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GUIDELINES FOR THE FORMULATION OF NATIONAL INDUSTRIAL AND TECHNOLOGICAL INFORMATION POLICIES - BASED ON KOREAN EXPERIENCE*

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CONTENTS

LIST OF ABBREVIATIONS

DACOM	Data Communications Corporation of Korea
DPM	Deputy prime minister
EPB	Economic Planning Board, Korea
ITDC	Industrial Technology Development Centre
ITI	Industrial and technological information
MCI	Ministry of Commerce and Industry, Korea
MOST	Ministry of Science and Technology, Korea
KAIST	Korea Advanced Institute of Science and Technology
KDI	Korea Development Institute
KIEI	Korea International Economic Institute
KIET	Korea Institute for Economics and Technology
KIIS	Korea Institute of Information Scientists
KORSTIC	Korea Scientific and Technological Information Centre
KOTRA	Korea Trade Promotion Corporation
NCST	National Council for Science and Technology
OECD	Organisation for Economic Co-operation and Development
R & D	Research and Development
SDI	Selective dissemination of information
SMIPC	Small and Medium Industry Promotion Corporation
SMIs	Small and medium industries

CHAPTER I

INTRODUCTION

Information is a basic element of industry. Each country is, therefore, expected to have a national policy for the effective management and use of this information needed for its industrial activities. This is recognised in most industrialised countries where with varying degrees of completeness and success national industrial and technological information policies and national information systems developed on the frameworks of such policies are emerging.

Most governments in the developing countries are also aware of the necessity of such a policy, and some of them have already commenced reviewing their existing policies, most of which are not expressly stated in writing, to develop a coherent and comprehensive one covering all related types of industrial and technological information (hereafter abbreviated to ITI). Policy planners in these countries will benefit greatly if they are provided with some properly formulated guidelines for a national ITI policy that are suited to, and workable for, the situations in their respective countries. The present Guidelines are an attempt to meet this need.

PURPOSE OF THE GUIDELINES

These Guidelines seek to provide a framework on which policy makers in the developing countries will be able to formulate and implement a national ITI policy suitable to their own situations. The Guidelines are concerned with, in relation to the general structures and needs of developing countries, by what bodies and through what mechanisms the national ITI policy is properly formulated, inplemented, and administered, what its content is, and how it is

linked to industrial and technological policy. A large portion of the Guidelines is based on the Korean experience. Since there is no body of theory in this field, the Guidelines can only be derived from experience.

THE VALUE OF INFORMATION

A strong base of information and the ability to use it can contribute importantly to the prosperity of a nation. For example, information on economics can help produce economic stability; the availability of technological information is one of the characteristics of the technologically advanced countries; the dissemination of health information provides a great assist to preventive medicine programmes in countries with longer life expectancies.

As Borko says, "Information is seen as means by which a developing nation can increase its gross national product, raise the standard of living for its citizens and narrow the gap between the have and the have-not nations of the world. In short, information is seen as a very valuable commodity which should flow freely across national boundaries to the mutual benefit of all" (Borko, 1968).

The concept of information as a commodity has led to attempts to consider its market value and the price the user is prepared to pay for it having regard to its value to him. The approach has inevitably led to market research about information services. This approach has not so far produced any useful results. Because information is a very strange commodity, it is impossible to place a financial value on each of the different information services which were used. However, the total value of the information supplied is greater than its cost for, without information, there would have been no development.

THE EXPLOITATION OF INFORMATION IN INDUSTRIAL ACTIVITIES

There are various uses in industrial activities to which information can

be put, and one simple division is into two: for problem-solving, and for innovation. Problems arise constantly in the day-to-day running of any industrial enterprise; most of them perhaps can be solved immediately or in due course by skill and experience; a few, however, are beyond the capabilities of the workers and management of the enterprise concerned, and so they need help. This need is often in the form of information, or at least has a large information component.

Innovation is much more difficult, since what is involved here is not so much information about the familiar, current operation of an enterprise, but about its possible future operation, perhaps in a novel, or even unknown, area of activity. The need for innovation exists in all industries in all countries, but especially in developing countries. Unfortunately, particularly in small enterprises, it is often the case that the need is seen too late, perhaps when it is discovered that there is no longer a market for the product they are making, or perhaps more commonly when they find that their competitors are using more up-to-date methods, and are manufacturing a superior product at lower cost.

Information can be applied to the solution of specific problems and innovation, but often is not. It has a much broader role than merely problem-solving and innovation. Wisely used, it can educate, stimulate, inspire as well as simply inform. It can also alert the industrialist to the problem and then suggest to him possible alternatives or solutions. Information can not of course be a substitute for the skill and experience of the technical or commercial staff of an enterprise. Information can not change the basic realities of an enterprise. But it can become a valuable tool for making the best use of an existing situation.

PROBLEMS IN THE SUPPLY OF INFORMATION TO INDUSTRY

There are many problems in supplying industry with the information it

requires. These may be geographical, such as national frontiers and distance. For instance, in many developing countries, industrial enterprises are thinly spread over a large area. "Although distance is not necessarily a question of a hundred miles, it may only be say ten feet--a different room may constitute a barrier to communication" (Gerritsen, 1963). There are also infrastructural problems. Developing countries are lacking essential capabilities required to transfer ITI and to channel it to ultimate users. In some countries, such infrastructure does not exist; in many others, it is too embryonic to meet growing requirements. As a result, these countries are unable to identify their information needs adequately, to acquire pertinent information, to adapt it to prevailing conditions and requirements, or to disseminate it to those who need it.

Developing countries turn to the industrialised ones to obtain much of the currently available scientific and technological information, as embodied in literature and other forms of information storage, needed for industrial development. But in the developing country situations, the acquisition of scientific and technological information from overseas is often hampered by currency exchange and import control. In some instances, "individuals or institutions have difficulty in obtaining convertable currency; in many others, the time and effort involved to obtain convertable currency serves as an effective deterrent" (U.S. National Academy of Sciences, 1972).

It is fundamental to the success of any communication process that the intended recipient of the message must be attentive and ready to receive it. Where the recipient is not sufficiently motivated, communication suffers. The receptiveness of industry is generally small and fragmentary. Studies on the use made in the developing countries have revealed that only a handful of enterprises make use of information on innovations: the average industrial enterprise is content with conventional processes and techniques and seeks out the minimum of information by haphazard methods. Most small and medium-sized enterprises in developing countries, in fact, do not seem able or willing

to take advantage of the wealth of information that exists in one form or another and put it to use.

Information requirements of engineers are different from those of research workers. Engineers need to cover a wider field. An engineer may need information on design specifications, measurement methodology, material properties, and computer programmes in order to carry on his own project successfully. Generally, engineers have less time and means to spend on individual problems; they are interested in facts, data, instructions, rather than methods. They, therefore, require information services supplying the information itself rather than references, bibliographies, or journal articles. Journals, for instance, are less suited to the manifest needs of engineers in all countries, but more particularly in the developing countries; for, although containing valuable information, this documentation is not usually adapted to the needs of users. It is presented in bulk and does not seek to impose a particular point of view. Currently only very few information services are presenting new knowledge contained in primary publications in that manner most engineers want.

Lastly, there is the language difficulty. Whatever an engineer's knowledge of foreign languages may be, many of the information resources in which he is interested will be written in languages with which he is unfamiliar, and here we have one of the greatest barriers to the supply of information to industry. Some national libraries or national information centres in industrialised countries have establi hed a panel of translators with appropriate subject background that provides translations offering good guarantees of accuracy from both the subject and the linguistic points of view. Unfortunately, it is difficult to establish such panels in the developing countries where translations are most needed.

CHAPTER II

THE NEED FOR NATIONAL INDUSTRIAL AND TECHNOLOGICAL INFORMATION POLICY

Today, ITI of all kinds is widely recognised as far too essential to industrial activities to allow its availability and quality to remain unguided by a broad governmental policy. An early opportunity should be taken by governments, particularly those in the developing countries, to formulate a national policy for the effective management of their ITI resources, taking account of changes brought about by recent international developments in this field. The need to formulate and implement such a policy, and some of the Korean cases are discussed in this chapter.

