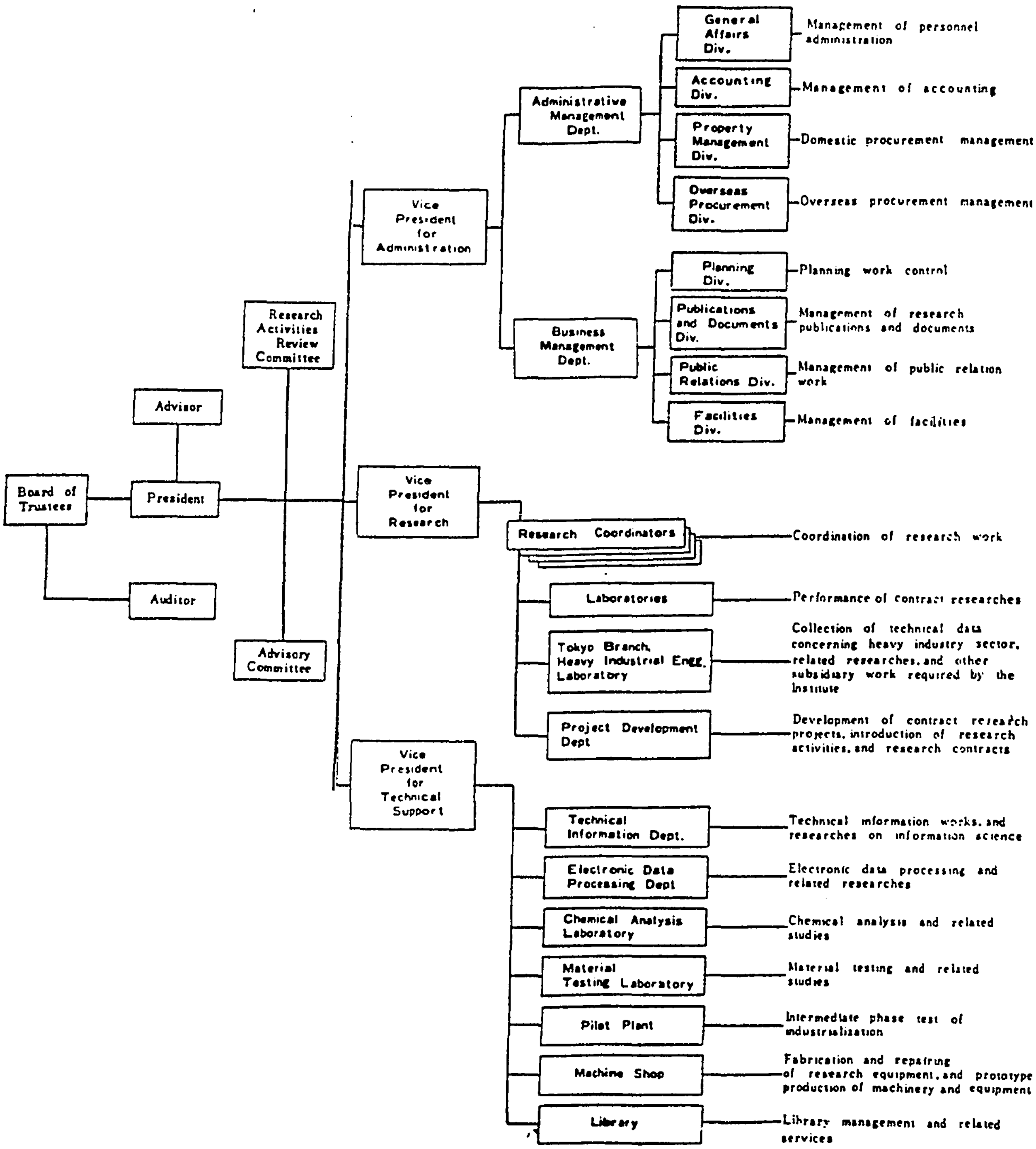
as of July 1966



Source: KIST, The Establishment of KIST, p. 47.

Figure 4.3

KIST Organization Chart & Duty Assignment (1970)



Source: KIST, Establishment of KIST, pp. 50-55 combined.

and 1970 periods, for example, KIST changed its Organization Regulations six times to expand its R & D capabilities (both in laboratory work and its management); to empower KIST's president in the management of the Institute (i. e., autonomy in the restructuring its organization) free from BOT interference; and more importantly, to support the Korean government's industrial policies.[72] The creation of the Tokyo Branch, and the Heavy Industrial Engineering Laboratory (Figure 4.3) is a good example of KIST's efforts to support itself in Korea's forthcoming Third Five-Year Economic Development Plan (1972-1976) which emphasized heavy and chemical industries as the core of the industrialization strategy.

A specialist from BMI who served as a project manager for the establishment of KIST evaluates the significance of the TESKI survey in following terms.

> Not only did this survey (TESKIP) serve to provide the needed information on which to base the technical scope of KIST, it also provided the initial 'stock-in-trade' for the techno-economic section of the Institute, which was created to act not only as a source of techno-economic research services to sponsors, but also as a 'connecting link' and means of interpretation between sectarian industry and the scientists and engineers being assembled as staff for the Institute.73

KIST's efforts to build a strong KIST-industry linkage are further found in many aspects of its management. From an organizational point of view, the creation of the Project Development Department (PDD) in 1967 (Figure 4.3), and the "unit laboratory research management system" KIST adopted are interesting to note. PDD (Figure 4.3) functions as a liaison between its clients and the institute by "selling scientific research concepts to industry and by helping industry to formulate the questions to ask the institute."[74] Typically, PDD's involvement in the project development process is as follows as one of my interviewees (a PDD manager) revealed:

> After laboratories (KIST) bring in the prospective sponsors of projects to PDD, we (PDD) then get involved to do the necessary paper work for a research contract. ...about 80% of all of the prospective KIST project sponsors came to KIST through its laboratories and 10% of them came to PDD directly to develop projects. In the former cases, the success rate for actual project development is high whereas in the latter cases the rate is only about 10%. The main offices at KIST which function as the "window" to industry are its laboratories, top management offices, and the Public Relations Division of KIST.[75]

PDD's function in the initiation of research project development is rather limited. But as the central office for research management, PDD performs such important functions as a coordinator between the KIST laboratory and its clients as well as a trouble shooter in the cause of conflict of interest which may arise during the contract period. It also provides or arranges necessary legal, financial and other administrative aid to clients. In particular, as a manager of the government's block grant for R & D and KIST endowment funds, PDD itself sponsors and enters into research contracts involving various KIST laboratories and industrial firms. In addition, it provides

KIST's top management and its laboratories with up to date information about government's industrial policies, business trends in industry which are important in decision-making about the future direction of KIST research.

The KIST research management system is based on independent laboratories of speciality as basic organizational units. Headed by a Principal Investigator, the operation of each laboratory is conducted according to "a cost accounting system" designed to "gauge input as compared with performance, including logging use rates on equipment, space, and utilities."[76] Principal investigators were given maximum autonomy without restraints from outsiders in such activities as managing research expenses, and staffing. In return, they assume responsibilities for the results. The research laboratories in the KIST organizational structure were not permanent, but flexible reflecting the demand-supply formula (i. e., when there is no research project or no qualified principal investigator, the laboratory may be closed).

Noteworthy is that the unit laboratory research system has not only empowered heads of each research laboratory hoping for maximum research results, but it has unintentionally resulted in forcing them to become a salesmen for research projects. Heads of each laboratory, under strenuous pressure for financial independence, therefore, have tended to spend much time looking for project sponsors. And the kind of research projects performed at KIST therefore have tended, to some observers, to be "money-making-oriented" for the survival of their laboratories rather than the general interest of KIST.[77] Some of my interviewees even diagnosed that the root of this kind of problem stems from the very philosophical principle of KIST's management of "independence and autonomy from government and in return no financial support from government for KIST's annual operation expenditures other than government's endowment fund" for which Choi and other KIST scientists in its early institutionalization period have fought so much. And they further wondered "didn't KIST cut its own throat?"[78] This is an important issue which will receive further analysis in Chapter five.

In spite of such a negative view, however, the unit laboratory management system on the other hand, demonstrates to us how aggressively KIST has attempted to link itself to local industry. From an organizational perspective of Korean public administration, the KIST approach is also interesting. Despite the fact that most national laboratories in developing societies replicate formal organizational structures of "modern" states, they were often criticized for their "formalism" and "malfunctioning." One of their most serious problems is identified as a weak linkage with the needs of the local society. From this organizational stand point, KIST's approach to industry, at least at the intentional level and in its early phase of operation, seems to be an important factor for its viability.[79]

Marketing Principles

In such an environment like Korea in the 1960s wherein such concepts as "industrial R & D," "contract research" were hardly understood, the question of how to approach its clients was of paramount concern to KIST's management. The most significant approach KIST's builders adopted was to define the institute as a contract research Institute thereby inducing industry's involvement from a business perspective as Choi notes:

> While it was reckoned that it would be almost impossible to expect industry to commission contract research in sufficient volume, it was also thought crucial to inculcate the concept of contract research to induce industry's involvement by attracting financial commitments on the one hand and by obligating research workers on the other to commit themselves to producing something relevant to industry's needs by their being supported financially by industry.[80]

In addition, KIST stressed the following aspects in its management which represent the philosophical and behavioral principles of KIST's management in its dealings with industry. First of all, how to build public confidence and credit was a deep concern. The KIST approach to this issue was to "insure" industry to be aware of KIST's value via the "demonstration effect" of the first few projects KIST would undertake.[81] The system of techno-economic appraisal of each proposed project was devised as a means to insure industry the probability of KIST's success.

Second was the emphasis of "responsibility" on the part of KIST. As a contract research institute, KIST experienced numerous project offers from local industries to provide technical assistance to develop certain products already available in competitive industrial firms. KIST's position toward such demands has been consistently firm and no such projects were undertaken at KIST regardless of its economic value (i. e., profit). In fact, how to deal with the "conflict of interests" among local firms was one of the most difficult tasks for KIST's top managers to handle.[82]

KIST's emphasis on the responsibility issue can be also found in many other aspects of its management. The Chemical Analysis Laboratory (Figure 4.2 & 4.3), for example, has been praised by KIST's top management for its "value-neutral" and "confirmation-oriented" laboratory work (i. e., laboratory orders will be tested more than once by different technicians to verify the test results) which undoubtedly contributed in building a good public image as a "reliable" institution.[83] The KIST managers and researchers also received special training at BMI on the contract research management covering technical and legal issues such as the "nuts and bolts in contract documentation and project report writing," "patent management," and "how to use lawyers for consultation?", etc. As of 1971 a total of 38 researchers had received such training on average for a four month period.

Such training may look trivial, however, it was very important to KIST in the Korean context of the 1960s as the following episode may explain. The first sponsor of KIST's contract research was a friend of the project leader, Hahn, Sang-Joon (who later became the third KIST president). As KIST researchers and the sponsoring company reached an agreement for contract research, the company president handed over to KIST personnel the deposit money for the contract. When the KIST staff were preparing for the receipt, the company president interrupted and said "What's that? We don't need such things between us! Just keep it (money)!"[84] This incident reveals Korea's business culture of the 1960s (which still is true to a certain extent) in which personal ties (rather than law-based) functioned as the most important factor in business transactions. In such a culture, legal actions have been perceived as the last avenue to take in human as well as business transactions in contrast to the Anglo-American perception of law as the first step in opening up a new business relationship. As such, KIST has faced social pressure to perform the role as a change agent in society, in addition to its own manifest function as an R & D center. Further discussion on this issue will continue in the following chapters.

Third, KIST's top management has stressed that its researchers "always discuss with entrepreneurs"[85] during the development or working stages of research projects. This client-oriented management approach, together with those aforementioned, indicates that KIST has attempted not only to be a "center of excellence" for the nation but also a "center of relevance" in its environment.

Summary & Conclusion

For successful implementation, Pressman and Wildavsky argue that "implementation should not be divorced from policy...and designers of policy (must) consider direct means for achieving their ends."[86] The institutionalization process of KIST reveals that financial, legal, and other administrative supports from the government were provided on a continued, and timely basis. The KIST case also shows that the Korean government provided a package of policies targeting both KIST and its clients. "Explicit" technology policies included policies to help KIST directly as a target group (government-research linkage). Parallel policies have also been pursued to help industry (government-production linkage), hoping it will utilize KIST (research-production linkage). From the perspective of Sabato's triangular model of explicit technology policy (as discussed in Chapter two), the Korean government took the right approach in the beginning. Government support and its approach were crucial factors in making the KIST-building policy-decision a success. These ingredients, however, may be of basic necessity for any organization to successfully translate policy goals into actions. What makes the KIST case different from conventional implementation studies (in the Liberal-Pluralism model), however, is the magnitude of political support from the government, and the capacity of presidential power resident in Korea's political system.

The government's involvement during the early period of KIST's operation can be characterized as follows. First, the Korean government took an unprecedented initiative and played a leading role in S & T affairs. For example, the government's policies toward industry (i. e., tax benefits on R & D expenditures, etc.) were solely government initiated policy decisions without industry pressure.

Second, the KIST case clearly demonstrates the magnitude of presidential power. Without President Park's intervention, KIST would not have been given the autonomy and managerial independence from the government authority. Park's patronage and supports were crucial, especially when conflicts of interests among actors arose. If Korea's National Assembly had an equal weight of power comparable to that of the presidency, and the "checks and balances" were in order, KIST might not have enjoyed the kind of autonomy granted under Park's political leadership.

Third, as in the decision-making phase discussed in the previous chapter President Park's involvement was continued throughout the institutionalization process of KIST. Like other policy areas in Korea, the KIST case confirms the President playing multiple roles as a policy agenda-builder, policy-maker, and as an important implementer. In this president-centered policy processes, normal bureaucratic procedures and political processes could often be ignored. To many observers who view "managing the unmanageable or vice versa" as characteristic of Korean politics and public administration, President Park's intervention in policy processes was nothing unusual. The President's interference in the KIST site selection process is an excellent example of how "the unmanageable was managed," to the detriment of the bureaucracy.

Fourth, President Park played a cardinal role in empowering KIST scientists. KIST's scientists had an organized voice when their interests were in jeopardy as noted in the AAKIST case. The history of KIST for the last two and a half decades, however, confirms that the AAKIST case was rather a sporadic, exceptional event. KIST's gains (i. e., autonomy, government's continuous financial supports, wage reform, exceptional "perks" to reverse brain drainees, etc.) were not the outcomes of KIST's "bargaining" with different government interests (i. e., the National Assembly, bureaucracy). Rather, they were by and large the result of President Park's intervention, and his capacity for power, allowed in the particular form of Korea's political system.

The KIST case under Park's paternalism is significant, for power-holders attempted to break the bureaucratic control and anti-professionalism so characteristic of management of public R & D in Korea. Certainly, Park's intervention empowered KIST researchers. However, newly rising technocratic power did not yet have the strong footing of an autonomous interest group in a pluralist political system. Its position was state-endorsed. During the Park regime, the Korean government utilized a "carrot and stick" approach in dealing with technocrats. While a great package of benefits were offered employees of KIST, under the Korean government's Labor Dispute Adjustment Law which banned organized labor activities in the "strategically important" socio-economic institutions such as KIST, have not been allowed to unionize.[87] The merger and separation of KIST with/from KAIST in the 1980s also explain the limitations of KIST's scientists power as an autonomous special interest group in Korea's political system.

Empowering scientists was functionally necessary for the nation's industrialization goal, as well as for solving Park's political legitimacy troubles. At the structural level, it was also necessary to strengthen the presidency. In other words, KIST scientists' technocratic power is an outcome, and also an important element of, bureaucratic-authoritarianism. Empowering KIST scientists was non-threatening to the status quo of his regime's power structure, for technocratic power stands below the real power elite (military junta) in Korea's power pyramid. KIST scientists' self-image as being "politically-neutral" people who "do not know or do not want to know anything about politics"[88] was perfect for building strong symbiosis--an important element of bureaucratic-authoritarianism.

Another important aspect of KIST's relationship with the Korean government is that the relationship is more or less based on personal linkage between Choi and President Park. Again, this personal linkage was out of functional necessity, and was conditionally available depending upon how the top executive of the nation valued KIST. As the political value of KIST dropped during the Chun and Roh regimes, KIST's power stance was weakened.

The involvement of American experts (i. e., BMI and USAID officials) was also important. Their involvement was mainly technical and financial in nature. However, their support was important for KIST's top managers in obtaining autonomy from the interference of government authority and from KIST's BOT. Unlike the highly criticized negative view of transnational politics effected by American foreign aid and other socio-economic institutions, USAID and BMI have played limited roles (basically technical and financial) in

KIST activities throughout its history.

Analysis of the KIST-industry linkage in this chapter has been, however, limited largely to the early period of KIST's operation. In the following chapter we will further inquire into this issue by asking "how has this aggressive effort in KIST-industry linkage-building continued as KIST fully engaged in R & D?" Specifically, the analysis will be centered on "what sorts of R & D have been actually performed by KIST and why?"

Notes

1. Pressman Wildavsky, p. xv.

2. Ripley & Franklin, pp. 219-220. Also refer to Bardach; Michael Lipsky, "Standing the Study of Public Policy Implementation on Its Head," in Walter D. Burnham & Martha W. Weinberg, eds., American Politics & Public Policy, (Cambridge, Mass.: MIT Press, 1978); and literature listed in endnote number 1, Chapter two.

3. KIST, The Establishment of KIST, (Seoul: KIST, Feb. 2, 1971), pp. 44-46.

4. The scope of BOT's power ranged from the approval of the annual operating programs and budget, selection and dismissal of key officers at KIST, decision-making in such areas as the management of KIST's property, assets, loans, establishment of branch laboratories and offices, and so forth. Ibid., pp. 18-19.

5. An interview with a MOST official during my field study (1981).

6. Interview with Dr. Choi Hyung-Sup on February 12, 1981. Also refer to Donald D. Evans, "The Korea Institute of Science & Technology: Cases A Through E," Mimeo, pp. 19-20.

7. Evans, ibid., p. 33.

8. Interviews with Dr. Choi Hyung-Sup (February 26, 1981) and Dr. Hahn Sang-Joon (April 10, 1981).

9. However, his favoritism also evoked jealousy among members of his own bureaucracy and S & T community, which some believe has contributed to the weakening of KIST power during the Chun regime.

10. S. K. Jeon, p. 93.

11. KIST (1971), p. 19.

12. S. K. Jeon, p. 93.

13. Interview with Mr. Hyun Won-Bok, Spokesman, The Seoul Science Park on June 11, 1981 & ibid.

14. Ibid.

15. Ibid.

16. S. K. Jeon, p. 94.

17. KIST (1971), p. 20. However, KIST became subject to government audit in the later 1970s.

18. My field study data (1981).

19. Evans, "Problems of the Interaction of Technological Institute with Industry," p. 69.

20. Other research institutions that KIST referred to as its model cases are BMI, the Commonwealth Scientific and Industrial Research Organization of Australia, the Max-Planck Institute of West Germany, and the Rikken Institute of Japan. Refer to KIST (1971), pp. 45-46.

21. S. K. Jeon, pp. 82-87.

22. Pressman & Wildavsky.

23. Interview with Dr. Choi Hyung-Sup on February 26, 1981 and my work experience at KIST.

24. Interview with Mr. Roger Earnst (March 23, 1983) in Honolulu, Hawaii.

25. As a result of these measures, 79 industrial firms spent a total of US$7.7 million in 1974 for the development of industrial technology, and as of June 1975, 45 companies had allocated US$5.55 million in spite of the economic slowdown. Refer to H. Choi, S & T Development for Industrialization in Korea, p. 43 & 60 (table c).

26. KIST, op. cit., p. 20.

27. E. E. Slowter, J. L. Gray, W. J. Harris & D. D. Evans, Report on the Establishment and Organization of a Korean Institute of Industrial Technology and Applied Science to US Agency & International Development (Columbus, Ohio: BMI, December 15, 1965), pp. 43-44.

28. Even in the U. S., BMI's experience reveals that it took several years until the contract research system worked.

29. KIST information (KIST, The Establishment of KIST, pp. 53-54) about financial matters used figures both in won and dollars but failed to note exact exchange rates

between the two currencies. Some figures show the exchange rate was $1=W300 whereas other figures are calculated based on $1=W260.37, and so on. These seem to reflect the fluctuation of exchange rates during the 1966-1970 period. When applying $1=W300 exchange rate, W7,449 million is equivalent to $24.83 million. However, USAID sources reveal that KIST-building was a $24 million project (refer to Hentges (1975), p. 95).

30. According to another KIST document, KIST received a total of $8,313,000 from the American government (including AID loan) as of December, 1975. See, KIST, Hankuk Kwahak Kisul Yonkuso Ship Nyun Sa (Ten Year History of Korea Institute of Science & Technology) (Seoul: KIST, 1977), p. 98, Table 13.

31. KIST, ibid., p. 55.

32. Evans, "The Korea Institute of Science & Technology: Cases A through E," pp. 9 - 10.

33. Hentges (1975), p. 96.

34. Different calendar fiscal year systems (it begins in January in Korea), for example, complicated the funding schedule. Additionally, ordering construction materials/scientific equipment from U. S. companies took a long time because those companies gave priority to Vietnam war-related orders. Refer to KIST, Hankuk Kwahak Kisul Yonkuso Ui Kunsul (Construction of KIST, KIST History Series Vol. 2), Ch. 3.

35. Interview with Mr. Roger Ernst (1983).

36. Hahn Yong-won, Chang Kun (The Creation of the Army), (Seoul, Korea: Park Young Sa, 1984), pp. 218-262; Jones and Sakong, p. 161.; and The Hankuk Ilbo (The Hankuk Daily Newspaper), Seattle edition, March 28, 1991.

37. According to my field study, he was not promoted to a higher level in the Army later on and retired as a one star general.

38. During the Chun regime, however, a number of Korean Military Academy graduates were appointed to high-ranking posts in the government such as minister of MOST and a high-level secretarial post in the Blue House in charge of S & T. Also, Dr. Lee Chong-Oh, a military academy graduate and KAIS professor served as KIST's president and MOST minister. Lee's case is

certainly an example of Chun's patronage politics. But these cases need to be carefully monitored before we perceive them as systematic.

39. KIST, Construction of KIST, p. 33.

40. Bang-Soon L. Yoon, "Reverse Brain Drain in South Korea: State-led Model," Studies in Comparative International Development, Vol. 27, No.1 (1992); Harriet Hentges, "The Institute of Science & Technology: A Case Study in Repatriation," IDR/Focus (1974/3), pp. 27-20; Hentges (1975); and Heather L. Ruth, "Korea" in Praeger Special Studies in International Economics and Development, The International Migration of High-Level Manpower (N. Y.: Praeger Publishers, 1970).

41. MOST, '89 Science & Technology Annual, p. 247; MOST, Kwahak Sisul Hangjung 20 Yunsa (The 20 Year History of the Science & Technology Administration) (Seoul: MOST, 1987), P. 147; and The Korea Science & Engineering Foundation (KOSEF), "Repatriation of High-level Manpower from Abroad," Mimeo (Seoul: KOSEF, 1990).