WHY IS A NATIONAL INDUSTRIAL AND TECHNOLOGICAL INFORMATION POLICY NECESSARY?

Information is needed when a problem has to be overcome in the execution of an industrial project. Industry in developing countries finds it difficult and time-consuming to obtain this type of information. It is not easy even in industrialised countries to select and provide specific information that may be the key to solving a particular technical problem in industry. This calls for national action.

Both large and small enterprises require technological information in order to decide whether to introduce new or improved production processes or products. They also need information on laws and regulations, manpower, sources of supply, potential markets, standards, etc., the control of which is no longer within the capacity of individual enterprises. A national policy needs to be formulated and implemented to bring these various types of information to

industry.

Large enterprises are in a position to establish their own information units which, in co-operation with their own research and development units, are processing the necessary information. Small and medium enterprises are not in a position to do the same. With few exceptions, the small and medium enterprises engage in no research. They rarely have the means to set up an information unit or any technical service, either individually or collectively. Nor do they appear to make frequent use of public, university, or governmental libraries. These libraries, in any case, are rarely designed to meet the specific requirements industry needs. The small and medium enterprises are, in fact, supposed to put more effort into exploiting information than the large ones because the former are more vulnerable to economic and social changes. The latter frequently have a built-in marketability of their products because of its long established reputation. Here also a national policy needs to be formulated and implemented to provide the small and medium enterprises with the information that they need to promote their productive and competitive capacities.

On a national scale, many different organisations endeavour to meet the specific information requirements of industry. These organisations include governmental agencies, industrial associations, professional societies, research institutes, universities, libraries, information and documentation centres, and data banks of all kinds. They have, however, developed piecemeal, without liaison between them, without co-ordination, in a somewhat haphazard fashion. They may as a result provide unnecessary duplication in some spheres and inadequate facilities in others. It is necessary to formulate and implement a national ITI policy to draw up plans for improving the existing arrangements and to ensure that all who engage in industrial activities have access to the information they need.

SOME DEFINITIONS

The concept of "information for industry" is difficult to define. This difficulty arises from the fact that "industry", as we call it, is in no sense a unity. It is a broad and complex grouping of many differing and competing undertakings, relatively unorganised. Thus, before proceeding further it is necessary to define some basic concepts relevant to the subject of these Guidelines.

Industrial Information

Industry is the system of production that has arisen from the steady development, study, and use of scientific knowledge. Since industry does not grow without markets and sources of capital, similarities in the economic preconditions for industrial development have been identified. These bases for the development of an industrial sector include an available labour force, markets for finished production, access to raw materials, a source of investment funds, and finally, access to technology. Equally important to the development of industry is information on how to produce goods and services, information on sources of supply, information on consumer markets, and information on manpower available now and in the future. The efficient use of such technological, marketing, and management information is vital in all activities of any branch of modern industry.

The term "industrial information" is commonly used to refer to such information and know-how that are required and utilised by industries in order to facilitate their activities for production and sales of goods and services. A mistake that is often made is to equate industrial information with scientific and technological information. The broad expanse of industrial information is often underestimated. The intellectual activities within industry are very

diverse and embrace o· te a number of sciences, technologies, and other specialist fields. In many cases, even within an enterprise, the staff employed covers a variety of disciplines. The need for adequate information transfer to support these many and varied activities is unquestionable.

It seems impossible to provide complete inventories of subjects to be covered by industrial information. The following list made by Schwoerbel indicates some of the areas and fields of information which are essential to the activities of modern industry:

(a) Market information in the broadest possible sense. Domestic and foreign markets; consumer habits and fashions, tariffs, taxes and other market restrictions; prices, including prices of goods produced by competitors; availability of transport and distribution schemes, etc.

(b) Information on industrial equipment, machinery and technologies. Available alternatives, prices, capacities, spare parts situation; maintenance and repair facilities.

(c) Information on raw materials and semi-finished goods. Opportunities to substitute imported raw materials by domestic ones; new raw materials such as artificial fibres, synthetics, etc., prices, qualities, local appropriateness.

(d) Infrastructural information. Availability and supply costs of energy, water, transportation; quality of electric current; labour situation, training opportunities, wages, social insurances; availability of qualified managerial personnel.

(e) Information on industrial environment, services, research facilities, industrial legislation including legislation on patents and licensing, enquiry and extension services, export promotion, etc. (Schwoerbel, 1975).

Still incomplete as it may be, this list gives an indication of the large variety of information that may have to be acquired and utilised in running industrial enterprises.

Since technological information is treated separately in these Guidelines, the term "industrial information" will exclusively designate the information and knowledge exemplified under a, c, d, and e in the list that are required and utilised by industries to buy raw materials, to sell products, and to finance and manage enterprises.

Technological Information

The term "technological information" is used in these Guidelines to refer to information on technologies that are utilised in producing material goods and services. Technologies are bodies of skills, knowledge, and procedures for making, using, and doing useful things. They are techniques, means for accomplishing recognised purposes.

A distinction is drawn between the natural sciences and technology; the former emphasise the acquisition of knowledge, while the later stresses practical purposes. This is a rough distinction with a number of complications, but it provides an important guide in understanding the concept of technology.

Deliberate technological change has been institutionalised in Western countries for some time. Most modern technologies include not only traditions for making and doing things but also traditions for advancing the state of the art; for producing new knowledge, processes, and products. In the various private sectors of modern economics, the amount of effort devoted to technological changes, and the magnitude of the changes themselves, are strongly influenced by economic demand and profitability. This accentuates the importance of distinguishing major steps in the process of technological change which differ in their dependence on physical facilities and other resources and in their relationship to economic costs and rewards. The first step is invention or applied research, by which is meant the processes of

getting new ideas and bringing them to the point of technical feasibility demonstrated through small-scale testing. This is different from the later steps: development of workable full-scale plans; innovation, which means putting plans into actual, full-scale practical use; and imitation or diffusion of innovations to additional producers and users. In addition, minor processes of improvement may occur in any of these phases. Finally, the spread of technology within a country is not just a matter of literal imitation but usually involves significant processes of technological adaptation to the local habitat and local economy and other conditions.

Changes within technology, as well as outside it, obviously have something to do with the very recent large expansion of resources devoted to R & D; with the rapid increase in organised R & D efforts as compared with those of independent inventors; with the expanding role of professional scientists and postgraduate engineers in R & D; with the increasingly radical nature of the technical advances being achieved; and with the wide differences in R & D efforts and accomplishments between industries and technological fields.

It is important for developing countries to ensure an adequate flow of information on technologies, for not only do they work under the handicap of starting later than the advanced industrialised countries, but they also lack the accumulated experience that only time can bring. It is possible, however, in many instances to bypass the long road of experience. Developing countries can utilise the research results obtained by the world research community with negligible cost. By constantly upgrading current technologies through open literature, it is possible to incorporate the current technology in design and production. Experience in many developing countries has demonstrated that with access to reliable information, the manufacturer, for instance, can sometimes leap over technological periods and adopt systems directly without going through a painful and costly development phase. It is important to recognise here that a major component of the technology transfer process is the transfer

of information.

Industrial and Technological Information Policy

ITI policy refers to a broad range of the objectives for which ITI services in a country should strive. In the field of ITI, as elsewhere, the determination of national policy lies with the government. The government gives leadership and guidance through the declaration of a national ITI policy, and directs impetus to the policy's implementation by the provision of adequate funds and resources to a designated national authority.

Policies are broad, comprehensive, elastic, dynamic guides. They require interpretation in their use. A policy does not explain exactly what to do. It points out the area or defines the area in which decisions, or actions to be taken, are to be made. Policies spell out sanctioned, general direction and areas to be followed. By keeping within these predetermined boundaries, but with freedom to decide within the stated areas, ITI authorities perform their work in keeping with the overall planning of the nation's ITI services. Working within a policy, they can gain assurance that their actions are in keeping with the wishes of, and will be supported by, the government.

The formulation of an ITI policy is important. Policies should be formed only after adequate consideration has been given all contingencies. Hastily conceived policies frequently prove to be unsatisfactory. High priority should be given to policy formulation when changes in planning are to be made. The policy formulated must be workable for the country concerned. It is a waste of time to formulate a policy which is too idealistic. An important consideration to heed in the formulation of ITI policy is to establish a sufficient number of pieces to cover the areas deemed important. At the start, a country normally has enough to serve as needed benchmarks in various areas. With time more are added, and they should neither overlap existing policies nor leave any

neglected gaps. A policy ignoring a portion of its total area means that certain activities are being carried out without adequate guides.

Preferably, policies should be in writing. Some feel that a policy actually does not exist unless it is written. Verbal and implied policies are frequently too nebulous and limited in their meaning to all interested parties. Many countries do not put all their policies in writing, but the tendency towards written policies is increasing. A written policy assists in giving inclusiveness to the policy.

The primary object of an ITI policy is, to provide R & D workers, engineers, technicians, managers, and more generally all who have some part to play in industrial activities with access to the information they need and this as economically as possible. The basic option which is commonly adopted is to build a national information network on the existing infrastructure, by co-ordinating present activities, articulating the various services, developing their strong points, encouraging public and private initiatives and filling in existing gaps.

USERS OF INDUSTRIAL AND TECHNOLOGICAL INFORMATION

The users are the reason for existence of the ITI facilities. All of their information needs related to the enterprise missions and their own professional development should be the principal focus of a national ITI policy.

Who are the ITI users? They may be conveniently divided into: management, technical staff, marketing staff, skilled workers, and development engineers. The management of an enterprise needs technical, financial, marketing, and other information on which management decisions can be based. Industrial managers usually have a professional background, and have a general awareness of current developments in their own fields. They are aware of information sources available to their own professions. But relevant informa-

tion from other areas of knowledge is often not used because those who need it are not aware of its existence.

The technical staff uses technological information as an aid in the interpretation of data, in the design of new equipment, or to solve a technological problem. Project leaders need much economic and marketing information plus a share of technological information. The marketing staff is rapidly becoming more aware of the utility of information. Their information requirements are becoming more technological as their products grow more complex. In many cases, technological information is interpreted and disseminated for skilled workers by newspapers and magazines, by film, and by television. Some governments issue numerous publications on a wide variety of subjects written for them.

Development engineers are mostly heavy ITI users. They are able to help themselves, require a broad range of subject matter and formats, and require both the most recent and the classics in their fields. They need some marketing and specifications information, plus much of the technological content used in the laboratories. Systems engineers need the information of the preceding groups but in less depth. Simulation facts and computer access are important. The pilot operation stage needs trouble-shooting and industrial standards information.

IMPACT OF INDUSTRIAL AND TECHNOLOGICAL INFORMATION ON NATIONAL DEVELOPMENT

The indispensable role of science and technology in national economic growth is well understood in most developing countries. In industrialised countries, many studies have shown that more than 30 per cent of long term economic growth stems from technological changes which improve productivity or lead to new products, processes or industries (Goldsmith, 1970). For this

reason, the question often raised is how science and technology, which appear to be the key to development in the industrialised countries, can be effectively used for economic and social development in the developing countries.

In industrialised countries, technology moves ahead at an accelerated pace in a close relationship with industrial development. The results of R & D clear the way for the establishment of new enterprises to produce new items with new know-how, a process which improves the industrial structure. Investment in R & D is directly linked to production. Developing countries, however, have little accumulation of scientific or technological capabilities. Besides, scientific and technological development in a developing country faces a host of obstacles both economic and social.

Under these general circumstances, the Korean government adopted scientific and technological development as a major policy goal, and established the Ministry of Science and Technology (MOST) in 1967 as a central body in charge of the formulation of basic policies, and the integration of plans, for scientific and technological development. Since then, all explicit and implicit policies for the development of science and technology have evolved in conjunction with or as an integral part of the five-year economic development plans. This has made technological progress a contributory factor to the industrialisation and economic growth of Korea. The need for technological development is now increasing due to a changing and unfavourable global economic environment in addition to the specific requirements of the Korean economy itself.

Thus, the government efforts have recently concentrated on: (a) establishing specific research institutes to serve such priority industrial sectors as the electronics and machinery industries, and other institutes which cut across industrial sectors such as those to serve in the areas of standardisation and energy conservation, for example; (b) ecouraging private enterprises to establish their own R & D institutes in order to strengthen international competitiveness; (c) encouraging increased importation of

foreign technologies by relaxing administrative control on foreign technology transfer; (d) promoting domestic engineering capabilities by providing incentives for local engineering firms; and (e) building a national co-ordinated system which would improve both the quality and the quantity of R & D activities in government-supported research institutes, in industrial research laboratories, and in academic institutions (Korea Development Institute, 1980). In short, a key technology issue facing Korea has been the formation of an adequate infrastructure and institutional base.

One part of the Korean economy that is profoundly affected by policy decisions of this nature is the nation's ITI services. There are two immediate implications. Firstly, it would be foolish to invest time and money, and more importantly, skilled research manpower, in what has been discovered already. A first priority in any R & D project is to secure all the information on the topic that is already available. Secondly, each new worker in R & D will demand information support for his own particular activity. The productivity of R & D workers is directly affected by the completeness, pertinence and quality of the information available to them. Loeb's observation concerning the role of the library in promoting the advance of science is relevant here. "A new discovery is a new combination of old ideas and those combinations are most likely to occur in the mind of the scientist, not when he is handling material things, but when he is brooding over the thoughts of other men and rethinking them himself ... The library remains the greatest essential to discovery" (Loeb, 1923).

It is commonly found that the role which ITI can play in national development is undervalued. Yet there is firm evidence to show a positive correlation between the spread of such information in a country and the stage of its industrial and economic development.

THE NEED FOR LEGISLATIVE ACTION

Legislative action should be taken in support of the implementation of a national ITI policy, as only thus can the information services be assured of a high level of priority and continuity. Because the benefits of ITI are not easily identified, as the final report of the Intergovernmental Conference on the Planning of National Documentation, Library and Archives Infrastructures held in Paris in 1974 indicates, "individual elements of the information infrastructure which is not based on a secure legal foundation may on occasion become vulnerable targets for reductions in the budget" (Intergovernmental Conference on the Planning of National Documentation, Library and Archives Infrastructure ... 1975). In such a case, a vital contribution to the national development will be lost. The right legislation made with full knowledge of the part that ITI has to play in national development will guard against this and safeguard further progress.

Legislation is necessary to outline the role of the government, the information institutions of national competence, and industry in the implementation of the policy. Legislation is also necessary to give the private sector the incentive to join actively the national system of service outside their immediate jurisdictions. Without incentive and assistance, it is unlikely that local jurisdictions will allocate funds to provide extra-jurisdictional services through national systems. Each government should of course frame its legislation in the light of its own circumstances, but there are some model acts which might serve planners in the developing countries as guidelines.

An example of efficient legislative action was recently seen in Korea. The Korean government mandated the Korea Institute for Economics and Technology (KIET) to study the possibility of designing a technology information system in 1983. When "A Proposal to Design the National Technology Information System" written by KIET was submitted to a quarterly Presidential Conference

on Technology Promotion, chaired by the President in 1984, a legislative framework laying down the policy in broad terms was attached to the Proposal. Both documents were discussed together and approved by the Meeting. Subsequently, a decree on the establishment of the Technology Information Dissemination Centre was issued and the System became operational in the Centre in June 1985.

REVIEW OF INDUSTRIAL AND TECHNOLOGICAL INFORMATION POLICIES EXISTING IN THE DEVELOPING COUNTRIES

As an OECD ad hoc group on scientific and technical information indicates, "few countries of the world, if any, can be said to have a coherent, comprehensive information policy covering all related types of scientific, technological, economic, and sociological information" (Organisation for Economic Co-operation and Development, 1971). Certainly, no developing country appears to have such a policy, although some are undoubtedly developing ITI policies in conjunction with their economic and social development plans.