42. KOSEF data (1990).

43. Ibid.

44. Hentges (1975), p. 117.

45. Ibid.

46. In fact, those who were invited to an initial personal interview were requested to submit research plans to KIST along with a manpower projection needed in the research, and those whose expertise as well as research interest fit into KIST research scope were invited for a second personal interview. Eighteen applicants were finally selected. However, although the technical economic survey results served as the principal guideline in selecting researchers, some adjustment was made when KIST was unable to recruit personnel in particular fields.

47. Choi Hyung-Sup, Kaebal Dosangkuk Ui Kongup Yonku (Industrial Research of Developing Countries) (Seoul: Il Cho Kak, 1976), pp. 165-170; and H. Choi (1980), pp. 253-254.

48. Hentges (1975), p. 123.

49. Ibid.

50. KIST, Hyunwhang Kwa Chunrak (The State-of-the-Art and Strategy) (Seoul: KIST, 1880. 8), p. 17, and KOSEF data (1990). This figure includes repatriation at both KIST and KAIST, for the two organizations merged.

51. KIST brochure (1989), p. 4.

52. B. Yoon.

53. Typically, he would have a Ph.D. and five years of work experience beyond it. There was not a single female researcher with Ph.D. at KIST.

54. KIST, Ten Year History of KIST, p. 86.

55. Evans, "The Korea Institute of Science & Technology: Cases A through E.," p. 36.

56. B. Yoon.

57. Hentges (1975), pp. 170-171. In the 1970s, salaries of professors increased steadily at a rate faster than that of researchers at KIST and other government-endowed R & D institutions which remained fairly constant. By late 1980, average academic salaries were greater than those of researchers at public institutions, including KIST.

58. Howard E. McCurdy, Public Administration: A Synthesis (California: Benjamin/Cummings, 1977), p. 301.

59. My field research data (December, 1990) & Ruth.

60. James M. Utterback, "The Role of Applied Research Institutes in the Transfer of Technology in Latin America," World Development, Vol. 3. (Sept., 1975), pp. 667 - 668.

61. This practice has been somewhat changed after Choi left KIST to resume the new post at MOST. However, he revealed during my field study interview (1981) that he, as a Minister of MOST, continued to use this direct communication method.

62. Choi Hyung-Sup, "Notes for A Speech By Dr. Hyung-Sup Choi, Minister, Ministry of Science and Technology, Republic of Korea to the Management Seminar of the International Bank for Reconstruction and Development." (Washington, D. C. on February 26-28, 1973), p. 10.

63. Ibid., pp. 9-10.

64. Evans, "The Korea Institute of Science & Technology: Cases A through E."

65. S. K. Jeon, pp. 90-91.

66. One _pyung_ is equivalent to six by six foot.

67. S. K. Jeon, p. 92.

68. Ibid, pp. 92-93 & KIST, _Construction of KIST_, p. 5.

69. My own work experience at KIST.

70. In fact, the KIST compound had several tennis courts for its own employees with a night-light system which was exceptional by Korean standards of the 1960s wherein a shortage of electricity was a social problem. Such "luxury" apparently irritated the neighborhood and KIST management later regulated use of the tennis court at night.

71. KIST, _The Establishment of KIST_, p. 23.

72. Ibid., pp. 47-49.

73. Evans, "The Korea Institute of Science & Technology: Cases A through E," p. 4.

74. Choi Hyung-Sup, _Industrial Research in the Industrialization of LDCs_ (an article in Proceedings of a World Congress June 10-12, 1975 on the theme of "Educating Engineers for World Development" held in Estes Park, Colorado), p. 13.

75. Interview at KIST PDD on March 20, 1981.

76. Choi H., _Industrial Research in the Industrialization of a LDC_, p. 13.

77. My field study data (1980-1981) and my own work experience at KIST (1971-1976).

78. Ibid.

79. H. Lee (1972), p. 11.

80. H. Choi H., _Industrial Research in Industrialization of a LDC_, p. 13.

81. Interview with Dr. Choi Hyung-Sup (February 26, 1981). Also refer to his literature cited in this chapter.

82. Interview with Dr. Hahn Sang-Joon (April 10, 1981).

83. Ibid.

84. My field study data (1981).

85. Interview with Dr. Choi Hyung-Sup (February 26, 1981) & his literature.

86. Pressman & Wildavsky, p. 143.

87. Under the new labor policies of the Roh, Tae-Woo regime, employees at government-endowed public R & D institutions for the first time were allowed to unionize. In 1988, five hundred researchers at KAIST, for example, went on strike demanding a wage increase and improvement in personnel management. Labor union activities are quite active now. Refer to The Hankuk Ilbo (The Hankuk Daily Newspaper), San Francisco ed., May 28, 1988.

88. My field study data (1981).

CHAPTER FIVE

KIST's R & D PERFORMANCES AND IMPACTS

This chapter attempts to answer the following questions: a) what sorts of R & D have actually been performed by KIST; and b) what are their impacts? The analysis of KIST's R & D outputs will be done from two functional perspectives, manifest and spin-off effects. Specifically, the manifest function will be analyzed from the standpoint of KIST's R & D in relation to industrial technology development in Korea. The indirect, spin-off effects will be evaluated from such perspectives as what are the impacts of KIST's R & D on: The development of scientific personnel; the development of R & D infrastructure; the strengthening of technocratic power; and the building up of national confidence in domestic R & D.

Defining R & D and Its Measurement

R & D, which is often defined in terms of basic research, applied research, and development (i. e., NSF definition), assumes that such activities are value-neutral, universal or stereo-typical, and apolitical. Their outcomes are accordingly measured or evaluated in techno-economic terms. Neither the complication of international political economy (as evidenced by i. e., techno-nationalism or the current technological order), nor the particularities of a given country under investigation (i. e., technological level) are considered. When R & D is defined in such terms, R & D policy inputs and outputs are also measured in such a way that represents only scientific, engineering, and economic dimensions.[1] For example, the measurement of R & D inputs are the amount of R & D spending, and R & D personnel (i. e., scientists, engineers, administrative, and other supporting staff, etc.). R & D outputs are measured in terms of the number of discoveries, inventions, innovations, and overall technological drift.

Specifically, basic research output is measured by scientific discoveries, or other research activities such as feasibility studies and survey research. Bibliometric data (i. e., scientific publication and citation) is also an important indicator of basic research output. The possible output of applied research is invention, measured by patent, formulae, and so forth. The most successful result of development research (the improvements in products or process, or engineering refinement) may be technological innovation (the creation of new system or the introduction of new things to the market) measured by patents, sales of new products or new formulae, etc. Technological drift refers to activities to cope with minor problems in engineering, process, products, marketing, servicing, etc.[2] These measurements are widely accepted across the globe and successful R & D policy outputs mean more patents, innovations and so forth.

And yet, for a number of reasons, there are shortcomings when applying such a definition to the KIST case and we need to redefine R & D as well as its measurements. First, the conventional view which assumes R & D a universal activity is rather inappropriate, for each country has different levels of technological progress as well as different socio-political contexts. Unlike the technologically advanced countries such as the U. S. whose R & D is characterized as "creative research" (stress on the development of new products), Korea's R & D is basically "absorptive research" (emphasis on building up adaptive capacity of imported technologies developed elsewhere) although its ability to create some "emerging" or "new" technologies is not undermined.[3] Given Korea's technological context, the development of indigenous technologies (which is one of KIST's goals), therefore, refers to in most cases so-called "reverse engineering" of "mature" (old) technologies available in the industrialized countries, as my interviewee noted:

> (It means) the development of technology first in Korea, not necessarily first in the world. In other words, it is the development of import-substitution type of technology by imitating or slightly imitating technologies already available somewhere in the world.[4]

When KIST's R & D is conceptualized in such terms, the number of patents KIST has registered, especially in foreign countries, may not give us much information about KIST's research productivity although it will be partially useful in understanding KIST's R & D activities.

Korea's low technological level inevitably altered the meaning of R & D in the Korean context. KIST was expected by local society to extend its services to non-technical/ engineering fields which can hardly be counted as R & D by conventional wisdom. KIST president Hahn Sang-Joon recalled that

> It was necessary for KIST to perform commercial assessment of technologies before and after lab work is done. Market testing, not only technical testing, was an important part of KIST R & D demanded by local industry. At Korea's technological level, scaling up laboratory results to commercial production (i. e., pilot plant) was needed and it was inevitable for KIST to provide `turn-key' type technologies.5

As a matter of fact, pilot plants at KIST were built despite the opposition of AID officials who believed that such jobs should be done by industry, not by KIST.

Added to this situation of low technological level, there existed a poorly organized R & D system as well as little understanding about R & D both in the business and government. Naturally, a sort of public education was necessary for KIST to introduce such concepts as "R & D," "contract-research," "technology transfer," etc. Certainly, such services may not be precisely quantifiable, nor be recognized as a yardstick to measure R & D output in the literature. Furthermore, with a lack of alternative organization of high-level manpower in S & T which would function as technocracy or "think-tanks" in industrial policy-making in Korea's early industrialization period, KIST was expected to perform such roles. In fact, the social expectation of KIST was so high that KIST was not only expected to perform as a "center of excellence" in industrial R & D, but also a model agent of social change.[6] "Competence," "expert," and "Ph.Ds." are few examples of words attached to or equated with KIST in local society. This situation tells us that R & D in the Korean context of the 1960s and 1970s went beyond the conventional horizons of scientific, engineering, economic activities.

Included in this study as important evaluation criteria of KIST R & D then will be consulting and management assistance KIST might have provided to its clients, its role as think-tank, and other socio-political roles played in society.

Second, the conventional assumption of R & D as a purely internal activity of a given society is questionable. What has been raised as an important issue in the literature on technology transfer is the transnational dimension of R & D. Some view that technology transfer may work against local R & D due to its "substitution" function, TNC-controlled technology transfer systems, and the high centralization of R & D facilities and manpower by TNCs. Others view that technology transfer *per se* is not harmful as long as the importing country has local capacity to accumulate and "internalize" the acquired technology.[7] Regardless of whatever perspective is held, the suggestion is that R & D is transnational in character.[8] Also suggested in the literature is that R & D is not only a techno-economic activity but also a political activity: It is a matter of political choice (i. e., decision-making over appropriate technologies) and political power (i. e., bargaining power and management skills in negotiation, information about the technology market, retaining high level manpower, and ability to organize or develop R & D system). These perspectives further advance our thinking that R & D is a matter of "self-confidence," "self-respect," or national autonomy--whether or not indigenous people can do things by themselves with little or no interference from outsiders.

When R & D is conceptualized from such perspectives, the measurement of R & D policy outputs as the number of patents, innovations, and so forth seems to be insufficient. In addition to the aforementioned conventional criteria, therefore, KIST performances in this study will be also evaluated from: Consulting and management assistance provided to its clients in engineering and in the selection and bargaining phases of (i. e., on the terms of) technology transfer; KIST's role in RBD and S & T manpower development; the relationship between KIST and the development of an in-house R & D system at industrial firms and other think-tank type social organizations; KIST's role in policy-making; and even the implication of KIST performance in building national confidence and self-respect.

KIST's R & D Outputs & Their Utilization: Manifest Functions

Industry as Major Client

KIST research contracts are classified into different categories based upon sponsorship: government, industry and KIST's in-house research contracts.[9] Government-sponsored research contracts are comprised of "government contract," "package deal contracts," and "computer use rate." The "government contract" projects (G-Projects) are contracted with government agencies either in the form of grants or aiming at actual utilization of research results by the sponsoring government agencies. The "package deal contract" projects (E-projects) are endowment projects by government.[10]

Industry-sponsored research projects consist of "Industry contracts" (I-project), "Technical Service & Petty Contracts", "Computer Use Rate," and "International Projects." KIST's "In-house research contracts" are self-financed, self-conceived research projects which are considered strategically important for the institute but lacking outside sponsorship.[11]

Prior to the merger with KAIS, between January 1967 and August 1980, as Table 5.1 shows, KIST had a total of

Table 5.1

KIST Contract Research by Funding Source: 1967-1980.

as of 8. 31, 1980

Sponsor	# of Contracts (%)	Research Volume (%) (Unit: Million Won)
Government	455 (19.8%)	6,430.8 (13.6%)
Industry	1,344 (58.5%)	23,498.9 (49.6%)
Package Deal Contracts	497 (21.6%)	17,444.1 (36.8%)
Total	2,296 (100%)	47,373.9 (100%)

Source: KIST Project Development Department.

2,296 research contracts with Korean government and industry of which 1,344 projects (58.5%) were under industrial sponsorship. The total volume of contract research during the same period amounted to W47.4 billion of which about one half (49.6%) was industry-sponsored, and 50.4% was financed by government either in the form of G-Projects or E-Projects.

Since the merger, KIST's goal has been re-defined by the Korean government stressing "nation-oriented" research rather than pure industrial clientele-oriented ones. The government's rationale for such a shift derives from the grounds that inasmuch as local industry has acquired its own R & D capacity (i. e., mushrooming of private sector R & D centers as noted in the previous chapters) to conduct applied and development research, public R & D centers such as KIST no longer need to duplicate research which would "waste" scarce national R & D resources. Within such a re-orientation framework, beginning in 1982 the Korean government started to sponsor a new type of research project at KIST, so-called "national R & D projects." The national R & D projects are jointly carried out by industry, research institutes, and government to meet specific research objectives. Several categories of research comprise these projects which are, to quote from a KIST document, as follows:[12]

- National Project: R & D projects initiated by the government with 100% funding.
- Government-Industry Projects: R & D projects jointly financed by the government and industry. The government covers 70% of research cost for small industry, 50% for the research association of large industries and 30% for large industries.
- International Joint Project: R & D projects jointly promoted with foreign research laboratories.
- Object-Oriented Basic Research project: Research projects to cultivate the basic research capacities especially for the universities, with 100% funding from the government.
- Evaluation Project: Projects for the preliminary study, evaluation of accomplishments and analysis of research results for the above mentioned projects.

During the 1981-June, 1989 merger period, statistics on KIST's research outputs are blurred, for they include research done by the academic side of KAIST (faculties of ex-KAIS) in addition to those of the research side (ex-KIST researchers). Nonetheless, KIST statistics indicate an overall growth of R & D, and the continuation of industry's sponsorship of KIST R & D to a considerable level in the 1980s although it is not entirely comparable to that of the pre-merger period.

Table 5.2 shows the overall picture of KIST R & D between 1967 and 1989. When we analyze the major research contracts (excluding "computer use rate," "technical service and petty contracts," etc.) KIST had a total of 5,612 cases of contract research projects with Korean government and industry. The total volume of contract research during the same period amounted to W182.5 billion. These figures indicate that between 1967 and 1981, KIST experienced an average of 70% annual increase in the number of research contracts, although the growth rates fluctuated in the 1970s. KIST's research volume also steadily increased marking on average, 66% increase during the same period except in 1981 when the institute experienced a post-merger (with KAIS) adjustment. The research expenditure spent per researcher also dramatically increased from a mere W3 million (1967) to W26 million (1980), and to W39 million (1989).

Significant to note is the research contract with industry. Prior to the KIST-KAIS merger, in particular, local industry was KIST's major client. As Table 5.3 shows,

Table 5.2

KIST Research Contract 1967-1989[a]

Year	# of Contracts	Research Volume (Unit: Billion Won)	Research Expenditure per Researcher (Unit: Million Won)
1967	5	0.02	3
1968	42	0.07	4
1969	95	0.18	6
1970	152	0.46	11
1971	186	0.89	19
1972	160	1.71	29
1973	166	2.37	34
1974	203	2.79	23
1975	224	3.21	19
1976	251	3.53	20
1977	241	5.02	26
1978	203	7.01	30
1979	172	9.43	31
1980	178	11.18	26
1981	236	6.15	18
1982	135	8.54	23
1983	244	10.13	25
1984	275	13.12	32
1985	330	15.31	31
1986	415	19.14	40
1987	502	20.27	38
1988	624	22.78	37
1989b	573	19.15	39
Total	5,612	182.46	

Source: Lee Dal Hwan, "Adaptive Roles of the Government-Supported Research Institute and Its Indigenous R & D Performance-An Empirical Study by Analysis of KIST Research Performance," Ph.D. Diss. from KAIST, 1990, p. 67, Table 3-4.

a. Excludes research activities done by KIST's affiliated R & D institutions. Figures between 1981 and 1988 (KIST's merger period with KAIS), include researches done by faculty members of the KIST's academic side (KAIS).

b. Excludes researches done by KAIS faculties.

Table 5.3

KIST Research Contract by Funding Source: 1967-1989[a]

Year (Contract Volume, Unit: Billion Won)	Project by Sponsorship				
	Government			Industry	KIST's in-house Projects
	Endowment Projects	Nat'l R & D Projects			
		Nat'l Projects	Gov't-Industry Projects		
1967-1971 (W1.6)	34%	-	-	63%	3%
1972-1976 (W13.6)	17%	-	-	82%	1%
1977-1981 (W38.8)	35%	-	-	64%	1%
1982-1986 (W66.2)	9%	38%	28%	24%	-
1987 (W20.3)	5%	55%	20%	20%	-
1988 (W22.8)	4%	63%	19%	13%	1%
1989[b] (W19.2)	4%	61%	18%	16%	1%

Source: D. Lee, Figure 3-1 in p. 68 and KIST data (1989).

a. Figures during 1981-1988 include researches done by KAIS faculties.

b. Excludes KAIS faculties' research.

industry's sponsorship accounted for 63%, 82% and 64% of the total research volume during the three time periods between 1967 and 1981. During and after the merger (1982-1988 and 1989), pure industrial sponsorship dropped steeply to 24%, 20%, 13%, and 16% whereas government sponsorship became a dominant feature. However, since the "government-industry projects" are co-sponsored by government and industry, as noted earlier, industrial sponsorship during the 1982-1989 period accounted for nearly one half (48%) of the total KIST research volume. An in-depth analysis of KIST projects during the 1982-1989 period shows that the ratio between government sponsorship and industrial sponsorship dropped from 7.1:2.9 in 1982 to 5.4:4.6 in 1989.[13]

The above statistics indicate that KIST was quite successful in attracting local industry as its major client, particularly before the merger period (at least until the mid-1970s). In addition to KIST's credentials (i. e., researcher's high ambition and hard work), Korea's low level of technology also seemed to have allowed KIST to attract local industry. Certainly, KIST has enjoyed the comparative strength (i. e., high level manpower, and other resources) in Korea's R & D community whereas R & D capacities of local industry and universities were virtually non-existent in the 1960s and the early 1970s. In addition, Korea's low level of industrialization demanded rather simple, and mature technologies (in the industrialized countries' product life cycle), thus easy to duplicate in Korea. Yet, the quality of KIST's R & D should be further analyzed before arriving at a firm view on KIST performance in meeting its manifest goal.

The Nature of R & D

An overview of KIST's R & D by nature of work is presented in Table 5.4. Several features characterize KIST R & D over a period of time. First, from the outset of KIST operation, applied and development research have been the major components of KIST's R & D, far exceeding other types of research activities. This reflects KIST's top management principle which emphasized the "development" of technologies by indigenous effort rather than mere importation of ready-to-use technologies.[14] In the 1960s, simple and ad hoc crash technical problem-solving constituted a large portion of KIST's R & D. In the 1970s, higher level technical services were added aiming at cost reduction, productivity improvement, raw material development, improvement of imported technology and so forth. Since the mid 1970s, development research accounted for one half of the KIST contract research volume with an overall increase afterwards (percentage-wise). Between 1967 and 1989, development research comprised on average 67% of KIST's total contract volume, reaching 83% in 1989.

In the beginning, small-scale laboratory research

Table 5.4

An Overview of KIST R & D by Nature of Work

Unit in parenthesis: Billion Won

	'67-71	'72-'76	'77-'81	'82-'86	'87	'88	'89
	[a] (1.6)	(13.6)	(38.8)	(66.2)	(20.3)	(22.8)	(19.2)
Basic Res.	1% (0.02)	-	1% (0.39)	6% (3.97)	8% (1.62)	3% (0.68)	5% (0.96)
Applied Res.[b]	16% (0.26)	9% (1.23)	9% (3.49)	10% (6.62)	11% (2.23)	11% (2.51)	7% (1.34)
Development Res.[c]	37% (0.59)	49% (6.66)	51% (19.79)	72% (47.66)	70% (14.21)	80% (18.24)	83% (15.94)
Survey Res.	13% (0.20)	9% (1.23)	6% (2.33)	6% (3.97)	6% (1.22)	4% (0.91)	4% (0.77)
Techno-Economic Res.	6% (0.10)	4% (0.54)	1% (0.39)	-	-	-	-
Others[d]	27% (0.43)	29% (3.94)	32% (12.42)	6% (3.97)	5% (1.02)	2% (0.46)	1% (0.19)

Source: Primarily based on statistics presented in D. Lee, p. 107.

a. Research volume in billion Won.

b. Research on the i. e., improvement or modification of products.

c. Development of new technologies or processes.

d. Includes such as computer-related projects, laboratory testing fees, etc.

aiming at certain products in mind were prevalent, some of which were quite successfully commercialized later and received favorable citations for their innovation in the international market. Development of the TV remote-control technology which was later "stolen" by Japan's National Co.,[15] and the development of a pocket-size calculator (1971) are examples of such research. KIST was quite proud of such innovations for they were developed indigenously without importation of foreign technology. In the case of the pocket-size calculator, according to KIST, the product earned $10 million from export in 1975 alone and was cited as one of the best new products of the year in Consumer Reports in the U. S.[16]

It is important to note that KIST's research on electronic engineering literally pioneered the introduction of some leading edge electronic technologies in Korea, and laid the ground for future development of Korea's electronics industry (i. e., the semi-conductor industry). In the case of TV (both black and white, and color), which became a basic need item for every Korean household and Korea's major export item for over a decade, KIST's interests as well as production research preceded local industry although the latter took over later with commercial success.

Application of foreign technologies to develop new products or processes utilizing local resources was another type of development research. The development of technology to process red ginseng (1971) is a good example, which also promoted exports. The development of both process and manufacturing technologies for Freon (widely used refrigerant and aerosol propellant) is a major accomplishment in KIST's R & D in the area of chemistry and chemical engineering. The Freon project (first began in 1970 and continued into 1990 to develop a program to meet the environmental concern of ozone depletion) was, in fact, a magic wand which converted Korea's cheap natural resource into an expensive commodity.[17] Korea is one of the few countries in the world which possesses an abundant and high grade fluorspar ore, the chief raw material for Freon production. This raw material used to be exported at W12,000 per ton whereas Freon makes W500,000 per ton.[18] This particular product earned money from the import and export of the Freon, and also affected Korea's electrical and electronics industry. These industries entered into mass production of home appliances for both export and domestic consumption beginning in the 1970s. Perhaps a far more significant aspect of such type of research is found when we ask "if not local people (i. e., KIST), who would develop such local resource-based technology at all and how much would it cost if it is contracted out to an exogenous source (i. e., TNC)?"