In this section, the writer will try to review briefly some of the implicit and explicit policies for the provision of ITI recently followed by the Korean government. It would seem difficult to make identical recommendations on the formulation of national ITI policy for an entire group of developing countries since there is no single general formula in the field, and the developing countries are by no means a homogeneous group. There is great variation between the developing countries not only in terms of economic growth but also in terms of information activities. Each government must develop its national ITI policy in the light of its own circumstance. The developing countries could, however, benefit from the policies existing in a country at a similar level of development, by assessing their constraints and opportunities.

Industrial Policy

Korea's industrial policy, of which its ITI policy is an integral part, is made up of two, separate but closely related, courses of government action. One, the policies used to achieve immediate effects on export activities; and two, those used to bring about an impact on the industrialisation process of the nation. The export promotion policies have included foreign rate reform, government endorsement for foreign capital borrowings for export manufacturing, export insurance, preferential tax structures, and special allocation of foreign exchange to exporters; these were coupled with initial import restrictions, such as an import license system and import quota system, which have been gradually removed during the import liberalisation policy of the 1980s.

As for the technology promotion strategies, the government concentrated on legislative and institutional arrangement to lay the foundation for technological development. It legislated the Law of Promotion of Science and Technology in 1967 and the Law for Acceleration of Technology Development in 1972, and established the Ministry of Science and Technology in 1967. In the same spirit, it established such research institutions as the Korea Institute for Economics and Technology (KIET), combining the functions of the Korea Scientific and Technological Information Centre (KORSTIC) and the Korea International Economic Institute (KIET). It started to invest monies into R & D, while helping industries import advanced technology to provide a seedbed for domestic technological development.

Overall Industrial and Technological Information Policy Framework

Korea lacks a stated overall ITI policy. The overall ITI policy of the Korean government implicitly stated in the Revised Fifth Five-Year Economic and Social Development Plan, 1984-86, is that "the basic direction of policies

for the development of industries will be to encourage the industries to be self-reliant in their efforts to improve their competitiveness instead of giving them excessive protection and special support. To this end, emphasis will be placed on improving their accessibility to bank credit and industrial and technological information" (Korea, 1983). The Korean government's commitment to the promotion of ITI services was also underscored in the President's "New Year Policy Statement" presented to the National Assembly early this year when he stressed, among other things, the establishment of a nation-wide ITI system for the Korean industries.

"A Plan for Industrial and Technological Information System" drawn up by the Agency for Administrative Development was submitted to and approved by the National Council for Science and Technology chaired by the Prime Minister in 1980. The main objectives of the Industrial and Technological Information System are: (a) to ensure that basic minimums of information services adequate to meet the needs of the whole industrial community are satisfied; (b) to strengthen existing nation-wide ITI resources; (c) to co-ordinate existing national programmes of ITI services; (d) to encourage the private sector to become an active partner in the development of the national programme; and (e) to establish a nation-wide network of ITI services (Agency for Administrative Development, Korea, 1980).

These policy-related statements in three different documents jointly imply the recent intention of the Korean government to establish a greatly improved and closely co-ordinated system to collect ITI and to disseminate it to those who need it effectively and efficiently for the nation's industrial development.

Technological Information Policy

The recent technological information policy of Korea officially stated in the Revised Fifth Five-Year Economic and Social Development Plan, 1984-86, is "to strengthen the function of KIET, government-supported research institutes, and governmental agencies of providing internal and external technological information to the Korean industry" (Korea, 1983). In 1982, the Korean government merged KORSTIC and KIEI into KIET so that it could concentrate on industrial research and the dissemination of technological information.

Following the establishment of the Korea Advanced Institute of Science and Technology (KAIST) in 1966, eight other specialised research institutes were established in such areas as machinery, electronics, chemistry, etc. to meet the increasing demand for higher technologies and to complement the functions of KAIST. Each of these research institutes has a busy Technological Information Department "engaged in the handling of technological information to provide information services to Korean industry" (Ministry of Science and Technology, Korea, 1984).

Some governmental agencies and institutions including the Patent Office, the Office of Standards, and the Small and Medium Industry Promotion Corporation (SMIPC), provide nation-wide technological and related information services to industry. SMIPC, for instance, has a large staff of about 3,000 full-time and part-time liaison officers, who call on small and medium industrial enterprises "to point out their problems, technological developments and information needs; to help in clearly defining their particular problems; to show them where to find the sort of information or advice they need; and to help them to adapt and apply the information and advice received" (Small and Medium Industry Promotion Corporation, 1985).

In compliance with the national technological information policy, the Korean government approved the aforementioned Proposal to Design the National

Technology Information System, which was established in 1985. The National Technology Information System is now operating with a centralised database containing the following types of information to provide one-stop service (Korea Institute for Economics and Technology, 1984a).

(a) Contents. Description of the expertise and the name of the final product to which that expertise applies.

(b) Location. Place where the expertise in question can be identified.

(c) Forms. Information on whether the expertise in question is associated with one or more types of equipment.

(d) Terms of transfer. Information on selling and buying the expertise including royalties, licenses, etc.

Information Policy towards Small and Medium Industries

The policy of the Korean government for the provision of information required by the small and medium industries (SMIs) has evolved "in conjunction with the basic philosophy of the policies for development of SMIs", which are mainly directed towards, among other things, "technology improvement and management rationalization" (Small and Medium Industry Bank, 1982). The policy for information for SMIs stated in the Revised Fifth Five-Year Economic and Social Development Plan, 1984-86, is to increase the number of SMIPC's branch offices to "provide local companies with better extension services on technology and market information" and to set up the Industrial Technology Development Centre (ITDC) within the framework of the Korea Institute of Machinery and Materials "to actively help the industries to solve the technical problems with its highly sophisticated staffs and abundant technological information" (Korea, 1983).

SMIPC is non-profit organisation established in 1979 in accordance with the Small and Medium Industry Promotion Law for the purpose of implementing

various programmes for the promotion of SMIs including the provision of quality management and technology guidance to them. The major activities of SMIPC related to information for SMIs cover: (a) improving and co-ordinating the delivery of managerial and technical assistance by the various supporting agencies for SMIs, (b) research and publication of statistical information on SMI operations, and (c) operation of its Extension Services mentioned in the preceding subsection that encompass virtually all areas of business management and production.

The information services designed for SMIs and provided by ITDC and SMIPC, particularly through its Extension Services, are important to promote a balanced development of both large and small industries in Korea because the latter have had relative disadvantages in competition with the former in the areas of technology, marketing, and financing; and as a natural consequence, the latter are experiencing serious difficulties in achieving their development goals and in maintaining their areas of business. In Korea, as in other developing countries, SMIs have been playing an important role in the nation's economic development and are an important segment of the Korean industrial structure. Within manufacturing, there were over 32,000 enterprises in the SMI sector, accounting for 96.9 per cent of the total number of enterprises, 51.1 per cent of total employment, and 34.8 per cent of value added in 1981 (Kim, 1983).

Marketing Information Policy

Because of its poor natural resource endowment and small domestic market, the Korean government adopted in the early 1960s an outward-looking development strategy emphasising the growth of export. This necessitated the government to institute a policy measure to facilitate the provision of the latest overseas market information to the nation's industry. The marketing information policy towards industry pursued by the government in the past two decades was

"to strengthen the information functions of the Korea Trade Promotion Corporation (KOTRA) and KIET" (Ministry of Commerce and Industry, Korea, 1983).

KOTRA was established in 1962 when the first Five-Year Economic Development Plan was introduced. It is a non-profit-making organisation financed by the Korean government. Since its inception, KOTRA's activities, with strong support from both the private and public sectors, have constantly expanded. Today, KOTRA maintains 10 branch offices in Korea and more than 80 offices throughout the world. The principal activities of KOTRA and the services it provides may be summarised as follows (Korea Trade Promotion Corporation, 1985):

(a) Providing foreign traders with information on products available for export from Korea and the names of suppliers of those products.

(b) Forwarding specific enquiries received from traders throughout the world to the appropriate suppliers in the country.

(c) Collecting up-to-date marketing information through its world-wide network and disseminating it to local firms.

(d) Conducting research on overseas markets and analysing foreign buyers' requirements for use by domestic firms and the government.

(e) Introducing Korean industry and products to other countries through periodicals, films, and other media.