The development of a new process to manufacture Ethambutol (medicine for tuberculosis and one of Korea's largest imported medicine items) in the early 1970s is another KIST's technical success[19]. As a matter of fact, import-substitution types of research at KIST laboratories in the early 1970s were highly successful in manufacturing new medicines and fertilizers. and served as a catalyst in the development of speciality chemistry in Korea. This issue will be further discussed in the next chapter.

The rising trend of development research indicates an accumulation of technological capacity by local industry over a period of time, however, local demand for KIST's technical consultation has also continued. During the 1967-1970 period, about one third of the KIST research earnings came from various kinds of technical assistance KIST had provided. The types of work carried out under this category of research were to solve industry's immediate technical problems arising, for instance, in the production line when a plant was imported from a foreign country and/or in the development of import-substitution industries. The proportion of such technical assistance has declined in the late 1970s whereas development research rose. This can be interpreted to mean that local industry has accumulated some technological capacity thus it now demanded other, advanced type of research from KIST. On the other hand, the expansion of the Korean economy _per se_ and the increasing number of firms in Korea showed a steady demand for technical assistance from KIST which resulted in the development of technical cooperative program between KIST and small and medium industries in 1973. By the end of 1978, about 100 small and medium-size firms (SMFs) received such technical services from KIST. Between 1982 and 1987, a total of 425 SMFs (on average 70.8 firms annually) became KIST's beneficiaries for technical assistance.[20] R & D capacities of the SMFs in Korea are extremely low, although statistics show a remarkable expansion of the SMFs' R & D investment since the mid 1980s. For instance, the number of in-house R & D institutions in SMFs has mushroomed, exceeding those of large corporations since 1988 (the ratio between the former and the latter is 56:44 in 1988 and 55:45 in 1989).[21] And yet, the hidden agenda of such expansion seems to stem from non-technical motivations (i. e., tax benefit). In terms of manpower capacity, for example, only thirty out of 11,450 Ph.Ds in science and engineering work in small firms in Korea.[22] Given infant R & D capacities of SMFs, KIST's services to local SMFs should be viewed positively. KIST's technical assistance to SMFs also indicates the wide spectrum research activities KIST is providing.

Second, in the beginning of KIST's operation, survey research and minor contracts in the "others" category accounted for over one third of KIST projects (40% during the 1967-1971 period and 38% during 1972-1981 period), but overall, the proportion of such research contracts declined as the institute evolved over a period of time, particularly in 1982. Especially, the relative significance of KIST's survey research has diminished as Table 5.4 shows. The decline of KIST's survey research does not necessarily mean that KIST has lost its role as a major think-tank in S & T in Korea. On the contrary, such a role has been reinforced through organizational reform. Further discussion on this issue appears later in this chapter.

Third, as shown in Table 5.4, techno-economic research (i. e., economic feasibility study of new product or process, technology management, etc.) has diminished in the 1980. This phenomenon explains the strengthened R & D capacities of local firms in the 1980s thus little demand for KIST's research in such fields.

Fourth, research in the "others" category in Table 5.4 has also dramatically declined in the 1980s. One of the major causes of this phenomenon is that KIST's computer science field, the most productive field at KIST in the 1970s (accounting for 26.6% of the total number of research project cases and 25.5% of the total research volume as of August, 1980)[23] was organizationally separated from KIST in 1982. The latest re-organization effort gave birth to the Systems Engineering Research Institute (SERI), a KIST-affiliated institute, in 1984. SERI's research contract volume during the 1982-1989 period amounted to a total of 49.12 billion Won.[24]

Fifth, basic research has never been a focal point of

KIST's R & D as reflected in Table 5.4. In the 1980s, however, the government's redefinition of KIST's goal moving it into the "national R & D" area drove KIST to expand the "goal-oriented" basic research area. This type of research will grow in the near future as Korea aspires to high-technology industries which require a continuous supply of new scientific knowledge as well as technological innovation. KIST researchers have also been active in the publication of research findings.

An analysis of KIST contracts by field is presented in Table 5.5. At a glance, the table shows that overall, the chemistry/chemical engineering fields, which account for on average 30.9% of research contracts between 1967-1989, are most productive, particularly beginning with the late 1970s. The metallurgy/material science fields mark the second most active fields in KIST's R & D (representing on average 23.4% of research contracts). A closer look reveals that KIST research was highly concentrated in the computer science field which is included in the "others" category in Table 5.5. Before the merger (1967-August, 1980 period), KIST's contract volume shows a significantly large portion of computer science projects accounting for 25.5% of the total. This share was soon increased to 27.1% (570 projects) of the total projects completed as of October 1980. When we analyze industry-sponsored contracts alone, computer science projects in 1979 represent 53%![25]

Table 5.5

KIST Research Contracts by Fields

	Chemistry/ Chemical Eng.	Food/ Bio- logy	Electric/ Electro- nics	Metallurgy/ Material Science	Mechanics	Others[a]
'67- '71 (W1.6)[b]	15%	8%	18%	10%	18%	31%
'72- '76 (W13.6)	19%	5%	14%	9%	23%	30%
'77- '81 (W38.7)	26%	7%	5%	11%	9%	42%
'67- '80[c] (W47.3)	24%	6.3%	8.8%	10.1%	11.4%	39.4%[d]
'82- '86 (W66.2)	32%	7%	15%	18%	13%	15%
'87 (W20.3)	38%	1%	12%	20%	16%	13%
'88 (W22.8)	38%	-	8%	24%	23%	7%
'89 (W19.2)	48%	-	9%	25%	20%	4%

Source: KIST Project Development Department data & D. Lee, p. 108.

a. Includes computer science and industrial economics.
b. Research contract volume in billion Won.
c. As of August, 1980.
d. The computer science contracts account 25.5% (W12.1 billion).

Disproportionally skewed KIST research in the computer science field compared to other industrial fields casts a doubt as to whether KIST functioned appropriately as a multi-disciplinary R & D institute. KIST's computer science projects themselves should be viewed positively though. The nature of computer science projects at KIST in which 90% was to improve computerized management systems in the local industrial firms (the contracts with government constitutes 7% of the projects) clearly reflects a rapidly increasing demand for computer technology.[26]

Also, the growth of research and earnings of the computer science field at KIST may be viewed as proof of KIST's competence, equipped with the most "modern" facilities and manpower. The large share of computer projects may also be considered as an indication of endorsement by local industry, thus a good example of successful KIST-industry linkage. As a matter of fact, KIST pioneered bringing computer technology to Korea, and functioned as a godfather in the information technology field of the nation by training (both its own staff and the public) and transferring its staff to various social sectors. In addition to industrial projects, KIST's computer science research unit also had a dramatic impact on the development of computerization of Korea's public administration system. Some examples are the use of the Hangul (Korean alphabet) line printer in the computation of utility bills, the computerization of Korea's tax system as well as the college entrance exam system (a very hot social concern due to fierce competition), and the introduction of data communications technology. All of these promoted government efficiency. The successful management of the 1988 Seoul Summer Olympics also owed much to KIST's computer capacity which brought the head of SERI, Sung Ki-Soo (a Harvard Ph.D.), a most prestigious national decoration and citation from the Korean government. And yet, with a total of 404 employees engaged in the computer field (36.8% of the total KIST employees) in 1980, it is hardly deniable that KIST was becoming a computer center! The growth of computer science field research at KIST eventually resulted in the creation of SERI in the early 1980s.

Commercialization of R & D

Inasmuch as the ultimate, manifest goal of KIST R & D is its utilization by local industry, it is important to discuss its commercialization.[27] Before the merger, of the 2,106 KIST's projects completed as of August, 1980, ninety-one projects (4.3%) were commercialized and another eighty-one cases (3.8%) were under negotiation to be commercialized by industry.[28] The commercialization (completed) rate reveals that at least 10.2% of the KIST projects in the "Development of New Technologies & Indigenization of Foreign Technologies" category (see Table 5.10 in p. 258) have resulted in technological innovation. When the commercialized projects are analyzed in terms of sponsorship, about 60% of them during the pre-merger period were industry-sponsored, 17% under the government's "package deals" sponsorship, and the rest 23% under various kinds of other sponsorship (i. e., government's G-projects, KIST in-house projects, and KIST-government-industry joint projects). A KIST document computes the economic value (expected, not necessarily actual) of KIST's R & D results before the merger:[27]

Import Substitution	W97,600 million/year (47 firms, 76 products)
Export-promotion	W10,800 million/year (15 firms, 24 products)
Conservation of resources	W10,600 million/year (2 firms, 3 products)
Utilization of local resources	W10,900 million/year (3 firms, 3 products)
Know-How Export	$4.34 million (40 countries)

Between 1967 and 1989, as Table 5.6 shows, a total of 189 cases were commercialized (3.4% of the total research contracts), and a total of 411 cases of research projects were conducted in relation to that commercialization. The most successful fields in commercialization are in chemistry/chemical engineering (49%) followed by metallurgy/material science (20%). The table also shows that the

Table 5.6

Commercialization of KIST R & D by Funding Source & Fields: 1967-1989

Projects by Sponsorship	Chemistry/ Chemical Eng.	Food/ Biology	Electric/ Electronics	Metallurgy/ Material Sci.	Mechanics	Others	Total (%)
Nat'l R & D	47	2	11	24	15	-	99 (62)
-Gov't-initiated	5	-	4	4	5	-	8 (4)
-Industry-initiated	42	2	7	20	10	-	81 (20)
Industry	85	27	10	30	9	64	225 (55)
Gov't Endowment	36	21	5	19	2	-	83 (20)
KIST In-House	4	-	-	-	-	-	4 (1)
# of Projects Involved:							
	172	50	26	73	26	64	411
# Commercialized:							
	93	18	12	37	16	13	189
(%)	(49)	(10)	(6)	(20)	(8)	(7)	(100)

Source: D. Lee, p. 70.

commercialization rate is higher in industry-sponsored research contracts.

As will be noted shortly, KIST's R & D performance measured by patents is relatively high whereas the actual utilization of KIST's R & D results in the production system is low (3.4%). From the local industry standpoint, KIST is not a serious source of production technology either. Some research reports are particularly interesting in referring to this point. According to a study jointly done by the Korea Chamber of Commerce and Industry (KCCI) and KIST about the sources of production technology in Korea,[30] contract research results (i. e., done by KIST) represents only 1% of 509 production technologies surveyed. In contrast, industrial firms' own in-house research results as well as other domestic technologies, technology transfer, and joint venture accounts for 64%, 30% and 4% respectively. This survey report provides little information about the nature of firms surveyed. Also, some raise questions about the appropriateness of the production technologies selected for analysis in the survey, and about whether such a high proportion of technologies provided by the local firms' in-house or other domestic sources (64%) is valid.[31] And yet, it clearly indicates the low level of KIST's contribution to local production technology, and/or low utilization of KIST's R & D results in the local production system.

In the heavy and chemical engineering industries of the export sector, however, KIST's contribution is evaluated as far higher. Pursell and Rhee surveyed technology sources of some key export industries such as steel, machinery, ship-building, electronics, electric wire, sugar refinery, etc.[32] According to their study, 44% of those industries' technologies are supplied by domestic sources including 9.8% supplied by KIST and KORSTIC. Technology transfer from private foreign firms accounts for 54.4% of it. KIST's contribution alone represents 12% of domestically supplied technologies or 5.3% of technologies provided by both domestic and foreign sources. Throughout all the industries, KIST as a source of technology represents 4.6 % whereas that of KORSTIC is 4.4%.[33]

The KCCI/KIST study and the Pursell/Rhee study present a discrepancy about the KIST's contribution to industrial technology which needs further explanation. In addition to the differences of industrial sectors chosen as the units of analysis for the surveys, the different definitions of "sources of technology" employed in the two studies seems to have caused to this discrepancy. The Pursell/Rhee study defined it in a broader sense include such services as technical information whereas the KCCI/KIST study restricted its definition to technical know-how, industrial layout, and production technology. Nonetheless, the above mentioned studies indicate that KIST did not function as a serious source of production technology in Korea. Chapter six will consider why this link is so weak.

Patents & Royalties

In terms of patents, as shown in Table 5.7, KIST has applied for a total of 439 (388 domestic and 51 foreign) and obtained a total of 147 (134 domestic 13 foreign) as of December, 1980. The breakdown of the 134 cases of domestically obtained patents by category is as follows: 104 (78%) in inventions; 27 (20%) in utility models; and 3 (2%) in industrial designs (2.2%). The most productive field is chemistry/chemical engineering which represents 32% of the total patents obtained by KIST followed by electric/electronics and mechanical engineering/metallurgy which represent 30% each. Between the period of 1968 and December, 1989, a total of 830 cases of industrial property rights were applied for, of those 741 cases (89%) were in inventions, 79 (10%) in utility models, and 10 (1%) in industrial designs. Out of those applications, 390 patents (47%) were granted (299 domestic and 91 foreign).

Of the 289 cases of patent applications analyzed by sponsorship (KIST's PDD data), 31.8% (92 cases) were the result of government-sponsorship (mostly "package deal") projects, 26.6% (77 cases) were industry-sponsored projects, and KIST's in-house research produced no patent.

Table 5.7

Application & Registration of
Industrial Property Right by KIST

As of 12. 1989

Year	Application Domestic	Application Foreign	Obtained Domestic	Obtained Foreign	Total # of Patents Granted in Korea (Korean/Foreigner)[a]
1968	4	-	1	-	-
1969	22	1	4	-	-
1970	18	3	10	-	226 (150/76)
1971	27	3	19	1	229 (192/37)
1972	12	3	9	-	218 (213/5)
1973	35	-	6	2	199 (188/11)
1974	9	3	7	2	322 (227/95)
1975	15	2	20	-	442 (212/230)
1976	23	1	11	-	479 (191/288)
1977	19	4	7	-	274 (104/170)
1978	23	15	1	2	427 (133/294)
1979	6	2	18	2	1,419 (258/1,161)
1980	41	1	11	4	1,632 (186/1,146)
Sub-Total:	254	38	134	13	
Total	292		147		5,867(2,054/3,813)
1968-1989	830		299[b]	91	
Grand Total	830		390		

Source: The 1968-1980 data is computed based on statistics presented in KIST, <u>The State-of-the-Art of Research Contract and Achievement</u>, (1981. 3) & MOST, <u>The Science & Technology Annuals</u>, 1973, 1974, 1976, 1980, 1981, & 1987 editions. The 1968-1989.12 data is quoted from D. Lee , pp. 70-71.

a. In addition, industrial property rights granted in other categories during the 1968-1980 period are as follows: 12,612 cases in Utility Models, 27,477 cases in Industrial Designs, and 68,015 case in Trade Marks.

b. Excludes six cases of industrial property rights granted in industrial designs.

Statistics on the relationship between KIST's patents and its commercialization are not available. However, the following two observations reveal KIST's productivity rather positively. First, the number of patents obtained by KIST represents roughly 5% of a total of 2,054 patents granted to Koreans during the 1970-1980 period (an additional 3,813 patents were granted to foreigners during the same period). Certainly, a patent is a partial indicator of technological innovation. A sample survey done by the Korean Patent Office in 1982, for example, notes that only 17% of total patents granted (14% of domestic patents and 19% of foreign ones) had actually been utilized in the production system in Korea.[34] The actual utilization rate of KIST's patents by local firms for production therefore may be low. Nonetheless, the number of KIST-obtained patents (5%) should be recognized as an accomplishment. Second, a total of 135 KIST research projects (2.4% of KIST's research projects) brought royalty earnings amounting to a total of W2,777.3 million during the 1969-1989 period (Table 5.8). Before the merger period, KIST had experienced a remarkable growth in royalty earnings, both in number of cases and their monetary value. Between 1969 and August, 1980, KIST's royalty earnings amounted to a total of W898.3 million from 75 research projects.[35] Throughout KIST's operation, earnings from the royalty contracts steadily increased. An in-depth analysis of the 118 royalty contracts analyzed between 1967

Table 5.8

KIST's Royalty Contracts

As of 1989. 12.

Period	# of Contract	Royalty Earnings (unit: million Won)
1969 - 1971	12	14.4
1972 - 1976	32	421.8
1977 - 1981	47	646.0
1982 - 1986	23	786.3
1987 - 1989	21	908.8
Total	135	2,777.3

Source: Quoted from D. Lee, p. 71.

and 1987 reveals that 24% of them have generated royalty revenues to KIST which covered 76%-100% of R & D expenditures KIST spent for the projects (31% of them covered 51%-100% of the expenditures).[36] Significantly, however, such royalty contracts do not necessarily guarantee the actual utilization of KIST-developed technologies by local manufacturers. A study reveals that many local firms entered into royalty agreements with KIST "simply to block other competitors from utilizing KIST technology."[37] As will be pointed out later, often KIST has suffered from low utilization of its R & D outputs by local industry despite their technical success in many cases.

Role as a Technology Transfer Agent

Korea's industrialization is based on modern, western technologies. In the course of technology importation, as will be fully discussed in the next chapter, the Korean government played a "directive" role by imposing many restrictions although it gradually softened its restrictive postures beginning in 1978. During the early phase of Korea's technology importation, KIST played an instrumental role, as a technology adaptation center, knowledge power house, information clearinghouse, and bargainer.

RBD itself is an important, informal method of technology transfer. KIST's approach to RBD was an excellent do-it-fast approach in bringing foreign technologies into Korea as evidenced (Table 5.4) by the large percentage of KIST's applied and development research in its contracts (i. e., import-substitution types of research). Also, KIST-developed technologies in many cases functioned as critical leverage against foreign technologies when local industry attempted to import similar technologies. Needless to say, such competition has contributed toward enhancing local industry's bargaining power over the terms and conditions of technology transfer. KIST's R & D and its commercialization have also had an impact on the reduction of import prices of raw or semi-processed materials in Korea. In many cases, the import prices dropped by one half or one third when KIST-developed technologies became available for local production. In one of KIST's commercialization cases completed in 1986, the import price of raw materials dropped by nearly three fourths! Beside the economic advantages Koreans may have enjoyed from the production cost reductions, these incidences provided Korea with a chance to grasp the vivid reality of the technology transfer system, and the nature of power technology-haves may have. A senior KIST researcher in the chemistry field during my field research clearly pointed out the harsh realities of global technological world by saying:

> If you do an in-depth analysis of KIST projects which have been successful enough to reach the stages of pilot plant or commercialization, you will notice that nearly all of them, with few exceptions, have experienced direct challenges from the competing foreign technologies (either those already available in the Korean market or incoming ones). You will notice the price reduction to a significant level. The purpose is clear...it is to weaken the strength of KIST's technologies in the market.38

During my field research and my work experience at KIST, I heard similar stories repeatedly. These stories clearly tell us the difficulties KIST-developed technologies face in overcoming market-uncertainties, wrestling directly with imported-and-market-proven-technologies, and how seriously KIST has realized S & T knowledge as an important resource of national power in international business dealings. On the other hand, KIST's experience in the commercialization of its projects also raises a serious value question as to whether domestic R & D should be protected by government policy measures even at the price of higher burdens imposed on consumers. My field research indicates no clear-cut answer to that, but long term effects of local R & D will be more positive to the nation as a whole rather than negative.

In addition to such adaptive research, KIST has also provided local industry and the government with consultation on technology transfer matters. From the very outset of KIST's operations, the Technical Information Department (TID) was created to deal with the international circulation of technology (Figure 4.2 in Chapter four). The duties of TID included to function as a technical information clearinghouse, review the terms or conditions of technology transfer contracts, and conduct survey research to gather data on technology supply and demand. The primary target group of TID was local industry, but TID's research findings became the basis of many government policy decisions on technology importation.

In 1976, a more aggressive approach was taken by creating a new organization, the Technology Transfer Center (TTC) at KIST under government's subsidization. TTC was the centralized technology transfer center of the nation. The purpose of TTC was to function as a technical counsel to the government in technology transfer policy-making, as well as to local industries. In addition, TTC also functioned as a focal point for foreign technology exporters (i. e., information clearinghouse).[39]

A survey research done on technology transfer in the mid-1970s notes several problems associated with technology importation in Korea.[40] First, technology importation had too long a lead time (on average 24.5 months) for both negotiations with foreign sellers and for government approval. Furthermore, a majority of technology importation cases surveyed (79%) were approved by government on a conditional basis, thus requiring re-negotiation with foreign suppliers of technology. These situations made it extremely difficult for local firms to import technologies in timely fashion. Partly, government's restrictive policies of technology transfer (especially DFI) in the 1970s seemed to have caused the delay, but the major causes were identified, according to the survey, as the local firms' lack of information about the sources of technology, their poor bargaining power, as well as poor knowledge about the government's approval policy and procedures. Secondly, small and medium industries, which comprise 41% of industries importing technologies in the survey, did not have their own technical capacity to evaluate the appropriateness of importing technologies (i. e., to avoid low-level, outdated technologies and overcharge), nor to absorb/adapt or modify them suitable to their own needs. These situations resulted in the vicious circle of technological reliance on foreign sources.

TTC was created to cope with these problems, and its operations produced some positive results. Between 1976 and 1979, a total of 493 cases of counseling services were provided by TTC. Details of their service areas as well as share of their workload percentage-wise are as follows:[41]

-Review of industries' technology import contract drafts for revision of contract conditions and terms	some 30%
-Professional advice about appropriate technology suppliers	30%
-Consultation about conditions and terms of concluded contracts (i. e., those concerning royalty payment & contract period)	20%
-Explanations about how to write a contract & the government's approval procedures	10%
-Others	10%

In addition, in the 1976-1979 period, TTC conducted a total of 1,111 studies to evaluate the appropriateness of technology for import (upon requests from government and industry) covering a wide spectrum of industrial sectors.

The above consultation services TTC provided were very educational when technology transfer system (both global system as well as domestic policy process) was not well understood by local firms, particularly SMFs. They were economical as well. During the 1972-1981 period, for instance, a total of 756 cases of technology consultancy were provided by foreigners which cost Korea a sum total of $73.3 million.[42] Even though the differences of the nature of consultancy that may exist between foreigner's and TTC are recognized, we can draw a conclusion that TTC's services had some economic value. Besides, such TTC intervention strengthened the political bargaining power of local industries in their business of technology importation against foreign technology sellers, and against government bureaucracy. A study done by TTC in 1978 indicates that after TTC's service intervention, the lead time for technology imports was dramatically shortened to six months, and the government's conditional approval rate of technology import contracts also dropped to 15% of the total applications for approval.

Spin-off Effects of KIST's R & D

KIST's operation in the past two and a half decades has resulted in some positive spin-off effects. KIST's innovative approaches to RBD, and the migration of KIST staff into other sectors in the economy have contributed to the systematic development of high-level S & T manpower. KIST has also served as a model institute in the development of other government-endowed strategic institutions. By conducting policy-recommendation type of research, or other methods, KIST has also functioned as an important "brains" in Korea's industrialization path. This section attempts to inquire into these issues.

RBD & the Manpower Development

As discussed in the previous chapter, KIST's recruitment of Korean scientists and engineers from abroad was the major breakthrough in Korea's systematic utilization of high-level manpower in S & T fields, and KIST serves as a microcosm of Korea's RBD. KIST's RBD practices have contributed to the administrative and procedural development of RBD. The KIST approaches to research personnel management had a tremendous impact in terms of defining their status in Korea's socio-political strata. Significantly, KIST-initiated RBD has been highly successful. Very few repatriates went back to industrialized countries. Increasingly, expatriates are "flocking" back to Korea. Brain drain is no longer considered as a social problem by policy-makers.[43] In many S & T fields, how to accommodate, not how to bring, all those Korean "brains" heading home has become a salient problem. Some people in Korea already joke about Ph. D. holders as a "dime a dozen," whereas others argue that without "re-entry chances" such as some kind of social or family network, it has become very difficult to return home for employment.[44] In the 1960s and 1970s, KIST's RBD model had a limited impact on the public sector R & D or think-tank establishments. But in the 1980s, its impacts spread into the private sector as well when local firms began to aggressively recruit high level researchers from abroad.

Local firms in-house R & D centers began to mushroom beginning in the late 1970s, and firm-financed RBD in large corporations has been fast growing, particularly since the mid 1980s: Between 1987-1988, a total of 347 were recruited from abroad and another 442 were planned for 1989. As of 1989, a total of 215 high-ranking employees in 44 companies under the umbrella of the 10 large conglomerates held doctorates obtained from foreign countries.[45] One of Korea's chaebol, the Lucky-Gold Star group had two hundred Ph.Ds. as of 1989, and during the 1988-1990 period, they hired a total of ninety new Ph. Ds recruited mostly from abroad.[46] Other top-ranking chaebol pursue a similar approach.

Importantly, when chaebol companies in Korea began to establish their in-house R & D centers, they often recruited KIST-repatriates and other personnel for key posts (i. e., Samsung & Lucky-Gold Star). This type of personnel movement from KIST to local industry undoubtedly transferred KIST's model of R & D management (i. e., personnel management skills) into industrial firms. The KIST model of recruitment, and "perks" became standard in private RBD. As a matter of fact, the private sector tends to offer more material benefits to returnees than any other sector (public

R & D sector and the academic community), such as better salaries, more generous relocation expenses, subsidy for educational costs for returnees' children, housing, automobiles, and so forth. KIST's idea of top-salaries for the returnees, in particular, has been adopted into the private sector. Returnees in the private sector are also paid a special, "repatriation allowance" in addition to their basic salaries, called "Ph.D. allowance" or "Master allowance." In 1990, one of Korea's leading firms paid between W30,000-40,000 ($42-56) monthly for Master degree-holders and between W200,000-500,000 ($282-704) for Ph.Ds. Although the difference between the home-grown Ph.D. and foreign-Ph.D. is diminishing, it has been a common practice that the latter received more material compensation than the former: Foreign-Ph.Ds. in one of the <u>chaebol</u> firms in 1990 on average received about $280 more per month than their peers who earned a doctorate locally. The underlying assumption is the comparative advantage of foreign Ph. Ds. in market skills (i. e., foreign language ability, familiarity with an industrial country's business system) offers better access to foreign technology.

In addition, KIST has served as an informal training institution or a stepping stone for many researchers who would later serve in other sectors in Korean society. Prior to the merger, between 1967 and 1980, a total of 628 research and technical members left KIST.[47] By the end

1989, KIST had experienced a total of about 3,000 staff members quitting their jobs at KIST to resume new posts in industry, educational institutions, and other R & D establishments. Such a high turn-over rate was certainly a big loss for KIST, but represented a gain for Korean society as a whole. Additionally, about 400 personnel are annually hired by KIST on a contract basis who will return back to their home institutions when projects with KIST are over.[48] Of the senior level research personnel alone (i. e., Ph.Ds. or equivalent), as shown in Table 5.9, a total of 334 have left KIST moving into other societal sectors. Of those, fifty-four researchers or 16% are now working in industry. During the 1981-1989 merger period, 182 Ph.Ds. from KAIST (27% of its doctoral graduate) and 1,922 Master degree holders (45% of its 4,262 Master graduates) were employed in local industrial firms.[49] Although their primary goal was an educational degree, they also gained hands-on experience at KIST labs while receiving educational training.

Development of R & D Infrastructure

Korea for the last two and a half decades, as noted earlier, experienced a phenomenal growth of R & D infrastructure (i. e., R & D spending, number of R & D centers, manpower). In this growth path, KIST has functioned as a seed-bed. By conducting contract research and facilitating personnel flow, KIST literally taught

Table 5.9

Research Manpower Movement from KIST to Other Sectors

	'67-'72	'73-'78	'79-'84	'85-'89	Total
# of personnel departed from KIST	37	121	118	58	334
Destination					
Study Abroad	2	2	6	3	13
University Enrollment	8	11	37	21	77
Industry	6	34	9	5	54
Other R & D Centers	9	64	34	18	125
Others	12	10	32	11	65

Source: KIST Personnel Department data quoted from D. Lee, Table 5-5 in p. 114.

local industry the meanings of "R & D," and how to manage research professionals.[50]

In the case of government-sponsored strategic R & D institutions, KIST's influence was more direct. As the above Table 5.9 notes, a total of 125 KIST senior level research personnel moved into those R & D institutions. In the 1970s Korea began to expand government-sponsored strategic R & D institutes in specific S & T fields such as in ship-building, electronics communication, ocean research, machinery, metallurgy, chemistry, standardization, and electrical engineering. The number of such institutes created in the 1970s reached fifteen, of which seven were off-spring of KIST (formerly KIST's laboratory units). Korea's public R & D system has henceforth experienced two major organizational restructurings. The first one took place in 1981 when the Chun regime launched a massive merger of sixteen government-endowed strategic R & D institutes into eight. The second major shift occurred during the late 1980s under the Roh administration which separated, merged, and transferred the administrative aegis of some government-endowed strategic institutions from MOST to other ministries. This latter reorganization resulted in the expansion of such R & D centers to nineteen as of 1989[51] of which ten can trace their roots back to KIST. As of 1990, KIST had four affiliated research institutes: Korea Ocean R & D Institute (created in 1978); Genetic Engineering Center

(1985); Center for Science & Technology Policy (CSTP, 1987); and SERI (1984). They are all government-endowed and constitute Korea's strategic R & D system. The number of employees at KIST's affiliate institutes were 791 (497 researchers and engineers) whereas KIST itself had 794 (472 researchers and engineers) as of 1990.[52]

Development of Technostructure

KIST's role as a think-tank in S & T fields is another way to look at KIST's impact on local society. KIST's survey research, often under government sponsorship, was conducted to help the national government in making various industrial policies across industrial sectors.[53] Beginning with Korea's Third Five Year Economic Development Plan (1972-1976) KIST has participated in the preparation of a series of the national industrialization plans. KIST, along with EPB, became an integral part of the "task elites" in developing Korea's industrialization plans.[54] An ex-KIST senior researcher who participated in the development of the fourth and the fifth economic development plans recalls that

> For the fourth economic plan, about twenty research teams were formed by government for an in-depth analysis of industrial sectors. Typically, each team was made up of three members, officials from EPB and a bank, and a KIST researcher. Our own team traveled to France for a month to study its technology and industrial policies. Upon return to Korea, we submitted a field study report with policy recommendations to the government which became the basis of the fourth industrialization plan in our assigned technology field. Other teams did similar jobs, visiting other European countries and the U. S.

> Inasmuch as KIST researchers in the study team were the only ones who had science and engineering backgrounds, we were 'the eyes' of the group. I am sure our (KIST participants) inputs were essential.[55]

As Table 5.10 indicates, as of October, 1980, policy-recommendation type of research represented 12.4% (261 cases of projects) of the total of KIST's projects completed. Without technocrats at KIST, the Korean government's financial burden of foreign consultant fees would have been significantly higher as an IBRD consultant commented:

> Unlike other developing countries, Korea takes part of a project and seeks outside expertise on specific issue area-bases, rather than on the whole project.[56]

Moreover, KIST's involvement in such sensitive, and strategically important areas, as national defense[57] and the development of the heavy and chemical industry (5.2%) signifies its role as an important elite cadre in Korea's industrial policy-making. In fact, KIST's role as "the Blue Ribbon" brains in industrial policy-making was in high demand as evidenced by KIST's top management's membership in important cabinet-level top policy-making bodies, some of which were chaired by President Park himself. Some of these were: The National Trade Promotion Meeting (which became the focal point of Korea's export drive), the Committee for Economy and Science, Foreign Capital Inducement Deliberation Committee (FCIDC), and so forth. In S & T policy making at MOST, KIST's "technical and scientific" opinions exerted a great deal of influence (i. e., on whether or not

Table 5.10

KIST Projects by Nature: 1967-1980. 10

Type of Research	# of Projects (%)
Policy-recommendation	261 (12.4%)
Special Task-Oriented Projects[a]	110 (5.2%)
Development of New Technologies & Indigenization of Foreign Technologies	891 (42.3%)
Computer Science Projects[b]	570 (27.1%)
Technical Assistance, etc.[c]	179 (8.5%)
Techno-Management Assistance[d]	95 (4.5%)
Total	2,106 (100%)

Source: KIST, Upmoo Hyunwhang Bogo (Business Report), 1980. 11.

a. Includes such projects as defense industry, special task-oriented government projects in the heavy & chemical industry.

b. In addition to computer use rate, they include such projects as the development of management information system (MIS) and software programs for the computerization of various kinds of administrative procedures, i. e., computerization of utility bills, entrance exams for schools, etc.

c. For example, technical assistance to the small-medium industries, small scale projects, etc.

d. Such projects as KIST's assistance and consultation in the construction of the Pohang Iron and Steel Company (POSCO), and other special steel plant.

the importation of foreign technologies should be allowed). KIST's top managers were also assigned to various committees on S & T affairs which ran under the jurisdiction of MOST.

In addition to KIST's counsel to the government's industrial policy-making, KIST's techno-management assistance to local industry was also crucially important in many cases. Perhaps, the most significant case is KIST's engineering services rendered to the construction and expansion of POSCO which grew to become a world class steel company with higher utilization rates and better profit margins compared to U. S. steel firms.[58] From the formative stage of POSCO, KIST got deeply involved with aid from a Korean-Japanese scientist (Dr. Kim Chul-Woo) and other KIST repatriates. POSCO, a state-run company, is considered the backbone of Korea's heavy and chemical industry, which carried much weight in Korea's industrialization of the 1970s.

Effects of KIST's survey research are also found in two other aspects. From an academic standpoint, KIST's analysis of vast amounts of complicated raw data across industrial sectors as well as the introduction of computer technology in its analysis literally "opened a new era" in survey research methodology in Korea in the late 1960s. At the same time, KIST's studies contributed to building public confidence in the reliability of public sector research.[59] In fact, building public confidence and reliability were catch words of KIST's management from the outset of its operation.[60] And KIST was quite successful in that matter. A former KIST president, Hahn, recalls his experiences at FCIDC meetings wherein his opinions often were adopted "because he is the president of KIST" (thus one whose words are reliable) when disagreements among committee members arose.[61] Certainly, the government's recognition of KIST's professional knowledge is significant in the Korean context wherein many intellectuals (i. e., professors, mostly from the social sciences and humanities faculties) who served various government committees or special task-oriented study groups suffered from a loss of professional prestige. Those intellectuals lost public support as well. Local people often blamed them for co-optation and power-oriented (rather than truth or knowledge-oriented) behavior, giving them such nicknames as <u>Kosuki</u> (rubber-stamper), and <u>Oyoung</u> <u>Kyosu</u> (pro-government professors). KIST researchers, in my observation, not only enjoyed support and respect within government but were insulated from such public insults, as well. As a matter of fact, KIST has enjoyed a high level of public acceptance as can be easily detectable through local mass media reports. Perhaps, one of the most dramatic incidents which assured the public of KIST's professionalism took place during the 1988 Seoul Summer Olympics when KIST's drug testing center (KIST' Doping Control Center) tested Ben Johnson's blood which eventually disqualified him from the golden medal. This case has not only helped KIST strengthen its image as a "reliable" S & T center in local society, but also it has surely satisfied Koreans' national ego and pride for their upgraded S & T ability.

The public's trust undoubtedly aided KIST in building a science and technology-based technocratic power base in society, at least before the KIST-KAIS merger in 1981. Indeed, some of my interviewees expressed the belief that there was too much public trust in KIST in its early era. Dr. Young-Ok Ahn, ex-KIST senior researcher repatriated from Dupont's central U. S. lab, recalls that

> Most senior researchers at KIST (during the early period of the institute) were not recruited from contract research institutes and it was quite true that they lacked the ability to develop/manage contract research projects by themselves. More seriously, their experience and knowledge were obtained from the industrialized countries and they did not match well with Korea's situations. Of course people in Korea at that time had a misperception about Ph.Ds. who, according to the public view, would know everything. It was very difficult for us to reveal our ignorance when public expectations were high. A good example was President Park's instruction to KIST researchers to assist the Kuro Industrial Park (one of the major industrial parks of Korea located in the vicinity of Seoul). We took our lunch and went to the site. It was the first opportunity for us to see the industrial sites--a good learning experience to grasp the reality of Korea's industrial situation.62

In the 1970s, other think-tanks have mushroomed in Korea and the comparative strength of KIST as the nation's brain-trust in S & T waned to a degree. However, as the Korean government shifted KIST's goal onto "national projects" beginning in the 1980s, KIST's role as the nation's S & T think-tank has expanded. And this strengthened role will continue into the 1990s as recent government policy confirms.[63]

Summary and Conclusion: The Meanings of Local R & D

This chapter attempted to analyze both manifest and non-manifest functional aspects of KIST R & D. An argument was made that in the evaluation of KIST's R & D we need to reexamine the conventional notion of R & D outputs, and consider the specific contextual settings of Korea (technological vacuum) in the 1960s from which KIST started its operation. This view certainly requires additions to the conventional yardstick to measure R & D outputs. Included in this study as the major KIST R & D output measurement are types of research, patents, innovations, development of new formulae, consulting and management services, roles in technology transfer, RBD and manpower development, R & D infrastructure building and think-tank aspects. KIST's R & D is analyzed in this chapter from various perspectives, historical, by nature, by client, and by field.

In the analysis of KIST's manifest goal-attainment, it is difficult to measure precisely to what extent KIST's R & D has contributed to the development of industrial technology in Korea although we try to quantify them in various measurements as presented in the previous section.

My field research and interviews with "experts" in this field did not provide statistical figures. However, based on my research as well as my personal observation during my employment at KIST, three research findings are found. First, armed with a high sense of motivation, enthusiasm, and even with a pioneer-like sense of responsibility for industrial research, KIST has generated relatively high research productivity and contributed to the overall accumulation of technological know-how in Korea. This is particularly true during the early era of KIST operation, in the late 1960s and until the mid-1970s, a period when local firms and universities were experiencing a technological vacuum. KIST taught Korean society the meanings and the value of R & D. Throughout its operation, applied and development research were the major elements of KIST R & D. Local industry, although the nature of KIST services varied, became KIST's major contractor. These indications certainly satisfy KIST's manifest mission as an applied research institute for industrial technology, given the Korean context. In fact, visitors to KIST would be impressed with its exhibition room filled with the many inventions and product development KIST researchers had produced, some of which also brought some economic benefits to Korea (i. e., import substitution, import price reduction of raw materials, exports, etc.). KIST has also been active in academic forums. The KIST-79/80 Annual Review reports that in 1979 alone, 181 seminars and symposiums (both international and regional) were sponsored by KIST across science and technology fields and KIST researchers' publication in professional journals increased.

In the late 1970s, the strength of KIST lessened. Informal views of KIST officials acknowledge it although they also value KIST's success in technology transfer within the society via manpower development/flow. Several factors seem to have had immediate effects on the weakening of KIST. First, many KIST researchers left to go into other sector-specific (i. e., electronic technology, shipbuilding, etc.) strategic R & D centers when the Korean government aggressively launched R & D infrastructure-building; private sector R & D and local universities also began to expand their R & D capacities to which KIST also lost some of its R & D manpower capacity; the sector-specific specialized R & D centers (both in the private and public sectors) are more efficient compared to multi-purpose R & D centers[64] like KIST; and importantly, there was the KIST-KAIS merger. Nonetheless, contracts with local industry, although government's subsidy or matching funds increased, still constitute at least half of KIST research contracts in the 1980s.

Second, when it comes to an issue of linking KIST's research results with the local production system, we find a weak linkage between the two although there are some cases of important innovations. The weak linkage between KIST and the local production system needs explanation which will be the subject of the next chapter. What seems to be important at this point, however, is that when KIST's contribution to local production technology is insignificant, should KIST's R & D performance be evaluated negatively? As a matter of fact, the negative views prevailed in Korea, particularly during the 1980s. The major criticism came from KIST's lack of technological innovation, which partly contributed to the Korean government's merger decision of KIST with KAIS.

Certainly, quantitative, mechanical measurement of KIST R & D output is important (i. e., the number of innovations). What seems to be underestimated in the evaluation of KIST in the past, though, is the socio-political (often non-quantifiable) aspects. R & D does not take place in a social vacuum. It reflects, for example, the given society's technological level, industrial capacity, R & D system, social knowledge, development goals, and so forth. When we consider Korea's particular situation during its early industrialization period which had extremely limited understanding as well as capacity for R & D, KIST, as an organization, was quite successful in transforming the R & D community very rapidly. Although KIST may not have been a significant factor for production, its overall contribution to local industry nonetheless offsets such shortcomings. Without the existence of such a multi-disciplinary R & D center like KIST, and its early positive demonstration effect (strongly supported by both government and public as well), the enlightenment of local industry about the value of R & D may have taken a longer time to come. Without KIST which laid the groundwork in the 1960s and 1970s by introducing new technologies into Korea (i. e., electronics technology, computers), local industries would have waited for some time before they experienced take-off, for it was not until the later 1970s that a few large firms began to create in-house R & D centers. Without KIST which also functioned as an intermediary in international technology transfer (both hardware and software such as management consultation), the mode of technology importation may have been somewhat different from what Korea had experienced in the past decades, perhaps moving into more dependency. This issue will be further discussed in the next chapter.

Third, another finding is that KIST has also played many different roles, unintended but with positive impacts on Korean society. KIST was the focal point for high-level manpower of Korea (i. e., repatriated scientists and other professional staff) with positive spill over effects for local industry. The development of other strategic R & D centers in Korea owes much to KIST as a seed model. KIST also functioned as an important pillar in Korea's technocracy, one of the crucial factors of the Korean "miracle."

Above all, the early demonstration effect of KIST as the nation's "center of excellence" equipped with the "best" qualified personnel, equipment (such as advanced computers), and high spirits have certainly added to national pride, and to Korean's "we too can do" mentality. One of the highlights of Korea's economic "success" story in the past decades is (although this issue failed to attract attention in the literature on the Korean miracle) that they had a tremendous impact on the development of Koreans' self-esteem. The recent industrialization process was a sort of test case for Koreans to see whether they can stand on their own feet economically and politically in the world community, getting out of the super powers' rivalry trap, so much characteristic of modern Korean history. Certainly, Korean industrialization assured Koreans of their ability and future-oriented ambitions. Korea's popular culture, for example, encourages Koreans to "push and push" things until they achieve certain goals no matter what hardship lies before them. Government policies, with few exceptions, set target dates by which certain goals will be accomplished. For example, a recent MOST policy states that "In order for Korea to become one of the world's seven most technologically advanced countries by 2000, ...the government will select 14 national projects in specific high technology fields on which R & D efforts will be concentrated beginning in April, 1992."[65] Once a target is set, the government usually supports the goal with a good package of goodies (funds, administrative supports, to name a few). KIST was one of the targets the Park regime had strongly supported. And its operations, especially in the 1960s and 1970s added to Korean pride (i. e., development of import-substitution type of technologies, development of some new technologies thus giving Korea's R & D community a sense of "we can catch the West," strengthening bargaining power in technology importation, building a first-class steel mill, organizing of high level S & T manpower, etc.). As matter of fact, the KIST compound was one of the nation's showcases that the Korean government wanted to show to foreign state visitors. There was high level confidence and public acceptance of KIST, as noted earlier.

In sum, in spite of KIST's limited contribution to local production technology, the wealth of other positive effects allow the author to evaluate KIST's overall performance rather positively. This is particularly true when we remind ourselves that KIST was created, in addition for promoting industrial technology development, for political symbolism--a visible example of Korea's modernization. KIST has met this symbolic expectation, perhaps far exceeding the original horizons of presidents Park and Johnson. For those who had a rather negative view on KIST's operation, their expectation was perhaps too high: no matter how many innovative approaches were adopted to make KIST the nation's center of excellence in industrial research, there are limitations on what a single organization can do.

Notes

1. However, there are disagreements in the literature about how to measure R & D inputs and outputs. Refer to Hyungku Kim, "Measurement Problems in R & D Activities," Journal of Science & Technology, Vol. 1, No. 2 (November, 1989), pp. 88-98; and K. Lee (1977), Ch. III.

2. National Science Foundation, National Patterns of R & D Resources 1953-1972 (Washington, D. C.: Government Printing Office, 1972) P. 21. Also refer to ibid.

3. For the analysis of "creative" vs. "absorptive" research, refer to Blumenthal (1976), p. 246. Jinjoo Lee & al. identify the technology development path of the industrialized countries into the following three stages which are influential to that of the developing societies: the emerging stage (emerging technology), growth stage (new technology), and mature stage (old technology). Refer to Jinjoo Lee & al., "Technology Development Processes: A Model for a Developing Country with a Global Perspective," R & D Management, Vol. 18, No. 3 (July 1988), pp. 235-250.

4. Interview with a KIST's senior level manager on May 22, 1981.

5. Interview with Dr. Hahn Sang-Joon on April 10, 1981. Also, refer to Choi Hyung-Sup, "Development Guidelines of Industrial Technology for Less Developed Countries," Wonjaryuk Hakwhaeji (Journal of Nuclear Energy) Vol. 12, No. 1 (1980), P. 70.

6. Refer to various local newspaper articles in the 1960s & 1970s.

7. J. Lee & al. (1988).

8. A recent study by National Academy of Engineering (1991) is excellent to look at the transnationalism of R & D, but from the perspective of U. S.

9. KIST Brochure 1989, p. 22.

10. Although the funding for the E-projects comes from the government, these projects are different from the G-projects because of their "package deal" feature and the restriction of usages attached to certain purposes. For example, when KIST is endowed from government with "promotional funds for the development of electronics

industry," it assumes all the responsibility to select and perform research projects for the given purposes.

11. Often, KIST's document on its R & D statistics classifies the "in-house projects" into the category of KIST's research contracts with industry.

12. KIST Brochure (1989), p. 22.

13. D. Lee, p. 69.

14. H. Choi, pp. 68-69.

15. The Dong A Ilbo (The Dong A Daily Newspaper), March 3, 1972.

16. Field study data (1981).

17. Korea did not sign the Montreal Protocols (1987) which regulate the production/use and import/export of freon (CFC) but under international pressures, Korea is expected to sign in 1992. Development of freon substitute is an urgent task of Korea for its broad impact on Korea's export market (i. e., automobiles and electrical home appliances). In 1990, KIST created a new research center within its organization solely to engage in the development of CFC substitute.