In the early 1970s, KOTRA reinforced its research function by setting up an Export Information Centre and a Commodity Research Department at its head office in Seoul. The Export Information Centre was given responsibility for providing export firms with information on foreign markets. All trade-related information collected and analysed by other KOTRA departments is sent to this Centre for dissemination. The Commodity Research Department was established to develop goods and industries with export potential. KOTRA's research function became highly specialised with the creation of this Department. The results of its research are efficiently disseminated through the Export

Information Centre to local firms. The research findings are also used by the government in its policy making.

"KOTRA will continue to assist domestic firms and export-related organisations by constantly upgrading its information services and research functions. It intends to extend the scope of its services to overseas firms as well" (Ministry of Commerce and Industry, 1983).

Since its creation, KIET has also been playing an important role in providing the Korean industry with marketing information. KIET's five Area Studies Divisions conduct market research and target geographical areas of potential interest to help private enterprises identify trading opportunities overseas. KIET's five Industry Studies Divisions conduct feasibility studies on the industries, areas of interest and potential business opportunities identified by KIET's experts, the government, or by industrialists. The research results from these Divisions are disseminated through KIET's Information Dissemination Services, Business Consultation Service and seven regional branch offices in Korea, and Regional Economic Advisory Service (Korea Institute for Economics and Technology, 1984b).

Financial Information Policy

Industry can not grow without constant access to sources of investment funds whether from the wealth and savings of the private sector, from the accumulations of the public sector, or from overseas. In order to seccessfully implement the industrialisation programme, it is essential to provide entrepreneurs with information on financing possibilities. They should be informed of the various financial sources which can be used for purchase of production equipment and facilities and for working capital. Korea lacks a stated national policy on the provision of this type of information, and hence there is no unifying concepts on which the operational policies for the various financial

information services can be based.

At present, each financial institution with information activity sets and implements its own separate policy. The Financial Information Service of the Korea Development Bank, for instance, concentrates almost entirely on the needs of its own customer group chosen in accord with the development strategies of the government which are stated in each Five-Year Economic Development Plan (Korea Development Bank, 1983). Through its Enquiry and Answering Service, SMIPC provides SMIs with information on various funds available to the industries (Small and Medium Industry Promotion Corporation, 1985). The Small and Medium Industry Bank, and the Korea Credit Guarantee Fund provide similar information services. The Korea Technology Finance Corporation specialising in investment and financing for technological development through the extention of venture capital and loans provides venture business with the information on the funds available to that particular category of enterprises.

Management Information Policy

Industrial managers have to make decisions at any point where there are at least two alternatives. Their decisions can only be as good as the information on which they are based. This makes it extremely important that industrial managers have access to information as they must have access to air, water, or light. But this is utopian. In real situations, they have great difficulty in getting relevant information when it becomes critical to have it within a short period of time. It is also true that a single information resource is bound to be inadequate for all their informational needs.

The basic characteristic of management information activities in Korean industry is that they are, for the most part, responsibilities of individual enterprises. As in most other developing countries, these activities have so far developed without any plan to seek to interconnect them nationally. The

large enterprises have established their own information departments to collect information necessary for their managerial decisions. But there remain a very large number of small and medium-sized firms that are unable to run information departments of their own. Thus, the provision of government-supported management consultancy services established in such institutions as SMIPC, KIET, the Small and Medium Industry Bank, and the Korea Productivity Centre, is aimed largely at the small and medium enterprises. The extent and use of these services have expanded significantly in recent years. SMIPC alone provided over one thousand firms with the information needed in their managerial decision making in 1984 (Small and Medium Industry Promotion Corporation, 1985).

Policy for Communications Services

Communications services are closely related to the modern ITI services. The stated policy of the Korean government for communications services is "to expand and modernise communications equipment and facilities to meet the rapidly increasing demand for greater and faster exchange of information (Korea, 1983). Some of the important policy measures stated in the Revised Fifth Five-Year Economic and Social Development Plan, 1984-86, are cited as follows (Korea, 1983):

(a) During the Revised Plan period, 3,836,000 additional local telephone lines will be installed to increase the number of subscriber lines per 100 persons from 12.1 in 1983 to 19.3 in 1986. This should largely clear the backlog of requests for telephone subscriptions.

(b) Only electronic switching systems will be installed during the Revised plan period. The ratio of automatic telephone facilities will rise from 92.5 to 99.1 per cent and the ratio of electronic switching systems from 33.9 to 62.1 per cent between 1983 and 1986. Electronic data transmittal and other telecommunications services will be widely introduced.

(c) In order to meet the sharply increasing demand for international telecommunications services, telephone circuits between Korea and its major trading partners will be automated, and an additional 367 satellite communications transmission circuits will be installed. The Fourth Earth Station for satellite communications will be built by 1985 to further increase the number of international telecommunications circuits.

(d) A basic plan will be formulated, which will forecast long-term demand for telecommunications and data processing services and which will lay the foundation for the construction of an integrated digital information communications network. This will be closely co-ordinated with efforts to accelerate the growth of the domestic communications industry and to develop high technology industries.

During the period of the Fifth Five-Year Economic and Social Development Plan, 1982-86, a total of approximately ten billion dollars will be invested in the projects for expansion of telephone switching systems and the accelerated development of data communications networks. In order to implement these projects, the Korea Telecommunications Authority was established in 1982 as an autonomous operating body for public telecommunications, and the Data Communications Corporation of Korea in the same year with the responsibility of developing nation-wide data communications networks and services.

Policy for the Nation-wide Industrial and Technological Information Network

Where purchase funds are not sufficient to acquire all information resources that a nation needs, it would be simple prudence to enjoin a degree of mutual co-operation through a network for the benefit of all. Such a co-operative approach would be particularly crucial in the developing countries where funds are limited and will remain so for many years to come, and maximum use is expected to be made of each piece of material. A network implies equal access

by any individual for any purpose to the sum total of the nation's information resources. In other words, a network implies a degree of democratisation of information, a steady increase in the ability to serve at all points of service, and co-operative sharing without the constraints of time, distance or type of information.

Two nation-wide ITI networks evolving in Korea, namely the Industrial and Technological Information System and the National Technology Information system, were already discussed in the preceding subsections. Another recent development in transforming the information structure in the nation is the government's thrust to establish a "Consolidated National Information Management System". "To cope with recent changes, it is necessary for the government to manage information in a systematic and efficient manner. Systematic management and utilisation of information would expedite prompt and comprehensive assessment of socio-economic changes and therby enable the government to meet rapidly changing situations efficiently" (Korea, 1983).

The policy stated in the Revised Fifth Five-Year Economic and Social Development Plan, 1984-86, is "to establish a national information system by consolidating the administrative computerisation projects carried out, and being carried out on an individual basis. The computer networks of national and public agencies will be connected with one another in an organic manner with a view to developing a consolidated national information management system." Some of the important policy measures stated in the Revised Fifth Five-Year Development Plan are summarised as follows (Korea, 1983):

(a) The System is aimed at achieving a fully integrated administrative information.

(b) To respond effectively to increasing demands for socio-economic statistics, the existing survey and statistics system at community, regional, and national levels will be readjusted and tied to information banks.

(c) Databases of the information on trade, public finance, industry, manpower, agriculture, fisheries, and others will be accumulated in the System. Information contained in these databases will be supplied to all who need it including users in the private sector.

CHAPTER III

FORMULATION AND IMPLEMENTATION OF NATIONAL INDUSTRIAL AND TECHNOLOGICAL INFORMATION POLICY

ITI is an essential national resource and one which should be administered by the establishment and implementation of a national policy. In developing countries, more perhaps than in industrialised ones which have greater resources and where problems of development and economic growth may be less acute, such a policy would be important. Some questions could be raised here. Who are the people concerned with the establishment of national ITI policy? Who are the people concerned with the implementation of the policy? How is it established and implemented by them? How is it linked to industrial policy? Again, there is no universal and invariant principle applicable to all the developing countries. This chapter will examine some of the Korean cases to help readers prepare their own answers to these questions.