18. The Seoul Shinmoon (The Seoul Newspaper), May 17, 1973.

19. However, it failed in the market, not because of its technical defects but for other factors. Discussion of this issues appear in Chapter Six.

20. Under this cooperative program, KIST identified technical problems commonly faced by SMFs and offered technical assistance. Refer to H. Choi (1980), p. 68; & KAIST, 1987 Nyondo Yonkoo Kaebal Sungkwa Bunsuk Bokoseo (A Study on the Analysis of KAIST R & D Performance 1987 (1988. 3), p. 67.

21. The Korea Industrial Research Institute (The Hankuk Sanup Kisul Jinhung Hyupwhoi), '90 Sanup Kisul Baekseo (1990 Industrial Technology Whitepaper) (Seoul, 1990), pp. 146-147.

22. Bello & Rosenfeld, p. 117.

23. KIST Project Development Department data (1980).

24. SERI, Nyunboo 88-89 (1988-1989 Annual Report), p. 15.

25. KIST Computer Center, Chunsan Kaebal Center Upmoo Hyunwhang (Business Report of the Computer Center) (Seoul: KIST Computer Center, 1980. 8).

26. KIST, Yonkoo Kyeyak Hyunwhang Mit Yonkoo Siljuk (The State-of-the-Art of Research Contract and Achievement), 1981. 3.

27. The term "commercialization" refers to six consecutive stages: (1) research (2) development (3) engineering (4) test-run (5) production and (6) marketing. Refer to Yun Yeo-Gyeong, "KIST and Its Activities in Commercialization of R & D Result," in KIST, Proceedings of the 7th ASCA Conference Pre-Seminar I on the Role of Local R & D for Industrialization May 14-16, 1979, p. 195.

28. KIST, The State of-the-Art and Strategy. But another KIST document (refer to endnote 26) presents different statistical figures thus confusing the reader. For example, the latter document notes that as of March 31, 1981, a total of 218 project were either completed in commercialization or ready for commercialization, and another 196 projects under negotiation for commercialization.

29. KIST (1981).

30. Korea Chamber of Commerce & KIST, Sanup Kisul Suqup Siltae Josabogo (Survey Report of the Supply of Industrial Technologies), 1979 quoted from Kim Kwang-Do, Kukje Kyungjaengryuk Kangwha lul Wihan Kisul Hyuksin Yonkoo (Technology Innovation Research for the Strengthening of International Competition) (Seoul: Korea International Economics Institute, 1980), p. 79.

31. K. Kim, ibid., p. 79 & 81.

32. Garry Pursell & Yung Whee Rhee, A Firm-level Study of Korean Exports: Research No. 2, Technology, Mimeo. (IBRD, December, 1978) quoted from K. Kim, ibid., pp. 80- 82.

33. K. Kim ibid., p. 84. Westphal, Rhee and Pursell in another literature note that: 9% (8.7% in traditional exports and 9.2% in non-traditional exports) of the 112 exporting firms surveyed in 1976 indicated KIST and KORSTIC as "important" source of process technology; and the domestic source of technology constitutes 50.2% of all exports whereas 48.9% process technology comes from foreign source. Refer to Larry E. Westphal, Yung,

W. Rhee and Garry Pursell, "Sources of Technological Capability in South Korea," in Martin Fransman and Kenneth King, eds., Technological Capability in the Third World (New York: St. Martin's Press, 1984), p. 285.

34. H. Kim, p. 93.

35. This figure could have been higher if local industry had cooperated. However, in many cases KIST failed to collect royalty fees mostly because the licensees (industrial firms) did not implement KIST technologies in their systems although royalty agreements were made.

36. KAIST, A Study on the Analysis of KAIST R & D Performance 1987, Table in p. 66.

37. Jinjoo Lee (1975), "Contract Research and Its Utilization in a Developing Country: An Analysis of Factors Influencing the Transfer of Industrial Technology from Korea Institute of Science and Technology (KIST) to Its Clients," Ph.D. Diss. from Northwestern University, 1975, P. 228.

38. Interview at KIST on March 20, 1981.

39. KIST-TTC, The Comparative Studies of National Experience in Technology Policies: The Case of the Republic of Korea (1980), p. 27 & 29. TTC no longer exists at KIST. The TTC's function was transferred to other government offices in the mid-1980s.

40. Ibid., pp. 27-29. Also refer to KIST, A Study on the Status-of-arts of the Technology Importation (1976).

41. KIST-TTC (1980), p. 30.

42. L. Kim (1984), p. 11.

43. My field research data collected in Korea, in December, 1990.

44. Keiko H. Bang, "Coming Home," KOREA Business World (November 1989), p. 29; & interview with Dr. Young-Ok Ahn, President, Olin-Far East (Korea), on December 5, 1990 in Seoul.

45. Chong Jo-Young, "An Empirical Study on the Strategic Procurement of Highly Qualified Manpower in Science & Technology," Ph.D. Diss. from INHA University, Korea, 1990, p. 86.

46. The Lucky-Goldstar Brochure and my field research data collected in Seoul, Korea in December, 1990.

47. KIST Personnel Division data collected in Seoul in December, 1990.

48. D. Lee, p. 113.

49. KAIST (formerly KAIS) data collected in Daeduk Science Town in December, 1990.

50. And yet, local firms are often criticized for their "mismanagement" of R & D personnel to whom, for example, orders are given by higherups in the corporate management to develop certain technologies within a designated timeframe at the price of research autonomy.

51. This figure includes two engineering schools but excludes the hospital for nuclear energy treatment, and the Korea Science & Engineering Foundation. Refer to _'89 Science & Technology Annual_, pp. 495-499.

52. These statistics come from KIST's English language brochure (p. 4) which I obtained in Seoul in December 1990. CSTP, however, merged with KIST in 1991 and their S & T policy research will continue under a new organizational framework.

53. Examples of such researches in KIST's early era are as follows: "Long-term Energy Supply & Demand Plan" (1967), "Survey Research for the Long-term Science & Technology Promotion Policies" (1967), "Plan for the Modernization of Mechanical Industry" (1969), etc.

54. It does not necessarily mean that KIST's power as technocrat is equal to that of EPB economists. In reality, no matter what technical expertise KIST provided, it was EPB, equipped with budgetary power, which made policy-decisions and KIST's policy recommendation may be dropped in such a course. Nonetheless, KIST's expertise was fully recognized by government policy-makers. In addition, KIST's inputs were vital in the development of a series of five year S & T development plans.

55. Interview data in Seoul on December, 1990.

56. Information gathered during my employment at KIST in the 1970s.

57. After the defense research institute, Agency for

Defense Development, was upgraded and expanded in early 1972, KIST's projects in defense R & D diminished significantly.

58. J. L. Enos & W. H. Park, The Adoption and Diffusion of Imported Technology: The Case of Korea, (London: Croom Helm, 1988), Ch. 7. U. S. firms refer to US Steel, Bethlehem, LTV, Armco, Inland & National Steel.

59. KIST, Ten Year History of Korea Institute of Science & Technology, p. 120 & H. Choi (1980), p. 68.

60. For example, at the KIST's Chemical Analysis Laboratory, the management principle for quality control was to test a single lab order by three different technicians.

61. Interview with Dr. Hahn Sang-Joon on April 10, 1981.

62. Y. Ahn, p. 121. Parenthesis added.

63. The Hankuk Ilbo, Seattle ed., October 10, 1990.

64. James P. Blackledge, "The Potential for Contribution of R & D to the Production System," in Mary Pat Williams Silveira, ed., Research and Development Linkages to Production in Developing Countries, United Nations Science and Technology for Development Series (Boulder, Colorado: Westview Press, 1985), p. 36.

65. The Hankuk Ilbo, Seattle ed., August 20, 1991.

CHAPTER SIX

KIST R & D, TECHNOLOGY TRANSFER, AND INDUSTRIALIZATION POLICIES OF KOREA

Introduction

A weak linkage between R & D and production is a universal problem regardless of the level of industrialization. Also, the high mortality rate of research projects is quite common no matter who performs R & D (industry or government R & D centers). Edward B. Robert in the early 1960s described the seriousness in these terms:

> ...The average experience of 20 companies in the chemical industry shows that only one successful product results from every eight projects that go into research. Similar situations seem to be present in all industry. Survey results covering more than 100 major companies show the median failure rate to be about 67%. ...In addition to the high failure rate, managers face an extremely long lead time before research pays off. ...The government's problems with research and development are even more evident. For example, ...The current lead-time from conception of a new weapon until its delivery is 7 to 8 years here in the United States. Russia does a comparable job in 5 years.[1]

The situation did not improve through the 1980s, particularly that of multi-purpose public R & D centers in developing societies, which suffer from selling research results to industry.[2]

Nonetheless it is important to inquire into <u>why</u> KIST has experienced a weak linkage problem from a policy analyst standpoint. The key issue of this chapter is that in the explanation of KIST R & D performance how important, other than KIST's R & D management, are the environment variables?

The environment variables are operationalized as MOST's technology development policies for the demand side of technology (i. e., towards industry), Korea's policies for industrialization and technology transfer ("implicit" technology policies), the international system of technology transfer, and the president-centered Korea's policy process.

The purposes of this chapter are to inquire into the following. First, how important are the dynamics of MOST's explicit technology policies as well as KIST's R & D management in understanding the causal relationship between policy goals and policy outcome? Second, do Korea's industrialization polices and technology transfer function as "blind forces" for and "run against" KIST's R & D, as often argued in development literature? And finally, what roles have Korea's bureaucratic-authoritarian policy process played, especially when conflicts of interests arose between KIST and TNCs?

KIST R & D Management

Local Views of KIST R & D

In the analysis of the weak KIST-production linkage, there are several explanations which view KIST itself as the central cause of the problem. Local industry has its own explanations for this phenomenon: 1) KIST researchers are too theoretical and do not know, nor, spend enough time to understand the practical problems of industry; 2) KIST's physical facilities are not well equipped; and 3) the cost of contract research with KIST is too high--often heard is, "We can get a Japanese expert for very much less."[3] The industry's ambivalent, "love-hate" attitudes toward KIST prevailed in the 1970s. Especially, industry's criticism mounted beginning in the late 1970s when large corporations began to set up their own in-house R & D facilities. The gap between KIST's R & D and industrial "needs" is a widely heard criticism and some people in local industry even wondered whether KIST as an industrial research organization should continue to exist.[4]

These criticisms were well recognized and often shared by others in the local S & T community. An expert on Korea's S & T system bluntly pointed out that "the nature of KIST R & D projects was too short for big corporations and was too expensive for small business."[5] KIST too was aware of those criticisms.

KIST's weak engineering capacity was also an issue often pointed out as a major bottleneck of KIST R & D by industry. During my field research at KIST, I inquired without much success about "how many KIST researchers and technicians have industrial experience other than academic degrees and teaching experience prior to their employment at KIST?" No data was available on this issue. Nonetheless, KIST's Personnel Division manager revealed the difficulties involved in the recruitment of capable engineers from the overseas Korean community: for example, KIST management gives top priority to degree holders (Ph.D.) rather than those with industrial experience in its recruitment practices.[6] During my employment at KIST, I, in fact, witnessed many top-level engineers with high research productivity who had enrolled in local universities for Ph.Ds. The same pattern was also found among the junior, and middle-level researchers and engineers who would either quit their jobs at KIST to pursue higher degrees abroad or at home. The traditional, Confucian culture of "literacy-first" dictates every sector of Korean society, and KIST has failed to escape from that framework.

Occasionally, KIST's R & D management itself was also a target of accusations that it is responsible for, at least partially, the divorce of KIST's R & D from industrial needs. Following are a few examples often pointed out as problematic:

a) The scientists-turned KIST top managers lack industrial experience and thus were "ignorant of the toughness" of the business world, and their "loose management" (i. e., which has never fired inefficient R & D personnel) was not appropriate for an R & D organization like KIST.[7]

b) The operation of KIST's R & D management system was also at issue. The selection criteria of research projects at KIST (for those Government Endowment and KIST In-House projects, for example) do not reflect industrial needs. One of my interviewees, a senior level researcher at KIST revealed his experience that one of his research proposals was denied repeatedly by KIST's research project review committee whereas his other proposal, a more personal academic interest-oriented one, was approved for funding. Ironically, the denied project later got funded and became a big hit in industry with successful commercialization.[8]

c) KIST's research autonomy from the interference of government control and KIST's cost-accounting system drove, although it was not intended, top managers and chief researchers to consider financial security as a prime concern of business. Heads of laboratories, for example, literally became salesmen. Obtaining money for the survival of labs, therefore, seems to be practically more important than industry-need oriented technology development.

KIST's Approach to R & D Management

Despite these criticisms, building and maintaining of a close KIST-industry relationship have been major concerns of KIST's management from the very outset of KIST's operation. Various measures have been adapted as discussed in the previous chapters (i. e., the appointment of industrial representatives in the KIST BOT meeting, conducting the nation-wide, cross-sectional industrial survey research upon which KIST's organizational structure has been developed, etc.). In addition, the "confidentiality obligation" has been required of KIST employees by law (KISTAI and AAKIST) to protect industry. By this measure, KIST employees shall not leak or disclose to others, nor fraudulently use, secrets acquired in connection with their duties. Furthermore, KIST's management stressed that KIST's R & D should avoid conflicts of interest among industrial firms (i. e., KIST's refusal of a research contract if the project would duplicate similar technologies already available in production by other local firms). Overall, these measures were well designed as an attempt to link KIST and industry and they were quite successful in the early operational phase of KIST in bringing industry's attention to KIST's R & D. However, their actual impact on the KIST-production linkage is limited. The problem of the weak KIST-industry linkage in part comes from KIST's failure to adapt itself to a changing working environment wherein local industries experienced a rapid expansion with a new industrial structure and new R & D system at the firm level.[9] To a certain extent, KIST management admits it. KIST president Hahn Sang-Joon wished KIST could have repeated the cross-sectoral industrial survey on a regular basis to keep up with industrial needs, which KIST failed to do due to a lack of financial resources.[10]

As KIST moved into full operation in the 1970s, commercialization of KIST R & D results in the local production system surfaced as a serious concern of its management. For many of KIST's industry-sponsored R & D results have not been fully utilized in production by sponsoring firms even though they were technically successful. Especially, the commercialization rate was very low for the know-how resulting from KIST's in-house projects, and the government-sponsored "Package Deals" projects (although one third of KIST's patents obtained before the merger period were the result of them!).

KIST management's diagnosis of the weak KIST-industry linkage was as something internal to industry (although external factors such as Korea's rapid industrialization, technology importation were not undermined), which can be summarized as follows[11]:

1) Low technological level of industry: Lack of engineering ability, thus incapable of scaling up R & D results for commercial production (pilot plants) by themselves.

2) Lack of entrepreneurship by local firms.

3) Or, to be more specific, lack of financial resources on the part of firms to use KIST-developed technologies in their production.

In fact, my field study confirms that Korean industry's technological level in the 1960s and 1970s was too low to fully utilize KIST, nor were they in interested in maximizing KIST services, either. There were wide-spread rumors that an important KIST patent was sold to foreign firms due to the lack of interest by local firms who could utilize it. R & D expenditures spent by local firms during 1970-1974 were a mere 17.98 billion Won (about 30% of the public sector R & D spending). Beginning in 1977, firms experienced a major boost in R & D spending, and a total of 182.3 billion Won was spent on R & D during the 1975-1979 period (about 58.9% of the public sector R & D expenditures).[12] And yet, funding was still a serious factor. The small size of R & D budgets constitutes only part of the issue. Perhaps more important is to look at the way R & D which failed to encourage local R & D was financed. Before turning to this issue, however, we will inquire into KIST's approaches to problem-solving.

Two approaches were taken by KIST's management to solve and to strengthen the KIST-industry linkage. First of all, KIST provided its industrial clients with extended services, both technical (i. e., pilot plant, "turn-key" type technologies) and non-technical services (i. e., techno-economic survey for marketing). Secondly, KIST's management took another, more aggressive, approach by creating the Korea Technology Development Corporation (K-TAC) in 1974 as its solely-owned subsidiary company with 20 million Won in capital.[13]

The purpose of K-TAC was to facilitate the commercialization of KIST's R & D results (and other domestic and foreign know-how as well) in Korea. K-TAC's primary target was those R & D results sponsored by

Government Endowment and KIST's In-House projects, although it later further broadened its scope to specialize in the creation of small and medium scale technology-intensive manufacturing firms as new business ventures in Korea.[14] Given Korea's situation as noted earlier, K-TAC attempted to tackle directly problems of engineering, financing and entrepreneurship. K-TAC and industry joint venture firms were created. Also, managerial as well as technical expertise was provided to firms by dispatching KIST staff until commercialization successfully occurs. K-TAC's direct involvement in equity and management is to assure local industry of "technical certainty" of KIST-developed technologies. Work of K-TAC in the 1970s also reveals that K-TAC's involvement provided a market testing function (i. e., market protection). This issue will be further discussed later in the chapter.

By 1980, K-TAC had commercialized ten KIST-developed technologies. It had grown to 700 million Won in capitalization, and its capital expanded to a total of 6,400 million Won as of June, 1989. Seven K-TAC subsidiary companies were created by the end of 1980 (four in chemistry/chemical engineering fields) of which six are still in operation whereas one company was sold to a local firm. The operations of K-TAC subsidiaries are quite positive: A total of 445 persons were employed, $18.5 million/year worth of import substitution occurred, and they began to export products as of 1978.[15] By 1987, thirteen new companies were created by K-TAC's equity participation (about 1.8 billion Won has been invested by K-TAC) of which all but two companies utilized KIST-developed technologies. In addition, K-TAC has also functioned as an intermediary broker in transferring KIST-developed technologies to local industries, although the number of such technologies transferred is yet small: Sixteen cases as of 1987.[16]

Financial arrangement is another important element of K-TAC's operation in addition to its direct investment in joint venture firms. Funds necessary for commercialization were arranged through cooperation with local financial institutions such as Korea Development Finance Corporation (KDFC), Korea Credit Guarantee Fund, and Technology Development Fund of the Korea Development Bank (TDFKDB). Such an arrangement was very significant when we consider the Korean situation in the 1970s when local financial institutions had been very reluctant to finance R & D projects. This will be discussed in the following section.

Structure of Technology Policy in Korea

Information gathered about KIST's management as noted in the previous section reveals that KIST management is to a certain extent responsible for the weak KIST-industry linkage problem. However, when we look at the environment within which KIST operates, effects of external factors seem to have been more significant than KIST's management _per se_.

To Jorge Sabato (chapter two), a successful technology development policy would be able to link three vertexes, research, production, and the policy-making body. What parallel policies have been pursued by MOST to strengthen KIST-industry linkages, and what are their limitations and why? This section will discuss the dynamics of Korea's technology policy and the mode of government intervention in industrial R & D, as well as how they have affected KIST's R & D.

R & D Financing Policy

When local industries suffer from scarce financial resources for R & D, government intervention or support in R & D financing could be a decisive factor in stimulating local R & D, thus strengthening the KIST-production linkage. The mode of government intervention in the local R & D financing system, however, clearly indicates the failure of Korea's explicit technology development policy in building a strong linkage between the local R & D community (such as KIST) and local industry.

The government has been the major source of R & D investment in Korea and accounted for about 70% of the total R & D investments of the country in the 1970s. Yet, between 1974-1980, for example, the nation's total R & D investment represented on average a mere 0.56% of GNP. Noteworthy is the heavy concentration of such a small R & D budget in the supply side of technology as discussed in chapter one (the share of the government-endowed strategic R & D institutions in national R & D budget was on average 70.3% during 1975-1980, and 64.2% during the 1981-1985 period).[17] As such, the small size of the R & D budget itself and the manner in which it was allocated (primarily on public R & D infrastructure-building), left few financial resources for R & D to stimulate local industry.

Furthermore, when the funding patterns for R & D are analyzed, the contribution of public funds for technological innovation is extremely limited. The structure of Korea's R & D financing shows a clear division of labor between public, non-financial institutions, and financial institutions. Among the different stages of R & D (ranging from basic and applied research, development, mass production to marketing) the public funds are heavily concentrated on the upstream of R & D (basic and applied research and development) whereas private financial institutions tend to spend on downstream technical activities (i. e., plant construction, production) and marketing.[18]

The government's R & D investments are made by various ministerial sources mostly in the form of R & D grants. The Korea Science and Engineering Foundation (KOSEF), under the budgetary control of MOST, provides grants for basic and applied research. The Academic Research Promotion Fund, administered by MOE, also provides grants to academic institutions. The Endowments for Public Sector Institutes under the auspices of MOST are the largest R & D investment arm through which such costs as construction and operation expenditures of public R & D institutions are met. In other words, in long process of technological innovation, public funds are concentrated in the earlier stages of technological innovation (basic & applied research, and development stages). In contrast, private sector financial institutions which represented about 30% of the total R & D investments of the nation in the late 1970s were the primary funding source of the later stages of technological innovation (i. e., production, marketing, etc.) that require higher capital investments. This observation, however, does not necessarily mean that public funds ignored industry in providing direct incentives to the later stages of technological innovation. As a matter of fact, public funds were used to finance the riskier stage of technology development processes (i. e., production) whereas banking institutions assumed the less risky stage (i.e., marketing). A study on the Korea's R & D system finds that:

> Private commercial banking institutions, except a finance company (KDFC) which provided venture capital, have never participated in financing technology development efforts of Korean industry. ... This implies that commercial banks behave in such a way to maximize their earnings in short-term. The traditional conservatism of banking institutions does not allow the

> banks to share the risks involved in technology development of industry. Even the development banks, primarily urged by the government, have exhibited a heavier concentration of their financing on the stage of marketing (77.6%) rather than that of mass production technology development which has a relatively higher risk.[19]

At MOST, the Matching Funds system was established to encourage industrial technology innovation. In 1977, MTI established the Subsidy for the Prototype Development of Machinery to subsidize industry in the development of prototype machinery which would substitute for imported machinery. Various tax incentives (i. e., The Technology Development Promotion Act of 1972) were also provided by government as discussed in the previous chapter.