INDUSTRIAL AND TECHNOLOGICAL INFORMATION POLICY AS AN INTEGRAL PART OF THE INDUSTRIAL DEVELOPMENT POLICY

As was stressed in the first chapter, the economic growth of the developing countries requires a strong policy for industrial development. The development works mainly through the creation within the individual enterprises of a willingness to modernise and go forward. An industrial development policy will be fruitless if it is not supported and complemented by an incisive information policy, which aims at establishing a climate of modernisation and progress, and at serving the needs of newly-formed enterprises.

Thus, ITI policy should be incorporated in the policy for industrial

development, which in turn should be incorporated in the policy for achieving economic growth and other national goals. 'Most nations and international organisations have usually considered these policies to be separable and have considered only fragments of the total picture at any one time" (Organisation for Economic Co-operation and Development, 1971). But the effectiveness of ITI services will undoubtedly be reduced by their isolation, where there is no overall policy for adjusting the services in relation to the nation's industrial and economic needs and potentialities.

The goal of ITI policy will be to ensure that services exist which arise out of the flood of available knowledge, and identify the improvements in production or management which can be applied to the nation's industry. Such knowledge exists. It is widely known, has been published, and all the details are available. But the potential users may be unaware of its existence or of how to apply it effectively. We are concerned here more with a transfer and application of knowledge rather than a simple transfer of documentation, and hence we see the need for an advisory service rather than just a straightforward liaison with formal documentation sources.

Policies of this kind are currently applied in some developing countries. The planners of industrial policy in the developing countries should consider ITI to be incorporated in their formulation of national industrial policies in the same context as manpower and material resources. Supporting industrial development through strong information services has probably been a determining factor in the rapid growth of the Japanese economy. If wisely applied, industry of the developing countries could surely equally benefit from a policy of this nature.

MECHANISMS FOR THE FORMULATION OF INDUSTRIAL AND TECHNOLOGICAL INFORMATION POLICY

As was discussed in the preceding section, it makes no sense to think of ITI policy in isolation. It is a set of policies to be used in conjunction with more general policies, i. e. industrial policy and technological policy, and principally to secure specific objectives, e. g. certain kinds of structural changes, imporvement of particular kinds of services, or promotion of services to particular industry. It is therefore common practice in many countries including Korea that ITI policy is formulated by the same people who establish industrial policy and technological policy, in parallel with those policies.

Policy is a course of public action adopted by the government. However, the role of government in the making of industrial and technological policies varies from country to country and time to time. The powers that governments have in principle can not always be translated into effective practice. Novertheless, it is largely the national governments that make industrial and technological policies. Regardless of political ideology, governments are responsible for mobilisation and allocation of resources, stabilisation of the national economy, and promotion of technological innovation.

The Korean case is not exceptional in this regard. A set of new industrial policies were established in the early 1960s to stimulate the economic development of the nation. Export-oriented industrialisation was adopted as the strategic course of development. This strategy was based on a broad range of critical development activities such as establishment of physical infrastructure, consolidation of industrial parks, manpower training, R & D in science and technology, legal and administrative framework for industrial promotion, and incentives for export-oriented industries. The "administratively planned growth" of the Korean economy during the 1960s and 1970s was faster than the foreign-aid stimulated growth in the 1950s. Thus, it is viewed that the Korean govern-

ment played a significant role in industrial development as well as trade expansion over the past two decades through effective formulation and implementation of policies. Throughout the period, the ITI policies of Korea were formulated within the framework of the successive Five-Year Economic and Social Development Plans.

Executive dominance in the Process of Policy Formulation

A major characteristic of Korean policy formulation is that the executive branch is the overwhelmingly dominant government partner. On the economic side, this may have something to do with the increasing technicality required to compete internationally and the necessity of speedy decisions to respond to a rapidly changing international environment (Article 51 of the President's Emergency Measure Regarding Economic Stability and Growth, 3 August 1972). Whatever the reason, it is clear that the executive branch overwhelmingly dominates not only execution but policy formulation as well.

Within the executive branch, the ultimate power is of course the President, and major decisions and disputes are ultimately decided by him. This is no rubber-stamp formality in Korea. Within the Blue House (the executive mansion), there is a small but powerful economic secretariat. The Economic Secretary holds the rank of assistant-minister.

The formal mechanism for conflict resolution is the Economic Ministers' Meeting, begun in 1964. The Meeting is chaired by the Deputy Prime Minister (DPM) and consists of all economic ministers and the Minister of Foreign Affairs. The Meeting is currently held twice a week. More informal interaction takes place every Saturday morning at the Economic Ministers' Round Table. Economic policy proposals agreed to at this formal meeting are sent to the cabinet meeting which is largely a rubber stamp.

Despite these mechanisms, interministerial conflicts arise. Power

struggles are common between ministries over jurisdictional and budgetary matters. For example, setting an annual export target can be a subject of heated discussion between the Economic Planning Board (EPB) on the one hand and the Ministry of Commerce and Industry (MCI) on the other. Such disagreements are ultimately resolved either through interministerial bargaining or through the arbitration of the Blue House.

Government-Business Interaction in the Process of Policy Formulation

The nature and extent of business influence on government is a porfound issue with ramifications well beyond the economic realm. One relevant paradigm of government-business interaction is represented by the notion of "Japan, Inc.", that is "the proposition that economic growth policies have been jointly decided and jointly executed by politicians and appointed officials together with representatives of private business" (Irezise; Suzuki, 1976).

Given the Korean government's dedication to growth and its substantial (though by no means exclusive) reliance on private sector activity, the success of government requires the success of business. This mutuality of interest implies a partnership and, to this extent, there is a "Korea, Inc." parallel to "Japan, Inc." This partnership is reflected in extensive interaction between government and business in the process of policy formulation. These relationships are facilitated by a network of personal ties between businessmen and bureaucrats, and by interchange of personnel between the two sectors (though the latter is decidedly less extensive in Korea). In these respects, there is a similarity between Japan and Korea, in large part due to a common cultural heritage. There is, however, one decisive difference between the two countries. In Korea, the dominant partner is unequivocally the government, whereas, in Japan, the reverse may be closer to the truth.

In brief, the Korean government is dependent upon the success of business,

but not upon its political support. It, therefore, must listen to the business community and frame policies that are in the long-term best interests of entrepreneurs in general. At the same time, however, it is in a position to take actions that are inimical to certain short-term interests.

Important Korean businessmen have regular opportunities to discuss economic policy with top government officials. Most notable is the Monthly Export Promotion Meeting and the more select luncheon that follows. Personal contacts with government officials are a traditional means of influence in Korea. Many such contacts evolve from the close ties generated by school, region, or family, and by the recruitment of ex-civil servants for industry positions. In addition to providing opportunities for transmittal of individual needs, they also serve to inform officials of business concerns in general.

Formulation of General Economic Policy

General economic policy in Korea is formulated by EPB; industrial policy, by MCI; technological policy, by MOST; monetary and fiscal policy, by the Ministry of Finance and the Bank of Korea; and communications policy, by the Ministry of Communications.

The EPB was established to institutionalise the government's planning function in 1961. It is responsible for economic planning, national budgeting, foreign capital management, and statistics. In 1963, its role and functions were increased when it was decreed that the Minister of EPB would concurrently hold the position of DPM. As mentioned above, both economic planning and budgeting functions are performed under the same umbrella of DPM. The rationale for this arrangement, in theory, is to narrow the gap between planning and implementation. In the early stages, however, communication between the planning Bureau and the Budget Bureau was not as smooth as had been hoped because of differences in their conceptual frameworks. The communication gap became an

obstacle for effective implementation. In order to facilitate communication and promote mutual understanding, a measure was introduced in 1966. This involved the exchange of intermediate-ranking officials between the two bureaux. It helped the planning officials learn about financial feasibility considerations, and the budgeting officials become familiar with the implementation requirements of projects.

The EPB sets macro-economic growth goals--including growth in trade gross national product, production, prices, consumption, and government income and expenditures--in economic plans which cover a five-year period. The economic plans provide a policy framework for the future, as well as data on the direction of the economy, that can be used by private enterprises and policy planners in their decision-making. The EPB has formulated six economic plans. The objectives of these plans have included modernising production facilities, promoting heavy industries, reducing dependence on imports, promoting exports, improving infrastructure, modernising low-productivity sectors, stabilising prices, and promoting social development.

Preparation of a Five-Year Economic and Social Development Plan starts long before the beginning of the actual plan period, utilising an input-output matrix and a dynamic projection model for testing the consistency of the overall plan as well as estimating sectoral investment and import requirements. The initial work is primarily macro-analysis to provide overall structure. Guidelines are prepared, and based on them, a tentative macro-plan is drafted. At this stage of planning, a number of scholars and experts from various fields are invited to participate.

To work out the details of the tentative plan prepared by EPB, about thirty specialised working groups, each headed by a high-ranking government official from a concerned ministry, are organised. Each group consists of government officials of concerned ministries, and experts from research institutes such as the Korea Development Institute (KDI), banks, industries, labour associations,

consumer groups, and universities. EPB officials act as secretaries to each team.

The detailed plans developed by tne working groups are co-ordinated by the Economic Plan Co-ordination Committee chaired by the vice-minister of the EPB. The committee consists of vice-ministers and heads of concerned governmental agencies, scholars, representatives of national banking institutions, business associations, labour associations, journalists' associations, the R & D community, the library and information community, etc. These plans co-ordinated and integrated by the Co-ordination Committee are then examined and approved by the Economic Plan Deliberation Committee chaired by the Prime Minister.

The aforementioned committee debate on and approve the drafts with relatively minor adjustment. Actual plans are prepared by young bureaucrats in close co-operation with KDI staff. KDI sponsors about ten Economic Policy Conferences in important policy areas. At these conferences, related working groups' plans are presented and commented on by participants from all walks of life. Suggestions made by the participants are valuable and greatly assist not only in determining the best policy but also in winning their acceptance, understanding, and co-operation. Participation of well-informed representatives of the economic and related communities in policy advising also assist in getting the formulated policy properly interpreted and used.

Formulation of Industrial Policy

MCI has principal responsibiliiy for formulating the industrial policies of Korea and ensuring their success. Along with its responsibility for the establishment of industrial policy, MCI is responsible for trade policy, the regulation of distribution systems, patent policy, industrial standardisation policy, and small industry. Since the ear.y 1960s, MCI officials have increas-

ingly influenced business decisions on production and investment through consultation and administrative guidance, and they are generally not authorised to compel compliance with their wishes (except in a few narrowly defined instances).

MCI's Industrial Policy Bureau has prime responsibility for the formulation of industrial policy. The process begins with developing draft policy on the framework of the Five-Year Economic and Social Development Plans, which do not, as a rule, contain more than broad general guidelines on the course of industrial development. The draft policies are confirmed pending evaluation and review by various industry-related committees as well as consultations with relevant ministries. Important policies and plans are determined after review by the National Council for Industrial Policy, which is the national council responsible for the evaluation of industrial policies. Chaired by DPM, it is composed of ten concerned ministers.

To reach a broad national consensus on the nation's industrial policy, a Private Sectors' Consultative Meeting on Industrial Development was formed under the National Council for Industrial Policy in March 1985. The Meeting, which consists of representatives of industries, consumer groups, banks, the press, R & D institutes, and universities, seeks out a broad range of public opinions. The Meeting seeks out business opinions on industrial, fiscal and financial policies and recommends them to the government. For possible revisions, it also evaluates and analyses all current industrial policies.

Formulation of Technological Policy

In developing countries, where the scientific and technological level is low and industry is almost incapable of developing industrial technology, governments must play a leading role in all areas. With this in mind, Korea made some achievements in laying a foundation for the development of science

and technology in the 1960s and 1970s. Recognising that systematic efforts to develop science and technology must be preceded by a realignment of administrative agencies responsible for science and technology, the Ministry of Science and Technology (MOST) was established in 1967. MOST formulates basic policies on R & D, cultivation of skilled manpower, international technical co-operation, development of rearch organisations and resources, and creation of a favourable societal climate for scientific and technological development.

Nevertheless, policy implementation resided in the hands of other action-oriented ministries. MOST was only the central co-ordinating agency for the various planning and management activities of other ministries concerned with the promotion of science and technology. There were at least eight government ministries that were actively involved in science and technology. For example, transfer of foreign capital and technology to Korea was under the jurisdiction of the EPB. Patent, industrial standardisation, and policy formulation and implementation of industrial technology development were under the jurisdiction of MCI. Science and engineering education was carried out by the Ministry of Education.

For this reason, the National Council for Science and Technology (NCST) was established in 1973 in order to develop science and technology as an integrated national effort. NCST consisted of the ministers of various government ministries concerned, together with representatives of industries and universities, and was chaired by the Prime Minister. NCST was supposed to deliberate, among other things, the long-term development policy of science and technology, co-ordination of major policies, co-ordination of overall budget in connection with scientific and technological development, and co-ordination of manpower development plans.

The administrative system presented above appeared ostensively to be adequate, but had many flaws. At the policy level, though MOST developed ambitious scientific and technological policies, they were largely ignored by

the action-oriented ministries. Major ministries which had power to shape industrial policies, such as the EPB and MCI, were so preoccupied with short- or medium-term tasks, e. g., achieving yearly export targets that scientific and technological policies with more long-term implications were not given adequate attention. Furthermore, industrial policies managed by these ministries in the 1960s and early 1970s had been literally protectionistic and, in turn, failed to create an environment conducive for technological innovation (Kim, 1985).

MOST, in contrast, was mainly concerned with the supply side of technology, with promoting local technological capability building. Such an imbalance between the ministries which shaped economic and industrial policies and MOST which endeavoured to promote the supply of technological capabilities, resulted in the poor integration of MOST's scientific and technological policies into national development plans, leaving long-term scientific and technological policies only on paper. NCST, which was created to correct these deficiencies, seldom met and functioned imperfectly.

However, as the Korean economy underwent a structural change towards the development of relatively more technology-based industries such as machinery, chemicals, shipbuilding, and electronics, the Korean government made a strong effort to accelerate scientific and technological development in 1982. One of the explicit measures taken by the government was a quarterly Presidential Conference on Technology Promotion, similar to the pattern adopted in the 1970s to achieve export targets. This Conference, attended by the President of Korea, all cabinet members, and representatives of universities, industries, and public research institutes, is expected to bring about effective interministerial co-ordination and to result in complete redesign of the national system for strengthening innovative capabilities (Ministry of Science and Technology, Korea, 1984). The Conference discusses all technological policy problems including those concerned with information. As mentioned previously, the

establishment of the National Technology Information System was an outcome of the Conference.

In addition, the government established the Technology Promotion Council in 1984 which meets monthly as a working level mechanism to integrate the technological activities of different agencies and to follow up on issues raised in the quarterly Presidential Council. The Technology Promotion Council consists of the vice-ministers of the cabinet ministries concerned with science and technology, the President's Economic Secretary, and various leaders of public research institutes.

Concluding Remarks

As presented above, Korea possesses the mechanisms needed for setting up its industrial and technological policies, of which the industrial information policy and technological information policy are an integral part. These mechanisms have functioned to draw up some policies for ITI in parallel with the industrial policies and technological policies, but not in an integrated manner. ITI policy problems should be made more clearly heard by the government. That is, of course, the responsibility of the ITI profession in Korea.

MECHANISMS FOR THE IMPLEMENTATION OF INDUSTRIAL AND TECHNOLOGICAL INFORMATION POLICY

Once a national policy has been formulated, it must be implemented. This link is by no means automatic. In the words of Hecksher: "Even in large countries ruled by strong governments, economic statutes and laws have ever so often remained pious wishes exerting little or no effect on the course of economic development" (Hecksher, 1954). This has been particularly true in developing countries where administrators are not capable of translating policies into

actions due to ignorance, lower motivation, lack of experience, or poor communication between policy planning and implementing agencies (Whang, 1985).

Nehru once said, "The real question is not planning but implementing the plan--I fear we are not quite so expert at implementation as at planning" (Morgan: Betz, 1970). His statement implies the cruciality of implementation and its inadequacy in a developing country. The writer believes that Korea is a notable exception, and that, in contrast to the Indian situation, Koreans are even better at implementation than at policy planning.