However, neither public funds, nor R & D financing systems developed by private sector financial institutions were able to make any crucial impact on linking local R & D (i. e., KIST's R & D) to production system. Nor were the government's other incentives (i. e., tax benefits on R & D expenditure). Several reasons explain this. First of all, the amount and duration of financial support provided by both government institutions and financial institutions has been either too small or too short to bring any substantial results. Under such finance support systems, small and medium firms (SMFs) with employees of 300 or less became major clients whereas large corporations were left out. In the case of the Matching Funds available through MOST, about two third of the funds went to SMFs, and 90% of MTI's

Subsidy for the Prototype Development of Machinery was taken by SMFs.[20] A large portion of KIST's clients are also SMFs. Second, conservative management practices of financial institutions often discouraged the entrance of new technology-intensive SMFs into the market. In case of TDFKDB (which is an authentic financial instrument for industrial technology development in Korea), for example, only tangible facilities could be the object of a loan and taken as collateral. Third, more importantly, local industry showed little interest in government incentives in its effort to link KIST-industry. For example, although corporate income tax deduction is allowed to local firms entering into research contracts with KIST, and KIST advertised this tax benefit, local firms were "insensitive" to such advantage.[21]

The lack of interest by firms in government incentive measures to spur industry's technological innovation is certainly a problem to a technology supplier such as KIST. But it is far from unique to KIST and to Korea. Such worldwide government incentive measures have been proven to have very limited impact on firm innovation. Studies of industrial firms in selected industrialized countries find that firms often perceive government actions such as general legislative, fiscal and regulatory actions (i. e., the general business climate and general tax programs) as more important than technology in their decision-making.[22]

In the Korean case, according to Linsu Kim, the cause of this problem is "due mainly to the absence of measures to create competitive markets that demanded innovations and also to high interest rates charged to R & D activities relative to other financing."[23] Other studies support this view. Research done on Korea's R & D financing system as a matter of fact notes that the advantage of long-term loans available to firms in the importation of foreign technologies was one of the major reasons why local firms prefer foreign technology to KIST's comparable technology.[24] Another study shows that the highly protectionist approaches taken by Korea's industrial policies reduced the level of competition among firms, thus reducing the interest of industry in technology development. In order to develop local industries, particularly in the heavy and chemical fields, the Korean government allowed a monopoly or near monopoly in certain products by a limited number of firms. This practice not only protected local firms from competition with foreign firms, but also among local firms themselves. These industrial policies certainly discouraged local firms' investment in technological matters.[25] Suggested implicitly in these findings is that Korea's industrial policies made by ministries other than MOST regulate industry directly in their choice of production technologies. These views are critically important in understanding the interrelationship between domestic R & D and Korea's industrialization, and an inquiry into this issue will follow shortly.

The analysis of the R & D financing system, in sum, clearly indicates the strength and weakness of explicit technology policy in Korea: whereas government-KIST linkage is strong, government's effort to link KIST-industry is weak. Without an in-depth analysis of the possible impact of implicit technology policies on KIST R & D it may be premature to draw a conclusion about the cause of weak KIST-industry linkage. However, it seems that explicit technology policies *per se* which disproportionally distributed government R & D resources to the supply side of technology (strategic R & D institution-building), and the R & D financial system are in part responsible for it. The importance of K-TAC is then found not simply in its role as a promoter in the commercialization of KIST R & D, but also as an example of KIST management's organizational dynamics to supplement weak, explicit technology policy on KIST-industry linkage.

Industrialization and Technology Transfer Policies

Implicit technology policies exert more direct influence on industry's decision-making on the choice of technology whereas explicit technology policies in Korea have been carried out in relative isolation.[26] Of particular interest is Linsu Kim's analysis which asserts that government's failure to create a competitive market in local industry is the prime cause of local firm disinterest in technological development. This ultimately affected KIST-industry linkage. My discussion in this section will focus on the relationship between 1) Korea's industrialization and technology transfer policies, and 2) technology transfer and KIST R & D as they are often targets of controversial debates in the technology development literature.

International technology transfer may take place in many different forms and channels. Common methods are via foreign licensing, direct foreign investment, capital goods import (CGI), technology consultancy (TC), and others such as acquiring technological know-how through journals, international conferences, overseas training, reverse brain drain, and so on. In this section, however, the analysis will be limited to technology transfer via FL, DFI, CGI and TC due primarily to data availability.

1) Industrialization Policies: An Overview.

Korea experienced two important changes in its industrialization policies in the 1960s and 1970s, which resulted in significant inflow of foreign technologies to Korea. During the 1950s, Korea's industrialization was characterized as inward-looking, heavily leaning on import-substitution (IS) to protect infant local industry (i. e., high tariff duties & quantitative restriction of imports, etc.). The first step to alter such policies took place in the early 1960s when export-promotion policies (EP) were vigorously pursued as a parallel policy to (if not a replacement for) IS in order to achieve both high economic growth and increased employment. Under the first and second five-year economic development plans (1962-1971), much of Korea's industrialization efforts were centered on the development of selective industries such as fertilizer, cement, oil, light industries for the domestic market, and the development of social overhead capital facilities (i. e., power plants, roads, harbors, etc.). There also developed some light industries aimed at foreign markets (i. e., textiles, plywood, clothing, etc.) and by the mid-1960s exports of such manufactured goods rose sharply.

The second important shift in Korea's industrialization strategy was observed in the early 1970s when the heavy and chemical industries began to expand under the Korean government's aggressive push for the development of "strategic industries" such as machinery, metal, electronics, petrochemicals, shipbuilding, etc. During the third and fourth economic development plans (1972-1981), in particular, light industries for the domestic market were developed into export industries. There was also a significant expansion of industries producing raw materials and intermediate materials, which undoubtedly contributed to solving the foreign exchange problems associated with IS.

The consecutive five-year economic development plans were highly successful and Korea enjoyed a phenomenal growth in its economy.[27] The GNP per capita of $87 in 1962 jumped to $1,636 by 1981, and the annual growth rate of GNP was on average 8.4% between 1962-1981. The annual growth rate of exports between 1962-1981 was 39.4%. Commodity exports which amounted to $54.8 million in 1962 reached $21.25 billion in 1981. There also was a substantial change in industrial structure. The mining and manufacturing sector which accounted for 16.2% of Korea's all industries in 1962 expanded rapidly to 30.9% by 1981. The annual growth rate of the manufacturing sector alone was 16.5% during the 1962-1981 period. Commodity composition of exports also changed dramatically. Until 1960, most export items (about 85%) were primary products (i. e., tungsten, iron ore, raw silk, agar-agar, rice, fish, etc.). Soon, this situation witnessed a complete swing as the export-drive policies were pursued. Exports of manufactured goods in 1981, for example, comprised almost 92.9% of a much larger volume of exports, and 30.8% of GNP. An average annual growth rate of manufactured goods exports was 49.8% between 1962-1981. In the 1960s and through the mid 1970s, exports of manufactured goods in light industry grew phenomenally. Footwear, clothing, wigs and other miscellaneous goods, which accounted for a mere 3.6% of Korea's total export in 1962, expanded rapidly reaching a peak of 42.2% in 1970. In the 1970s, export of such commodities began to shrink moderately comprising 31.2% of exports in 1981. However, when we include such export items as plywood, textile yarn, fabrics and so forth, exports of labor-intensive and/or low-technology based light industrial products were Korea's major export items in the 1970s. The 1970s also witnessed a rapid and steady growth of exports of other industrial products which required more sophisticated, and capital-intensive technologies. Exports of such industrial products as chemicals, electric machinery, transport equipment (mainly ships) grew from 4.4% in 1962 to 25.4% in 1981. When the exports of iron and steel products are included, the export figure of such heavy and chemicals industrial products will be much higher.

In sum, export-led industrial policies of Korea have driven industrialization, and they have reorganized its industrial structure from light industry into heavy and sophisticated industry concentration. Export performances clearly reflect such policy changes.

During the IS phase, production technologies as well as industrial equipment were supplied primarily by the international transfer of "packaged technology" which may consist of investment capital, technicians, machines, manuals, and managers as well. The Korean government's technology import policies administered by EPB in the early 1960s encouraged the importation of "packaged technologies." Under such a policy, combined with an absence of a competing, explicit technology policy for local R & D, indigenous technological development was not an important issue to industry. More immediate concern for the business community was, as mentioned in the previous chapters, how to get foreign loans or aid which brought technologies together. Limited engineering was all that was needed for production. As will be shown in Table 6.1, during 1962-1966, whereas the total value of technology transfer via FLs amounted to $777.3 thousand, that of DFIs and CGIs amounted to nearly $339 million.

Nonetheless, the Korean government shifted toward outward looking industrialization policies, and the heavy and chemical industries inevitably led local industry to be concerned about its own technological capabilities to meet, for example, specifications required and consumer tastes in the foreign market. New technology import policies, as will be discussed below, were also created in support of industrialization. Noteworthy phenomena resulting from such policy changes and industrial behavior are:

1) Importation of foreign technologies significantly increased in the 1960s, and 1970s in particular.
2) Heavy concentration upon Japan and the U. S. as primary sources of technology.

3) Mushrooming of in-house R & D centers in local industry.

The impact of such changes, together with Korea's export-first industrial policies, on KIST was the isolation of KIST from industry. KIST has been by and large left out by both labor-intensive and/or low technology-intensive industry based exporters and the heavy and chemical industrial sectors. For, there was too little technological demand from the former, whereas the rapid expansion and the sophistication of technologies needed for the latter were beyond KIST's capacity. Furthermore, the expansion of local industry's in-house R & D capabilities, as noted in earlier chapters, together with KIST's organizational instability caused by merger and "break up" in the 1980s have also weakened KIST's comparative strength in industrial R & D.

2) Technology Transfer Policies

A brief review of Korea's technology transfer policies is in order at this point. In retrospect, Korea's technology import policies have been highly restrictive and protectionist-oriented. Involved in the regulation of technology import were multiple government offices (EPB, MOST, MTI, MOF, and other ministries as well) among which EPB, as the central office for the implementation of the Foreign Capital Inducement Law (FCIL), played the key role. The mode of government intervention in this process goes beyond, albeit diverse, what Richard Luedde-Neurath calls the "promotional" but extends to "directive" in nature.[28]

Korea's technology import policies can be traced back to January 1960 when FCIL was promulgated to regulate both FL and DFI.[29] The primary goal of FCIL was to attract as much foreign private capital as possible to fuel Korea's industrialization. Naturally, the main emphasis of the law was on provisions on foreign loans and foreign investment. There were provisions for foreign technical assistance which were treated as a part of the foreign loans/investment package but the law failed to include any provisions for technology import (except grant-type technology import) separate from foreign loans/investments. These shortcomings were corrected when FCIL was amended in August 1966 with provisions for technology import contracts. In practice, however, technology has been still perceived as part of capital by local industry. In addition to FCIL, another legal device, Engineering Service Promotion Law (ESPL), also regulates technology transfer. Under ESPL, foreign engineering service firms may provide engineering services, for no more than one year, to local firms if such services are unattainable domestically.

By classifying technology import into two categories, FCIL-regulated technology imports as "First Category Technology" and ESPL-regulated ones as "Second Category Technology," technology transfer policies in the 1960s were quite restrictive, requiring *a priori* approval from the government. EPB is authorized to give final approval of First Category technology after consultation with MOST and MCI whereas Second Category technology import requires approval from MOST. Although the import of Second Category Technology has been a popular and important method frequently used by local firms,[30] the EPB-administered First Category Technology imports have had a tremendous impact in Korea. Moreover, lucrative tax holidays allowed by FCIL in such areas as income and corporate taxes, acquisition and property taxes, dividend taxes, import duty, capital gains tax, special depreciation, and so forth were attractive enough to encourage a flow of foreign technologies into Korea. Some features of the tax holidays are as follows.

> First, ...full holiday of corporate tax and income tax is granted for royalties on imported technology for the first five years after the import and half holiday (50 percent reduction) for three years thereafter. In addition, fees paid to foreign experts invited to the country under a technology import contract approved under the FCIL are exempted from earned income taxes.
>
> Second, ... foreign investors are granted exemption or reduction of income taxes, corporate taxes and property taxes from the date of the first tax assessment as provided for under the respective tax laws. They are also granted a 50% reduction of acquisition tax on the shares they hold from the date of registration of such shares.31

The government's intervention in technology transfer is also found in its "guidelines." According to general guidelines of FL provided by the government (FCIL) in 1968, technology importation priority is given to technology that:

1) promotes exports; 2) develops intermediate products for capital goods industries; 3) brings about a diffusion effect to other sectors; and 4) sets royalties within 3% of sales and contract duration within 3 years for the manufacturing sector and that no export restrictions were allowed. Such a restrictive intervention by government in technology transfer eliminated some "poisonous clauses", and enabled some local licensees to have bargaining power.

In the 1970s, FL policies were relaxed on the terms of royalties, contract period, and other restrictive clauses in order to allow more sophisticated technologies to be imported. In 1978 and 1979, major revisions were made to encourage more technology transfer by simplifying the government's approval procedure, and lifting restrictive clauses, etc.[32] For example, except those technologies related to defense, nuclear power and those whose royalty rate was above 10% of sales or a contract period of over 10 years, the ministries concerned granted FL without consultation with other ministries. As a result, the time needed to acquire government approval was shortened from an average 6 months to about one month.[33] Such a liberalization posture and simplified administrative reform were necessary to meet the technical needs of the heavy and chemical industry development plans set forth by the Fourth Five-Year Economic Plan (1977-1981).

In the case of DFI, however, the government took different approaches. Much welcomed DFI in the 1960s by the Korean government without many restrictions fell under the tight control of government in the 1970s. It was not until 1980 that the foreign investment guidelines were substantially liberalized by the government. DFI policies in the 1970s preferred joint ventures to wholly-owned subsidiaries. Other regulations were imposed on DFI in such areas as export requirements, foreign equity participation ratios (basically limited to 50%), and minimum investment requirements which rose gradually from $50 thousand per project in 1973, to $100 thousand (1974), to $200 thousand (1975), and to $500 thousand (1979).[34]

Significantly, Korea's highly restrictive DFI policies protected Korean firms and markets from penetration by foreign firms, but they also had a negative impact on local firms in technology development matters. Protection of the local market from the invasion of foreign capital reduced competition among local firms, a situation in which technological input was not perceived by local entrepreneurs as a pressing factor to their market survival.[35] The Korean government's policy changes in the 1980s lifting restrictions on DFI clearly manifested the government's concern on this problem. As Linsu Kim notes:

> This reversal of government policy in the 1980s was caused not only by the government's concern over the deteriorating balance of payments, but also the government's long term objectives to induce transfer of

> sophisticated technologies and to promote competition for domestic firms so as to encourage them to intensify their activities for technological development.36

Importantly, KIST's industrial R & D took place within this particular policy context wherein local firms did not value technology development as a decisive tool of their business success.

Furthermore, Korea's emphasis on the development of the heavy and chemical industries, and its export-drive policies seem to have further isolated KIST from the local production system. As Table 6.1 and Table 6.2 show, technology import has significantly increased in the 1960s and 1970s, mostly in the manufacturing sector. Beginning with the first importation of foreign technology in 1962 (Table 6.1) a total of 1,973 cases of technology import (FLs) were approved by the government between 1962-1981. Technology transfer by means of FL, CGI, and TC steadily increased every year both in terms of number of cases and value. In the case of technology transfer via DFI, a similar pattern is also noticed except for a fluctuation in 1977-1981 which reflected recession. Between 1972 and 1981, in particular, 1,645 cases of FL with a total value of $547.9 million were approved which accounted for about 84% of all the FL cases and 97% of all the FL value during the 1962-1981 period. In the case of TC, 756 cases were recorded with a value of $73.2 million during 1972-1981 period. This figure

Table 6.1

Inflows of Technologies to Korea: 1962-1981

	'62-'66	'67-'71	'72-'76	'77-'81	Total
Foreign Licensings					
Cases	33	285	434	1,221	1,973
Values ($1,000)	777.3	16,257.7	96,507.5	451,391.5	564,934
Cases/year	6.6	57	86.8	244.2	37.6
Value/year	155.5	3,251.5	19,301.5	90.278.3	5,649.3
Value/case	23.6	57.0	222.4	369.7	286.3
Direct Foreign Investments					
Cases	15	164	450	197	826
Values ($1,000)	22,999	72,673	565,239	587,743	739,654
Case/year	3.0	32.8	90.0	39.4	82.6
Value/year	4,599.8	14,534.6	113,047.8	117,548.6	12,486.5
Value/case	1,533.3	443.1	1,256.1	2,983.5	895.5
Capital Goods Imports ($1 mil.)					
Value	316	2,541	8,841	29,978	41,676
Value/year	63	508	1,768	5,996	2,083.8
Technology Consultancy					
Cases	-	93*	205	551	849
Value($1,000)	-	16,978.3*	18,596.3	54,691.9	89,986.5
Case/year	-	23.3*	41.0	110.2	60.6
Value/year	-	4,199.6*	3,699.3	10,939.4	6,427.6
Value/case	-	180.6*	90.2	99.3	105.9

Note: * represents for only 4 years (1968-1971).

Source: Linsu Kim (1984), Technology Transfer and R & D in Korea: National Policies and the US-Korea Link, p. 11.

Table 6.2

Foreign Technology Payments by Fields & Year

Unit: $1,000

	Total Allowances (# of cases)	Total	Ratio (%)	'62-'71	'72-'81	'82-'88
Food	180	26.0	1.1	0.2	5.2	24.5
Textile & Chemical Textile	286	66.3	2.3	1.0	26.7	36.9
Ceramic & Cement	146	53.6	1.8	0.2	11.4	42.0
Oil Refine & Chemical Ind.	913a	496.7	16.8	7.8	172.1	316.8
Drug	133	26.3	0.9	0.2	1.6	24.5
Metal	342	110.8	3.7	1.0	54.9	54.9
Electronic & Electric Equip.	1,169	835.4	28.0	2.0	58.3	765.1
Machinery	1,434	582.7	19.8	1.1	102.8	478.8
Shipbuilding	176	126.2	4.3	-	16.4	109.8
Communication	79	78.6	2.7	1.6	22.0	54.8
Electricity	81	390.7	13.2	1.1	27.1	362.5
Construction	82	32.4	1.2	0.1	17.9	16.2
Others	289	126.0	4.2	0.5	31.9	93.3

Note: a. A discrepancy, apparently a printing error, is, corrected by the author. In addition to this figure, there are also minor (perhaps printing) errors in the MOST data.

Source: MOST, _'88 Science & Technology Annual_, p. 428 & _'89 Science & Technology Annual_, pp. 463-464.

represents 89% of the total number of cases of TC and 81% of the total TC payments made between 1967-1981. Overall, technology transfer in DFI and CGI categories also jumped in the 1970s.

Clearly, the heavy influx of foreign technologies in the 1970s corresponds with the rapid expansion of the heavy and chemical industry sector of the nation. As Table 6.2 shows, beginning in the 1970s foreign technology imports particularly in such manufacturing sectors as oil refinery, chemical, metal, electronics, electrical equipment, machinery, shipbuilding increased remarkably. Their share of the total technology import payments between 1962-1988 was 72.6%. Specifically, the manufacturing sector accounted for 68.1% of the total DFIs and 81.8% of the royalty payments between 1962 and June 1984. Such industries as chemical, general machinery, electrical machinery and electronics alone accounted for 74.8% of the total DFI and for 71.2% of the total royalty payments in manufacturing sector.[37] These statistical figures clearly reflect the Korean government's industrial strategy and the structural change of Korean industry in the 1970s. These data also inform us of what impact Korea's implicit technology policies had on KIST's R & D. Interestingly, KIST's R & D in the fields of chemistry/chemical engineering, mechanics, metallurgy/material science, and the electric/electronics fields, to a certain extent, also have been quite productive when measured by research contracts, patents and commercialization rates (Chapter five). In other words, there were clear indications on the part of KIST to keep step with Korea's industrialization pattern. And yet, with a massive flow of DFI and other forms of technology transfer, necessary to implement the heavy and chemical industry development plans, KIST was systematically forced to assume an inferior position, somewhat aloof from local industry.

Korea's export-driven policies too had negative impacts on KIST-industry linkages. They either encouraged local firms to import market-proven-and-ready-to-use technologies from foreign sources, or Korea's low-wage-and-labor-intensive commodities based export program seemed to generate little technological demand. And both of these cases seem to have caused local firm indifference to domestic R & D. Certainly, a lack of local capability is in part responsible for local industry preference for imported technologies over domestic ones. However, the market-proven-and-ready-to-use nature of foreign technologies also was an important factor in the choices of technology (domestic vis-a-vis foreign technologies). A survey done in 1975[38] of 361 local firms which imported 404 technologies (as of 1974, a total of 472 cases of technology imports were approved by the government) reveals that one third of the technologies were imported due to a lack of local capacity.

The remaining two thirds could be developed locally, but they were imported because local R & D might take too long a time for research (38.4%) or higher costs were involved in local R & D (28.8%). The same study also reports that only 19.1% (105 cases) of technologies were imported for export-promotion such as fabrics, whereas 66.7% (363 cases) were imported for the domestic market either to introduce new products or for import substitution.[39] In the case of technology transfer via DFI, exports were somewhat promoted, perhaps due to the export-promotion requirements imposed on DFIs in the 1970s. Chung H. Lee's comparative study of DFI technology transfer of U. S. and Japanese firms reports that during the 1974-1978 period, exports-sales ratio of Japanese direct investments was 49% whereas that of the U. S. was only 21%. Particularly, export performances of foreign direct investment firms in labor-intensive industrial fields were good (61% for both the U. S. and Japanese firms).[40]

Incentives attached to Korea's export-drive industrialization policies also show the possible negative impact of industrial policies on domestic R & D, although the causal relationship between the two is not as yet statistically documented. Two basic incentives, in addition to periodic adjustments of the exchange rate and the preferential interest rates, income tax reductions, and wastage allowances, etc., have been offered. Granting, for one, unrestricted and tariff-free access to the imported intermediate inputs needed in export production, and for the other, automatic access to bank loans for export activity:

> The unrestricted, tariff-free access to imported inputs establishes a free trade regime for export activities and allows producers to choose between suppliers at home and abroad when purchasing their intermediate inputs for export production. They can thus buy those inputs at world prices and suffer no disadvantage in the prices they pay for their raw materials. The access to bank loans for working capital for export production is automatic because the central bank will automatically rediscount the export loans that commercial banks make to firms. ...Would-be exporters can be easily discouraged from producing for export if the access to imported inputs and export loans is discretionary and slow. Producers in Korea are not so discouraged.41

In the implementation course of export-drive policies, export targets were set, most prominently on an annual basis, at various levels (firm, industrial sector, national), and they were carefully monitored by high officers in the government. Since 1965, the monthly National Trade Promotion Meeting has been presided over by the president of the nation himself and attended by key figures both in and out of the government (presidential secretaries, cabinet members, ambassadors, representatives from the national assembly, government banks, publicly-endowed R & D institutions including KIST president, industry, trade associations, etc.). Those high-achievers in export were publicly celebrated and rewarded (i. e., national medal of merit) by top government officials including the president of Korea, especially on "Export Day," declared on November 30, 1964 in celebration of

Korea's achievement of the $100 million export target.[42] In the science and technology field too, the government also developed an award system. Ever since 1969 when the government declared April 21 as "Science Day," 534 national medals of merit and other forms of distinguished recognition were given by the chief executive of the nation and other top officials in the government to prominent scientists and engineers. Since 1987, a new, bi-annual award system has been added to recognize scholars and researchers in the pure science field.[43] However, these science awards do not seem to be comparable to the export award in terms of political weight, publicity, and the public value given by local society. The net result of the export regime's contribution to domestic R & D was rather minimal, as one study reports:

> Rather phenomenally rapid growth of Korean industry during the past decades (1960s and 1970s) is, however, mainly attributable to the capital expansion for producing export goods under the favorable protection and incentive system of the government. ...Hence the amount of industrial investment grew at a high rate, of which little was shared for R & D activities. Industry has greatly depended on the machine-embodied foreign technologies until recently.44

As such, various kinds of implicit technology policies of Korea administered by EPB and other government offices were influential on the firm's behavior in the choice of technology, and they have affected Korea's domestic R & D endeavors. EPB, equipped with the power of budget allocation, in particular has played a crucial role in Korea's technology development. As one of my interviewees commented, S & T policy issues also belong to the (EPB) "economist's territory."[45] MOST's influence, on the other hand, on industry was very limited. Worse, MOST's explicit technology policies kept on expanding strategic R & D institution-building, thereby slicing the already scarce R & D resources (i. e., manpower, finance) into smaller portions among a number of R & D centers. Competition among the suppliers of technology has consequently been intensified while consumers (local firms) showed indifference to domestic R & D. The Korean government policies of restrictive DFI and R & D infrastructure-building in the 1970s themselves are not to be blamed, for in the long run they were wise policy approaches for the benefit of Korea. Korea's particular path of industrialization as discussed earlier might have been necessary for its economic survival, if its negative spin-off effects on social and political development (i. e., inequality, political rights and so forth) are not questioned. However, KIST's industrial R & D was affected, adversely, by these particular policy approaches.

Analysis of technology transfer (FLs) in Korea shows a heavy dependence on Japan and the U. S. as primary sources of technologies. During 1962-1981, as Table 6.3 shows, the number of technologies imported from Japan accounted for 56.9.% of the total technology import in Korea, followed by American technologies (23.6%). Although the degree of

Table 6.3

Technology Import by Year & Country: 1962-1988

Unit: # of Cases approved.

Year	Country				Total
	U.S.A.	Japan	Germany	Others	
1962-1966	13	11	4	5	33
(%)	(39.4)	(33.4)	(12.1)	(15.1)	(100)
1967-1971	61	203	6	15	285
(%)	(21.4)	(71.2)	(2.1)	(5.3)	(100)
1972-1976	90	280	13	51	434
(%)	(20.7)	(64.5)	(3.0)	(11.8)	(100)
1977-1981	301	629	70	221	1,221
(%)	(24.7)	(51.5)	(5.7)	(18.1)	(100)
1962-1981	465	1,123	93	292	1,973
(%)	(23.6)	(56.9)	(4.7)	(14.8)	(100)
1982-1986[a]	515	1,074	122	367	2,078
(%)	(24.5)	(51.7)	(5.9)	(17.6)	(100)
1987-1988	348	596	76	235	1,255
(%)	(27.7)	(47.5)	(6.1)	(18.7)	(100)
1962-1988	1,328	2,793	291	894	5,306
(%)	(25.0)	(52.6)	(5.5)		(16.9)

Note: a. A minor computation error was corrected by the author.

Source: EPB, Kisul Doip Hyunwhang 1962-1980 (The State-of-the Art of Technology Importation) (Seoul: EPB, 1981. 3), P. 13; MOST, Science & Technology Annual 1983, p. 350 & Science & Technology Annual 1989, p. 459.

Korea's technological dependence on Japan lessened in the 1970s and 1980s (to 47.5% during the 1987-1988 period), when Korea imported heavy and chemical industry technologies from the U. S. and Western Europe, technology import from Japan played a major role in Korea (2,793 cases or 52.6% of the Korea's total technology imports between 1962-1988). During the late 1960s through the mid 1970s, in particular, Japan, as Korea's main technology source, accounted for well over two thirds of total technology imports.

Reasons for such dependence stem from the particular economic ties of the two countries, local business culture, and Korea's industrial structure.[46] First, due to close economic ties, especially in capital investment, Korea's imports of raw materials, parts and components, and industrial equipment came primarily from Japan. Second, due to Korea's geographical proximity and its colonial history many Korean entrepreneurs (particularly older generations) are able to speak Japanese, thus contributing to closer business ties with Japanese firms. It is not uncommon to hear local entrepreneurs who are the key decision-makers in technology importation saying, "I by myself obtain technologies in Japan."[47] Third, Japanese technologies are already altered, modified, and adopted from the original Western sources suitable to Japanese industrial situations. Technologies imported from Japan therefore are easier for Korean industries to use without much additional work for adaption compared to those directly imported from Western sources. And fourth, technology imported from Japan is relatively cheaper than that from other sources such as the U. S. As Table 6.4 shows, royalty payments to Japan during the 1962-1981 period amounted to a total of $203.5 million (36%), and $923.3 million (30%) during 1962-1988 period. These figures contrast with the royalties paid to the U. S. which totaled $188.9 million (33.4%), and $1,361.6 million (44.2%) respectively.

The different price tags of Japanese and American technologies reflect the different kind of technologies transferred to Korea. Analysis of DFI in Korea during the 1962-1972 period notes that Japanese DFI was clustered onto the labor-intensive and low-technology industries, whereas American DFI was concentrated also in the labor-intensive but divided equally between the low-technology and high-technology industries. DFIs between 1974 and 1978 indicate that American DFI was more capital-intensive and high-technology oriented than Japanese DFI which was concentrated in the labor-intensive and high-technology industries.[48] Another study reports that "American DFIs are involved in larger scale and more capital intensive projects than Japanese DFIs, and ...American FLs are more technologically sophisticated than Japanese FLs."[49]

From the above description, we can infer that technology transfer from Japan, in particular, played a

Table 6.4

Foreign Technology Payments by Nation and Year

Unit: Million $

Year	Country			Total
	U. S. A.	Japan	Others	
1962-1966 (%)	0.6 (75)	-	0.2 (25)	0.8 (100)
1967-1971 (%)	7.8 (48.1)	5.0 (30.9)	3.4 (21.0)	16.2a (100)
1972-1976 (%)	21.3 (22.0)	58.7 (60.8)	16.6 (17.2)	b 96.6 (100)
1977-1981 (%)	159.2 (35.3)	139.8 (31.0)	152.4 (33.7)	451.4 (100)
1962-1981 (%)	188.9 (33.4)	203.5 (36.0)	172.6 (30.6)	565.0 (100)
1982-1986 c (%)	602.8 (45.9)	323.7 (24.7)	386.1 (29.4)	1,312.6 (100)
1987-1988 (%)	569.9 (47.5)	396.1 (33)	234.0 (19.5)	1,200.0 (100)
1962-1988 (%)	1,361.6 (44.2)	923.3 (30)	792.7 (25.8)	3,077.6 (100)

Note: a, b, c. Apparent computation errors are corrected by the author.

Source: MOST, _'89 Science & Technology Annual_, p. 562.

"substitution" function of local R & D, adversely affecting KIST R & D. If, for example, technologies imported from Japan had been expensive and had required a significant amount of adaptive research to localize suitable to Korea's industrial context, it is the author's strong belief that local industry's demand for local R & D centers such as KIST would have increased. On many occasions, however, the easy access to Japan's ready-to-use-and-market-proven technologies, further accelerated by the particular form of Korea-Japan economic/cultural ties seem to have discouraged local R & D center's potential. Japan's transfer of mature technologies to Korea was mutually beneficial to both countries' economies, though. Korea, as well as Taiwan and the ASEAN countries, have served as wonderful outlets for Japanese mature and declining industries (particularly small and mid-size Japanese firms) thereby allowing Japan a smooth structural adjustment for its industry.[50] Given Korea's receptive R & D infrastructure during the early phase of industrialization, the economic benefits of Japan's transfer of labor-intensive, mature technologies by small and medium size firms seem to surpass some problems associated with it as some argue (i. e., economic dependency).[51] As noted earlier in this chapter, however, the local business community often said "we can get a Japanese expert for very much less" whereas "local R & D costs more than technology imports." Japan's supply of low level technologies seems to appear as a competitor to KIST R & D. My view, however, is not derived from the "zero-sum" game perspective which may argue that if not for foreign technologies then KIST could have taken care of all local technologies needed for production. Nonetheless, Korea's country specific situation wherein KIST is lodged seems to have negatively effected KIST's potential for industrial R & D.

KIST Technology vs. Technology Importation: Mode of Government Intervention in R & D

As KIST began to introduce new technologies into the local market in the 1970s, KIST was confronted by many challenges, directly and indirectly, from foreign companies who supplied similar kinds of technologies. Confrontations were also noticed between local firms that imported technologies from foreign sources and those that used KIST-developed technologies. Confrontations brought on government intervention to solve problems, sometimes through legal measures, but more importantly using presidential power. The nature of presidential power involved in the commercialization of KIST project cases reveals that direct and visible exercise of power is not always necessary. Indirect and implied power was equally important. This section attempts to analyze two things. First, the nature and the dimension of government power involved in the clash of interests between domestic R & D vis-a-vis technology import, and second, the global technology transfer system and the barriers it imposed to local R & D. Two case studies will be analyzed: the HOP (Hydroxyl Pyrimidine) case and the polyester film case.

<u>The HOP Case</u>

HOP is used for the preparation of active pesticides and other chemicals, and it is an essential intermediate raw material for the production of the rice insecticide, Diazinon. As the following diagram 6.1 shows, the production of Diazinon requires HOP and an other primary chemical ingredient (CTD), and, significantly, HOP, the crucial ingredient in Diazinon production, is highly oligopolized by only a small number of firms in the world.[52] N. Co. in Japan and C. Co. in Switzerland were the only ones who had the capacity to manufacture HOP, and later, M. Co. of Israel joined this oligopoly family. And the world's HOP market was literally under the control of the two firms from Japan and Switzerland. HOP production requires two chemical ingredients, known as IBN and MAA (Diagram 6.2).[53] Again, IBN and MAA are also oligopolized by a few firms (American and German companies) and they are manufactured only on an order basis from HOP producers.

Korea's demand for Diazinon was high and the annual local sales volume reached an average of 4 billion Won in the mid-1970s. Diazinon had been locally manufactured by S. Co., one of the major agrochemical manufacturers in Korea, Diagram 6.1

Structure of Diazinon Production

HOP	+	CTD	$\longrightarrow$	Diazinon
Oligopolized by: Japan's N. Co. , Switzerland's C. Co. & Israel's M. Co.in the int'l market		Easily available in the int'l market		Korea's S firm manufactured it with HOP & CTD imports from Japan

Diagram 6.2

Structure of HOP Production

IBN	+	MAA	------>	HOP
Oligopolized by: America's E. Co. & W. German's A Co.		Oligopolized by a few firms		
&		&		
Manufactured only on an order basis		Manufactured only on an order basis		

which monopolized the local Diazinon market. S. Co. imported HOP and CTD from Japan. Japan's N. Co. had a license agreement with S. Co. to transfer Diazinon production technology but under such restrictive conditions that a) S. Co. was not allowed to manufacture HOP, and b) S. Co. could export Diazinon to Japan (about $200 million worth per year) but could not compete with the Japanese manufactured Diazinon elsewhere in the world market. As of the mid-1970s, the S. firm imported over 600 tons of HOP from Japan, worthy of $500-$600 million. The import price of HOP as of 1976 was between $8.30 and $8.40 per kilogram.[54]

KIST first began research on agrochemicals sometime in 1975. Upon request of H. Co. (the largest agrochemical manufacture in Korea with a market share of 40%) in March 1976, a research team led by Dr. Chae Young-Bok (a German educated researcher and ex-professor in the U. S.) began to develop HOP technology. It was an interesting project for KIST, for HOP had high value in import-substitution and its potential strength in the international market. Nine months later, the KIST team had successfully tested a pilot process. In March 1977, HJ. Co. was created to manufacture HOP locally with 300 million Won capital jointly invested (50%:50%) by H. Co. and K-TAC (KIST subsidiary). Three years later, HJ. Co. became H. Co.'s solely owned subsidiary. The first HOP production started in 1978 with the chemical synthesis technology developed by KIST. The local production of HOP by HJ. Co. resulted in $500 million import substitution and employment of 80.[55] Later, HJ. Co. innovated another KIST-developed technology, Captapol (the second development in the world after the U. S.) in the early 1980s, and the company expanded with a sales volume (HOP and other products) of 13.5 billion Won, and with 198 employees as of 1983.[56] HJ. Co. also began to export HOP to the U. S. market in 1980 ($0.6 million each in 1980 and 1981). Importantly, local farmers were supplied with HOP at proper the time whenever need arose (on average it took three months to import HOP from foreign market, thus often missing the critical time for the insecticide spray).

The commercialization of HOP was not an easy task, however, for it challenged directly the global technology oligopoly system, and it required bargaining power. To state a conclusion first, many observers note that if a private firm, not KIST, had developed HOP technology, it would have been extremely difficult to survive in the market even if it succeeded technically, especially when the HOP oligopoly firms, when challenged, responded with dumping threats. KIST too had a very hard time. During the research period, KIST kept the HOP project secret from the public and the press, for it "feared the potential challenge from the international cartel of HOP manufactures."[57] As soon as the news of the birth of HJ co., was released to the public, a series of "threats" were applied against Korea.[58] First, there were attempts to block off the supply of HOP raw materials. HOP producers from Japan and Switzerland pressured America's E. Co., German's A. Co. and others not to supply IBN and MAA (see Diagram 6.2) to HJ. Co. Second, HOP producers from Japan and Switzerland then offered a joint venture to block off marketing. An HJ. Co. director recalled that:

> Interference by representatives of C. Co. was enormous during the construction of HJ. Co. either through official mail or direct visits. They even threatened that they would sell HOP technology. Both C. Co. and N. Co. offered a joint venture. But they added one condition to their offer...HOP should not be exported elsewhere in the world market. ...When their offer was rejected, C. Co. representatives even said that they wished the HJ. manufacturing facilities would be burned out.59

And third, they threatened to dump the product in the Korean market. Since the profit margins of specialty chemical products are large, foreign HOP suppliers could have lowered the price if they wished to defeat the new competitor. Agrochemical producers in Korea, on the other hand, can not compete with foreign firms as far as price is concerned, due to Korea's heavy reliance on foreign raw or intermediate materials.[60] Free market competition, no matter how reasonable it may sound for the benefits of the consumer (i. e., low price), does not seem to work in Korea, according to my interviewees in industrial firms. They argued that when local firms' sources of technology differ, say, one using imported technology, and the other one locally developed, the latter's market survival rate is slim, for the former may receive all sorts of supportive protection from its technology supplier.[61] Those field workers engaged in the commercialization of KIST-developed technologies clearly pointed out the need of strong support from government. The conflicts were resolved under the conditions that a) HJ. Co. would only manufacture HOP, not Diazinon thus allowing the established order (S. Co. as the only local Diazinon producer), and b) HJ. Co. may export HOP to foreign markets.

In addition to K-TAC's financial involvement in HJ. Co., KIST guaranteed technical certainty and market testing. KIST dispatched three technical and administrative staffers to the newly created company and provided continued technical service, "with a minimum charge or no fee at all," until production was on the right track. They were highly motivated, "patriotic," and as KIST-dispatched technical staffers recalled, they worked 16 hours a day until the construction was completed, which was accomplished within a very short time period.[62]

KIST's involvement in the HJ. Co. case also reveals that KIST played an important role as a political patron when conflicts of interest arose between HJ. Co., and S. Co., and foreign HOP providers. When the KIST-developed HOP was challenged by foreign oligopoly, KIST used diverse methods to counteract it. Often it emphasized the fact that KIST was under the strong patronage of president Park. K-TAC's president, Yoon Yeo-Gyeong, often reminded C. Co. representatives during their meetings that president Park was the founder of KIST (by pointing to Park's picture hanging in the conference room), and if necessary, KIST would contact the Blue House for help.[63] KIST never appealed directly to the Blue House for assistance regarding the HOP case. But given Korea's powerful, president-centered political system, dropping the president's name in itself has great political value, and it has in fact functioned as an important tool in political bargaining. KIST certainly seemed to maximize this political situation and the implied political message seemed to be clearly delivered to foreign challengers, restraining them in negotiations. When the local production of HOP faced the dumping threat, KIST sought protection from the government. MOST minister, Choi Hyung-Sup, declared the KIST-developed HOP a locally developed technology, therefore subject to legal protection as stated in the technology development laws. He also reported the case at a cabinet meeting. His intention seemed to be to publicize the issue and obtain support among key policy-makers in the government to protect domestic R & D and its commercialization from the threat of imported technology.[64] Nonetheless, dumping has never occurred, and the price was stabilized: per kilogram price was $7 in 1977 and $8.40 in 1981 (the same price level as of 1976).

HJ. Co. officials did not think that the successful commercialization of KIST-developed HOP was due to any direct, or extraordinary protection from the government. Government supports were, they believe, rather at a general level allowed by law (i. e., tax benefits, bank loans for commercialization, declaration of HOP as a locally developed technology, import tariff duty free, etc.). In a sense, HOP did not receive full support from government because farmers' interests were involved, compared to other locally developed non-farmer-oriented commodity technologies which would have been treated more favorably with a better package of incentives or supports from government. To MAF, the primary concern was how to supply cheap agrochemicals and increase rice production, which was not necessarily compatible with MOST's interest in the development of domestic R & D.[65] If HOP foreign suppliers had waged a dumping war against HJ. Co., local support would have been uncertain. KIST-developed HOP has nonetheless received favorable, if not special, financial, and administrative support, and was legally protected from the importation of HOP for a limited time (for 18 months). Officials of HJ. Co., K-TAC, and KIST, those whom I interviewed, strongly believe that without KIST's patronage (and its networking power with government offices, banks, etc.), and especially president Park's patronage of KIST, at the deeper level, HJ. Co.'s initial survival would have been uncertain.[66]

The HOP case clearly demonstrates the significance of implied or potential, not necessarily the actual usage of, political power in bargaining with foreign technology suppliers. Another finding in the HOP case is the globally integrated structure of the agrochemical production system, and the difficulties that KIST R & D had to overcome.

<u>The Polyester Film Case</u>

A base polyester film was developed by KIST, and its technology relates to a process for manufacturing biaxially oriented polyethylene terephthalate (PET) film. PET film has wide utility in manufacturing such products as: audio and video tapes, computer tape, wire and cable insulation, electric motors, slot liners, transformer insulations, capacitators, microphone diaphragms and loudspeakers, typewriter ribbons, pressure sensitive tapes, metallic yarn, satellite balloons, missile diaphragms, packaging, engineering reproduction, graphic art s, industrial belting, stationary supplies, photographic film base, etc.[67] The KIST-developed technology, according to KIST sources, consists of two main process operations: the manufacturing process for PET chips suitable for "fish-eye-free film" manufacture; and the process for film extrusion and biaxial stretching.[68]

As a joint research project with S. Co., one of the <u>chaebol</u> corporations in Korea, KIST began to develop the technology. The project proceeded smoothly so that by 1977 it had completed a successful pilot-scale production followed in 1978 by successful commercialization by S. Co. The KIST-developed polyester film producer's total sales volume reached 217 billion Won, including about 173.8 billion Won worth of exports as of 1987, and the product's annual sales growth rate was 18-27%.[69]

The commercialization process was not easy though, for it involved another major *chaebol*'s business interests. By the time KIST built a pilot plant for techno-economics test of the newly developed product, it met a challenge from a local firm. H. Co. of one of Korea's largest conglomerates was in the process of importing the similar film technology for local production from Japan's D. Co. which then "monopolized" the technology. Korean firms in the past apparently attempted to import the technology from the D. Co. but without much success, for the latter would rather have preferred to control the technology, and thus its world market.[70] There was a good market prospect both in and outside Korea, and the competing interests between the S. Co. and H. Co. were escalating. Given their business status, both as Korea's leading *chaebol* group, the outcome of the competition was unpredictable.

Being faced with a "threat," S. Co. requested MOST in September 1978 to protect the KIST-developed technology from possible imports of similar technology by other firms. MOST brought the issue to the FCIDC, and declared the KIST-developed technology as being subject to legal protection. The legal ground for MOST's support was the protective clauses of the Technology Development Promotion Law (TDPL) which was specifically designed to protect locally developed technologies from the import of similar ones, thus to promote domestic industrial R & D. As a result of this protection, S. Co. was to monopolize the KIST-developed technology on which its polyester film products were based for the next four years for both domestic consumption and for export. In the meantime the negotiations between H. Co. and Japan's D. Co. went well. Japan's D. Co. changed its earlier positions and agreed to sell its technology to Korea with a high royalty as the news spread that KIST was successful in developing its own version.[71] As expected, H. Co. submitted an application to MTI for the technology import from Japan's D. Co., but the MTI minister turned it down "for the reason that the technology had already been announced by the Minister of Science and Technology as a locally developed process."[72]

But the legal ground was only a minor reason. A closer examination of government decision-making over S. Co. and H. Co. reveals that there was a significant power game going on, involving the two _chaebols_, MOST, MTI, EPB, and the Blue House. During my field study in 1981, the U. S. trained repatriate and the chief researcher of the KIST's polyester film project, declined to reveal the details.[73] But other information clearly points out that the KIST-developed technology was protected not simply on legal grounds, but to respect "KIST's face" and for its symbolic and demonstrative value of local R & D. As a matter of fact, the KIST-developed polyester film case was the first case to use the TDPL protection clause administered primarily by MOST. More importantly, while the issue was still hot with the government, president Park's favoritism to KIST and (therefore to S. Co.) was a crucial factor behind KIST's success in this particular case. One of my interviewees in a local firm even commented that:

> The MOST's decision was over protection. It protected more technology than what KIST actually developed. Compared to the KIST-developed technology, the Japanese technology was superior (latest) from which Korea would have benefited more economically. ...But President Park sided with S. Co. When Park's position was such, the game is over.74

The strong KIST-Park connection was maintained through an intermediate liaison, MOST minister Dr. Choi Hyung-Sup, and it was essential when H. Co.'s application for the approval of technology import was denied. Dr. Choi, as a former KIST president, was determined to support KIST, and his access to FCIDC, cabinet meetings, and president Park played a cardinal role. Although KIST should be credited for its technical success in the polyester film case, without the direct, positive, and protective support from government, its market survival, another important stage in the technology innovation chain, would have been doubtful. For EPB, MTI, and other industrial policy-makers' value of growth-first and export-first policy is not necessarily supportive of domestic R & D, for R & D is often equated with technical and market uncertainties.

When firms that import technologies view KIST-developed technologies as their potential competitor, then the latter is structurally cornered into a non-winnable situation. This is largely due to the particular system under which technology is transferred globally, where industrial technologies are highly oligopolized, and there is global integration of the production system. Inasmuch as Korea's reliance on raw or semi-processed intermediate raw materials from foreign sources is high, no matter what KIST's R & D outputs are (unless a major technological breakthrough, for the first time in the world), KIST's R & D seemed to be structurally con strained to be in a weaker position. Breaking out of this system is hard, and state intervention seems to function as a critical variable in this process. Inasmuch as industrial production technology involves competing interests among different government offices and firms, a commitment from higher ups in the government (president or his staff in the Blue House) became a salient factor in resolving the conflict.

Analysis of KIST projects, particularly those which failed in commercialization (in spite of their technical success) clearly confirms my view. The Ethambutol project, for instance, was in a very similar situation to that of the polyester film project case. The Ethambutol project had a dedicated industrial sponsor (HD. pharmaceutical company), it was technically successful, it directly challenged the technology oligopoly system, and it involved conflicting interests among local pharmaceutical firms. But unlike the polyester project, the Ethambutol project failed in the market. Many observers believe that a lack of sufficient support from the government, in contrast to the polyester project case, was a crucial factor in its market failure.[75] The KIST-developed ethambutol process technologies too received protection from government: The Ministry of Health and Social Affairs (MHS) protected the KIST-developed technical know-how for an 18 months period. MOST also tried to help, but since medicines are subject to regulations administered by MHS, MOST's support was limited. Upon the availability of KIST-developed process technology in this particular medicine production, the supply of raw materials (intermediate materials) was cut off under pressure from foreign competitors (a few firms from the U. S. and Italy) which had either license agreements with two other local pharmaceutical companies, or supplied raw materials to them. Then, HD. Co. continued to sponsor research at KIST to develop intermediate materials with success. But cut-throat competition among local pharmaceutical firms occurred, resulting in an overproduction capacity problem. Specifically, when the American and Italian technology/intermediate material suppliers to local firms manipulated prices to an artificial low, HD. Co. products could not survive in the market: the intermediate price dropped from $120 kilogram to $40-$50 when KIST was testing its pilot production.[76] About a year later, after HD. Co.

began production, it would shut down its facility, the outcome of five consecutive years of continued R & D with KIST. HD. Co.'s market failure was, according to observers, primarily due to a lack of support from MHS which "lacked the understanding of local R & D." Or, if HD. Co. was a chaebol company, they argue, it could have received a different treatments from government, if not MHS, then from other government offices. As a matter of fact, the HD. Co. case was reported by MOST to president Park, but there was no evidence that Park showed any interest in this particular case.[77] If MHS allowed a monopoly of the KIST-developed technology for at least four to five years, instead of 18 months, as in the polyester film case by MOST, practitioners in this commercialization process point out that the Ethambutol case would have became another success story of local R & D.

Control of raw or intermediate raw materials and prices are routine business practices and constitute the global technology system. The commercialization process of KIST-developed technology cases clearly demonstrates that government intervention, especially Blue House involvement, was often a crucial factor as to whether KIST technologies survived in the market or not. Especially, the government's protective intervention was critical in non-heavy and chemical industries, such as the pharmaceutical industry, for it has, like other light industries, a high risk factor in their business. Unlike the heavy and chemical industries wherein government's built-in involvement (i. e., loan guarantee on selective sectoral industries) reduced competition among firms, pharmaceutical industries are more or less unregulated by government thus resulting in fierce competition between firms.[78]

Summary and Conclusion

This chapter attempted to analyze what factors may explain KIST's marginal problem in dealing with the local industrial technology system. Analysis in this chapter shows that KIST management itself is in part responsible for the weak KIST-industry linkage. Some innovative approaches were taken by KIST--K-TAC for example--to link itself to the local production system. However, the contribution of K-TAC's success is yet limited in terms of solving KIST's weak linkage with industry problem. A more significant, and larger problem seems to come from other factors, external to KIST's management. MOST's policy toward KIST was supportive and strong. But it provided KIST with only a necessary condition, not a sufficient condition to make it an active supplier of industrial technology. The analysis of R & D funding policies clearly indicates the limit of MOST's capacity in the linkage area between KIST and industry. MOST also played a limited role in local firms' decision-making over the choice of technology, whereas other ministries such as EPB, MTI, and MOF exert direct influence on them. This is primarily due to the particular policies Korea has pursued in the past in terms of industrialization and technology transfer, which had profound influence on the choices of technology by manufacturers. A lucrative package of benefits provided by government to spur rapid economic growth or exports seemed to have turned off local interest by industry in local R & D. The impact of government policies of industrialization and technology transfer on KIST R & D is rather more negative than positive.

Case studies of KIST projects reveal the harsh reality of the global system of technology transfer, and the power of the technology-haves. KIST projects also clearly indicate the panorama of barriers laying before KIST R & D. Technical success is only the beginning of the story of technological innovation. How to cope with other constraints, such as the cutting off of raw or intermediate materials, market restrictions, price wars, and so on also constitute important tasks for KIST. KIST, in other words, was required in Korea's country specific situation to play more than just the role of technology-supplier. There certainly was local pressure to extend its role as a political bargainer...bargaining with foreign technology suppliers, government officials, local bankers, and so on. Within Korea's particular context of political culture and political system wherein so-called "primary group" politics, a variant of politics of patronage, works, such pressure seems to be reasonable to KIST's industrial sponsors. Analysis of KIST projects also informs us of the importance of political power in R & D. R & D or technology transfer is not simply a matter of technology (i. e., skills or knowledge of how to make things), but a matter of politics. When political power is supportive, especially that of higher ups in the government, KIST R & D's survival rates seem to be high, for industrial technologies involve multiple conflicts of interest. Significantly, president Park's patronage often protected KIST-developed technologies from foreign ones, when he was determined to do so. The lessons from KIST is that Park's direct involvement was not always necessary. Implied power often worked as effectively as overt power.

Notes

1. Edward B. Roberts, The Dynamics of Research and Development (New York: Harper & Row, Publishers, 1964), p. XV.

2. Blackledge in Silveira (1985); Susumu Watanabe, "The Patent System and Indigenous Technology Development in the Third World," in Jeffrey James & Susumu Watanabe, eds., Technology, Institutions and Government Policies (N. Y.: St. Martin's Press, 1985); and Albert H. Rubenstein, "Key Issues of Research, Development and Innovation in Developing Countries," in Goodman & Pavon (1984).

3. CPAMIT (1980), p. 19. My field study data also confirms this perspective.

4. Interview data, April 3, 1981.

5. Interview data, February 25, 1981.

6. Interview data on April 20, 1981. In addition, a degree-holder's salary is much higher than non-degree holders. But in cases of local recruitment and/or the junior and middle level researchers, industrial field experience is a critical criteria.

7. Especially, top managers of the 1970s were targets of criticism.

8. Interview with a senior researcher at KIST on April 21, 1981.

9. For this issue, refer to CSTP, KAIST, Reseach on the Function and Role-Defining of the Public Sector Endowed Research Institutes (1988).

10. Interview data, April 10, 1981.

11. Field study data collected in Spring, 1981.

12. MOST, Science & Technology Annual 1980, p. 352.

13. Since 1982, other government-sponsored R & D institutions, financial institutions, and other business corporations were added to the list of K-TAC's shareholders, which numbered eleven entities with capital totaling 6,400 million Won as of June, 1989. Refer to K-TAC, K-TAC Hyunwhang Mit Jeonmang (1974-

1988-1995) (The State-of-the-Arts and Prospect of K-TAC 1974-1988-1995) (Seoul: K-TAC, 1989. 6), p. 3; and K-TAC brochure.

14. Since 1986, K-TAC's main function has been changed placing more emphasis on its role as a financial institution rather than on commercialization of KIST-developed technologies.

15. K-TAC data obtained during the field study in 1981.

16. K-TAC, Shinkisul Kiupwha Upmoo Annae (Business Information of the Creation of New Technology-based Business Firm) (Seoul, K-TAC, 1988).

17. CSTP, KAIST (1988), ibid., p. 40. The percentage will go higher if we define the R & D budget as excluding the government's budget on other national R & D centers providing such services as lab testing or chemical analysis services.

18. KIST, Financial Institutions and Technological Development in the Republic of Korea (Draft, mimeo) presented at the Meeting in Poona, India From 12-16 January, 1981 (Seoul: KIST, December 31, 1980).

19. Ibid., p. 31.

20. Ibid., p. 38.

21. J. Lee (1975), p. 227. Technology Development Promotion Law recognizes R & D spending on both research and commercialization phases as untaxable losses in income account.

22. Rubenstein, p. 90.

23. L. Kim (1984), p. 15.

24. J. Lee (1975), p. 229.

25. Korea University Hangjong Moonjae Yonkooso (Public Administration Research Center), A Study of Desirable Administrative System for the Innovation of Technology (Seoul: Center for Science & Technology Policy, KAIST, 1988. 5), p. 52.

26. K. Lee & L. Kim (1984).

27. EPB, Major Statistics of Korean Economy 1982 (Seoul:

EPB, 1982). Also refer to Mason & al. (1980), pp. 136-137.

28. To quote from Luedde-Neurath, "promotional intervention aims to restore markets to their proper function, usually through non-discriminatory incentives. It also aims to provide 'public goods,' which the market cannot by itself supply efficiently, such as infrastructure, education, etc. Directive intervention, aims to achieve predetermined results through conscious interference with market forces and selective application of incentives and/or controls. Refer to Richard Luedde-Neurath, "State Intervention & Export-Oriented Development in S. Korea," in Gordon White, ed., Developmental States in East Asia (New York: St. Martin's Press, 1988), p. 103.

29. Before FCIL was promulgated, most imported technology had been incidental to the importation of capital goods funded with foreign loans and no statistics on such technology importation are available. The nature of technology imports prior to FCIL was the simple technical knowledge needed in the operation of turn-key industrial plants rather than importation of patents, etc. Refer to TTCKIST (1980), The Comparative Studies of National Experience in Technology Policies, P. 6.

30. TTCKIST, ibid., p. 7.

31. Ibid., p. 57. For the full text of FCIL's tax incentives, refer to Sang Hyun Song, Legal and Administrative Environment for Transnational Corporations in Korea, Sahoi Kwahak kwa Chongchak Yonkoo (Social Science and Policy Research), Vol. 22, No. 1, pp. 117-123.

32. This policy was further relaxed in 1984 in favor of technology transfer. Under this new policy, the government's approval system was replaced by a reporting system, and foreign licensing is completely open to all industries and for all terms and conditions.

33. TTCKIST (1980), p. 7.

34. L. Kim (1984), p. 9.

35. Ibid., p. 9.

36. Ibid., p. 10.

37. Ibid., p. 12.

38. KIST Technical Information Department, Kisul Doip Shiltae Chosa e Kwanhan Yunko (A Research on Technology Importation), (Seoul: KIST, 1976. 3), p. 138; & TTCKIST (1980), p. 22.

39. TTCKIST, ibid., P. 17.

40. Chung H. Lee, "International Production of the United States and Japan in Korean Manufacturing Industries: A Comparative Study," Weltwirtschaftliches Archive (Review of World Economics), Band 119, Heft 4 (1983), pp. 750-751.

41. Yung Whee Rhee, & al., Korea's Competitive Edge, (Baltimore, Maryland: The Johns Hopkins University Press for the International Bank for Reconstruction and Development/The World Bank, 1984), p. 11.

42. In celebration of Korea's having passed the $20 billion mark in exports in 1981, on Export Day of that year more than 600 prizes (i. e., national medal of merits, cash prizes, etc.) were awarded. Y. Rhee (1984), ibid., p. 31.

43. MOST, Kwahak Kisul Hangjung Leeship Nyunsa (20 Year History of the Science and Technology Administration), (Seoul: MOST, 1987), p. 270 & 273.

44. KIST, Financial Institutions and Technological Development in the Republic of Korea (1980), p. 4.

45. Interview with a senior administrator on April 10, 1981, in Seoul, Korea.

46. TTCKIST (1980), p. 18; EPB, Kisul Doip Hyunwhang 1962-1980 (The State-of-Arts of Technology Importation 1962-1980), (Seoul: EPB, 1981. 3); and my field study data (1980).

47. My field study data (1981). A survey of the 1,408 cases of technologies transferred to Korea during the 1984-1986 period reveals that the chief executive of a firm is the most influential in technology import decision-making (28.3%). Refer to Hankuk Sanup Kisul Jinhung Hyuphoi (The Korea Industrial Research Institute), Kisul Doip Shiltae e Kwanhan Josa Yonkoo (A Survey of the Technology Transfer) (Seoul, 1988. 9), p.iii.

48. C. Lee (1983), & L. Kim (1984), p. 26.

49. L. Kim (1984), pp. 26-28.

50. Walter Arnold, "Technology, Newly Industrializing Countries and the International System" (Working draft), mimeo (December 1985), p. 23.

51. Chung H. Lee, "Direct Foreign Investment and Its Economic Effects: A Review," (July, 1980).

52. The Hankuk Ilbo, February 9, 1978 and my field study data collected on March 28, 1981.

53. Ibid.

54. Ibid.

55. Ibid.

56. Jinjoo Lee, The Success and Failure of Venture Business with Special Reference to the Commercialization of Indigenous R & D Results from Public R & D Institute, (KAIST, September 19, 1985, mimeo), p. 20..

57. The Hankuk Ilbo, February 9, 1978.

58. Field study data, March 28, 1981.

59. The Hankuk Ilbo, ibid., and field study data, March 28, 1981.

60. Interview data on March 28, 1981.

61. Ibid.

62. The Hankuk Ilbo, February 9, 1978.

63. Interview data, March 28, 1981.

64. Ibid.

65. Ibid.

66. Field study data of 1980 & 1981.

67. KIST, Commercialized KIST Technology, (Seoul: KIST, April, 1980), p. 8.

68. Ibid.

69. D. Lee, p. 109.

70. Field study data of 1981.

71. Interview on January 15, 1981 and other field study data of 1981.

72. TTCKIST (1980), p. 56.

73. Telephone interview on March 22, 1981.

74. Interview data, March 21, 1981.

75. Interview data, March 21, March 22, March 28, April 10, & June 10, 1981.

76. Interview data, June 10, 1981.

77. Ibid.

78. Ibid.

CHAPTER SEVEN

SUMMARY AND CONCLUSION

Government-led R & D is a prominent characteristic of Korea. R & D in the past two and a half decades clearly demonstrates that it has not been a spontaneous phenomenon but a concerted state activity, vigorously pursued from the early phase of Korea's industrialization in the mid-1960s. Beginning in the late 1970s, private sector R & D grew phenomenally, and by the mid-1980s aggregate R & D investments in the private sector far exceeded those of the public sector. The number of firm-level R & D centers also mushroomed, and dwarfed that of the public sector. But when the average size of R & D budget and high-level R & D manpower per organization is analyzed, the magnitude of private sector R & D is not as large, well endowed, and qualitatively advanced as the government-endowed public R & D institutions. The size of government R & D investments also grew, and accounted for 2.1% of GNP as of 1988.

Recent policy statements from the Korean government assert that the government's R & D investments will continue to grow.[1] Given the structural changes the Korean economy is currently experiencing, a shift from the cheap labor-low skill based economy to a more technology-intensive one, such commitments seem to be inevitable. It is particularly true as Korea aspires to acquire, adapt or develop the core technologies of cutting-edge industries, such as computers, mechatronics, biotechnology, superconductors, telecommunication, and so forth.

The Korean government's involvement in R & D and the workings of KIST in the past suggest the need for a close look at the dynamics of state power and local R & D in rapidly developing countries. The literature on S & T and development asserts the importance of the state's role and R & D infrastructure-building. Studies also point out the limits of domestic R & D in developing societies under the current global systems of production and technology transfer. But less is known about the dynamism and inner workings of public R & D policies. If government's role is important in the set up of institutional R & D, what specific roles were played by the Korean government, when, how, and why? If domestic R & D is structurally conditioned to be "marginal," what specific measures were taken by both government and KIST to cope with the structural impediment, and what seemed to be an outcome? If the performance of domestic R & D in terms of industrial technology is disappointing, why then does government continue to allocate resources? This study attempted to inquire into these questions and the research findings are as follows.

First, the nature of the Korean government's involvement in R & D is "directive," rather than "promotional" in orientation. The directive mode of state intervention is discernible in its initiation of R & D institution-building in selected social sectors, and in the various policy measures employed to either stimulate domestic R & D or eliminate obstacles which may hamper such efforts.

Second, government support of R & D stems not from the value of domestic R & D for its own sake, but for its economic value. There also is involved a certain level of political symbolism and other political functions as well--important latent functions of R & D policy. R & D was perceived as a tool for achieving fundamental policy goals in Korea, namely, economic growth (and national security as well). R & D was therefore instrumentalized as a tool of political legitimacy. These assertions become clearer when we compare the R & D policy positions taken by different regimes in modern Korea.

Neglect of R & D by government (colonial government and Rhee and Chang regimes) before the early 1960s contributed to the extremely weak R & D capacity of Korea. Then, law and order were higher values of the governing elites and R & D had no political value. The Park regime's aggressive industrialization plan dramatically transformed such perceptions of the value of R & D in its polity. A series of political decisions made by Presidents Johnson and Park gave birth to KIST and laid the groundwork of institutionalized R & D in Korea. Park's voluntary guardianship certainly facilitated smooth sailing for KIST as an organization and KIST benefited from Park's patronage.

From Park's standpoint, KIST had an important political value: the mobilization of S & T brainpower was necessary to accomplish his national industrialization plans, thereby enhancing his political legitimacy in domestic politics. Building a world class R & D institution with top-notch researchers had tremendous demonstration effects and the Korean society accepted them positively. An alliance with the R & D cadre was functionally necessary to successfully consolidate strong presidential power, and politically non-threatening due to the particular form of the "pact of domination" in Korea's power structure. KIST researchers too did not show the political ambition to challenge the _de facto_ power structure of the military government. They defined themselves as an industrial arm.

During the Chun regime, R & D was again politicized by new power holders for their own political purposes (i. e., streamlining R & D system) but KIST did not enjoy its previous good luck. KIST was forced to merge with KAIS and the 1980s was a "Dark Age" in KIST's history. The Roh regime also intervened in R & D and restructured the nation's R & D system several times. This resulted in KIST's "break" with KAIS. Certainly, frequent S & T policy changes in the past few years reflect his political choices, ambitions, management style, and so forth, rather than purely outcomes of value-neutral "rational" choices.

Third, the "directive" mode of state intervention in R & D in Korea is primarily an outcome of the particular arrangement of political power allowed by the authoritarian-bureaucratic political system. Korea's political map clearly shows that political power is president-centered. An implication of this president-centered political system to technology policy processes in Korea is that the president functions as the key actor in policy initiation, policy decision-making, and implementation. Clearly, this model of policy processes is different from the liberal-pluralist model of policy processes often uncritically accepted by many in the policy studies literature. Lacking technology pork barrel politics from the National Assembly and pressure politics from competing groups both in and outside of government, the president can exercise an enormous amount of power once he is determined to commit himself to a certain project. And the nature of presidential power is not necessarily explicit. Implicit presidential power works as well. KIST certainly enjoyed this political system during Park's tenure of power.

Fourth, KIST's operation in the past clearly indicates the importance of policy environment variables. The impacts of the government's perception of domestic R & D as a tool for industrialization on KIST was both positive and negative. On the positive side, the continued support of the Park regime allowed KIST to grow rapidly as an organization with stability and high productivity in research. On the other hand, various industrial policies on export-promotion and technology transfer affected the local industries' choice of technology. This, I believe, contributed to weak KIST-industry linkage. There was a clear division of labor between "explicit" technology policy and "implicit" technology policy and MOST's explicit technology policies were limited primarily to the supply side of technology.

Global systems of technology transfer and vertical production arrangements certainly added constraints to KIST' R & D, especially during the commercialization phases. Worthy of note is state intervention when conflicts of interest occurred between KIST R & D and TNC-supplied technology. Case studies of KIST projects affirm that to protect domestic R & D, state intervention was necessary. Here, we are confronted with a value choice: to what extent should domestic R & D be protected if TNCs provide cheaper and more recent technologies for whatever political reasons (i. e., simply to defeat KIST-developed technologies in the market)? My view of this question is that whatever economic benefits foreign technology bring, they are short-term benefits and do not necessarily contribute to local R & D capacity.

Finally, the analysis of KIST clearly shows the multiple functions an R & D institute performs. KIST was more than a scientific establishment for applied research, its functions extended to other areas as well. KIST certainly functioned as an agent of change in Korea's early industrialization period, a bargainer in international technology transfer, an important pillar of Korea's technostructure, and as a model for RBD and think-tank institutions.

These observations have an important implication for the policy analyst in terms of raising the question of how to evaluate performance of R & D institutions in a developing society. Certainly, technology development does not take place in a social vacuum. When KIST's performance is evaluated in terms of its contribution to local production technology, the evaluation of KIST is rather negative. However, when we consider Korea's social setting of the mid-1960s when Korea was a technological vacuum, the evaluation of KIST will be positive rather than negative. Above all, when we consider the political symbolism attached to KIST, a visible example of Korea's industrialization, KIST has certainly met the latent policy goal--perhaps far above the horizons Presidents Park and Johnson expected.

Government intervention in S & T seems a "two-edged sword," or a necessary evil. It can be a wonderful facilitator of R & D institutions, and at the same time when government power is misused, it can easily jeopardize the workings of R & D institutions. For various reasons, President Park lent unlimited support to KIST. His continued commitment to KIST, and the grant of autonomy were crucial factors in KIST's success in its early operations. Government's commitment to an R & D institution should be continued in the long run, for technological innovation takes a long lead time. Autonomy, rather than government control is important because scientists and researchers by nature dislike outside interference. In the KIST case, there was a clear policy fallacy. The Chun regime's interruption of the R & D system via forced mergers was not only unnecessary but also disruptive. At the time KIST merged with KAIS under Chun's new policy scheme, KIST was only 15 years old, realistically too young for any R & D institution to accomplish major innovations. Deprivation of autonomy from R & D institutions while increasing government control was another major feature of Chun's approach toward R & D policy, and one which no one in R & D institutions welcomed. Although the Roh government has presented ambitious blue-prints for technological development, many observers in Korea worry about the lack of coherent policy directions. May KIST's "marginalization" problem be deepened by inconsistent and abrupt policy interruptions in the post-Park era? If so, to what extent are they responsible for KIST's linkage problems with local production systems? These issues are not analyzed in this study. However, those who attempt to analyze Korea's technology development policies from a structuralist perspective need to carefully monitor this issue.

In sum, without the Park regime's direct involvement via full-fledged policy supports from the very outset of Korea's R & D institution-building in the 1960s, and Korea's particular form of political system facilitating an interventionist government role, Korea's organized R & D would have been much slower, more sporadic, and perhaps less successful. It would have been delayed until the late 1970s when a few large local firms setup in-house R & D centers. Furthermore, if Korea's organized R & D had first begun during the Chun regime, which perceived R & D institutions as a subject to government control while the value of autonomy was withheld, Korea's R & D would have developed in a totally different mode. This may have been highly undesirable, as witnessed in the Ilhae Foundation case.[2] From Korea's organized R & D standpoint, Park deserves credit for his recognition of professionalism, although the deeper motivation may have derived from his own political interests. KIST and other strategic R & D institutes created by Park certainly evaded such corruption charges and contributed to the laying of solid ground for organized R & D as an institution in Korea.

Notes

1. *The Hankuk Ilbo*, Seattle ed., May 18, June 1, August 20, August 22, and August 25, 1991.

2. The Ilhae Foundation is a think-tank created by President Chun in the early 1980s. The endowment funds were collected mainly through coerced donations from major business corporations and Chun apparently attempted to use the institution for his own political purposes after leaving the presidency. Corruption charges against the Foundation were highly controversial during the National Assembly's hearings on Chun's Fifth Republic in the late 1980s and forced Chun to disassociate himself from the Foundation. After the scandal, the institute changed its name to the Sejong Research Institute.

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