Implementation is to make policies work. Implementation is an action process that converts an idea into reality. It represents one tier of means while policy planning represents the other tier of ends. It is in this context that policy planning and implementation could be viewed as a continuing process of action rather than separate processes, though the concept implies two distinctive stages of action. Nevertheless, a gap between policy planning and implementation may exist in a mixed economy, as policy planning by the government tends to be incomplete while implementation is left mostly to the private sector. There is a crucial discontinuity in the means-ends chain at the point where the government's control stops and the private sector takes over the remainder of the chain. The crossing of this interface is the critical bottleneck in implementation. The lowest tier of the government planning is a set of mechanisms whereby individual and enterprise compliance is stimulated, forced, or cajoled. A discussion of implementation can usefully concentrate on these means whereby the crucial interface is crossed, i. e. intervention mechanisms.

The extent of government intervention can be defined by two major variables: the mode of control and the instrument of intervention. In a mixed economy where economic control by the government is limited, two modes of government control are applied: (a) direct control by which government undertakes certain activities by itself, and (b) indirect control by which government stimulates

private initiative and participation in certain activities. Government utilises two major instruments: (a) finance made available primarily through taxation, and (b) power stemming from national sovereignty. By combining the two major variables, one can visulalise four intervention mechanisms: (a) government budgeting, (b) public institutions, (c) regulation, and (d) inducement. In the case of Korea, to what extent and what mechanisms are adopted by the government to implement ITI policies? One of the characteristics of the Korean implementation system in the field of ITI policies has been the emphasis placed on the utilisation of public institutions and regulation, as readers will see in the following discussions.

Implementation of Technological Information Policies

With the introduction of the first Five-Year Economic Development Plan in 1962, the government was compelled to establish a national scientific and technological information centre to help implement the ITI policy formulated in conjunction with the Plan. KORSTIC was thus established in 1962 as a mechanism to facilitate the international transfer of scientific knowledge and technologies by collecting, processing, and disseminating scientific and technological information comprehensively and systematically on a non-profit basis. To broaden its role, KORSTIC was merged with KIEI, an entity that undertook collection of market information and area studies, to become KIET.

KIET is an autonomous, government-supported industrial research institution and technological information service centre. Its research part is composed of five area studies divisions, five industrial studies divisions, and an international economic studies division. Its information part is a national centre for information on industrial technologies, patents, and the international market environment. It publishes 35 periodicals, offering information relevant to business and government decision-making. To facilitate the timely dissemi-

nation of information, it operates a computerised data bank, utilising databases produced at KIET and other domestic sources as well as international ones. KIET also has a business consultation service division, seven regional branch offices set up in the major industrial towns and three overseas offices in Tokyo, New York, and Frankfurt.

The National Committee on International Co-operation was established in 1983 as an advisory body to EPB, which is composed of twelve concerned ministries, the President's Economic Secretary, and other officials appointed by DPM. Its terms of reference include, among other things, gathering and analysing overseas industrial and technological information. In order to gather this information systematically, its Secretariat operates an Overseas Industrial and Technological Information Gathering System, making use of a network of the diplomatic and consular offices in foreign countries. The information gathered is sent to KIET to be processed and disseminated to industry after serving its primary mission within the Committee. This information has proven to be very useful at its second post.

As mentioned previously, the Korean government has concentrated on legislative arrangement as well as on institutional arrangement. That is, the government has utilised power and authority to directly influence the behaviour of the private sector. One such case was the enactment of the Foreign Capital Inducement Law of 1962 which was directed towards the promotion of foreign investment and technology transfer. Following this, several important laws for the development of industrial technology and technological information were enacted. They include: (a) the Promotion of Science and Technology Law of 1967 which defines the basic commitment of the government to the support of science and technology; (b) the Law for Acceleration of Technology Development of 1972 which provides, among other things, incentives to technological information services established in private enterprises; and (c) the National Technical Qualifications Law of 1973 which, through a system of examination and

certification, promotes the status of professionals including information specialists in technical fields, particularly those who practice skills.

Implementation of Information Policies towards Small and Medium Industries

At the national level, information services for the SMI sector are provided mainly as part of the extension services rendered by various government-supported institutions and industrial associations. The legal basis for the extension services for SMIs was established by enactment of the Basic Law of Small and Medium Industries of 1966. Since then, extension services for SMIs have been provided by an increasing number of institutions and associations. Extension services currently available to SMIs are shown in the chart below (Kim, 1983).

Institutions providing services	Areas of services	
	Managerial	Technological
Government-supported institutions		
Small and Medium Industry Promotion Corp.	*	*
Industrial Advancement Administration		*
National Industrial Research Institute		*
Korea Institute of Machinery and Metals		*
Industrial associations		
Korea Federation of Small Industry	*	*
Korea Chamber of Commerce and Industry	*	
Financial institutions		
Small and Medium Industry Bank	*	*
Korea Credit Guarantee Fund	*	*
Citizens National Bank	*	*

In addition to the institutions and associations listed above, KAIST, too, renders extension services to SMIs upon request from the Korea

Federation of Small Industry and individual enterprises. This is a statutory obligation of the institute.

In order to improve the institutional infrastructure for the extension services towards the SMI sector, MCI recently accredited these five institutions to provide specialised services: SMIPC, the Korea Production Technology Corporation (recently merged into SMIPC), the Korea Credit Guarantee Fund, the Small and Medium Industry Bank, and the Citizens National Bank. The managerial and technological assistance activities of these accredited extension service institutions are co-ordinated by SMIPC.

In order to supplement the limited in-house staff resources, some institutions rely heavily on outside consultants in carrying on the extension services to SMIs. SMIPC has built up a fairly large in-house extension service staff of ninety specialists but continues to use outside sources. The shortage of specialists is one of the major constraints to improving extension services to SMIs. Recognising the need to increase the number of qualified consultation workers, the government introduced a new registration system for qualified workers in 1979, in accordance with the Law for the Promotion of Small and Medium Industry. At the end of 1982, a total of 2,474 persons were registered as external managerial and technological consultants.

Implementation of Trade Information Policies

Among the many export measures introduced by the government, the creation of the Korea Trade Promotion Corporation (KOTRA) may be of particular interest to trade information officials in other developing countries. Though it is not the only organisation in Korea that provides trade information services to the trading community, KOTRA has been an important governmental element in the country's national trade information promotion framework. KOTRA was established in 1962 as a specialised trade promotion body. Today, KOTRA maintains ten branch

offices within Korea and over eighty offices throughout the world.

KOTRA's major functions related to trade information are: (a) to collect the latest overseas market information and disseminate it to the Korean business and industrial communitities; and (b) to provide the Korean government with the information on the world's regional markets, gathered through its world-wide network of the Korea Trade Centres (Korea Trade Promotion Corporation, 1985). KOTRA's Overseas Market Research Department comprising seven divisions undertakes, among other things, these tasks: gathering information on overseas markets for the major Korean export items and providing it to domesti enterprises, and analysing and evaluating commodity information to assist domestic enterprises in making their export efforts.

KOTRA's Information Department plans and operates computerised trade information systems; provides reprographic services; and operates a trade library which houses some 43,000 books, 2,100 periodicals, and 40,000 pamphlets and catalogues. Public Information and Publication Department publishes a number of trade-related monographs and periodicals for overseas as well as domestic distribution. Among these are the Daily Overseas Market News, which provides overseas market information to Korean exporters and importers; the Korea Trade, which is a bimonthly catalogue of Korean products; and the Korea Trade and Business, which is a monthly news bulletin. KOTRA's domestic branch offices conduct surveys of their regional industries, supply information on overseas markets, conveying trade enquiries, and hold exhibitions displaying various articles gathered through the network of the Korea Trade Centres. Its branch offices in most major cities in the world introduce interested Korean manufacturers and exporters to overseas importers and provide the latest information about Korean industries. Information regarding the Korean market and Korean importers is also provided by these overseas branch offices.

The Korean economy, despite the first oil crisis and its impact on the world-wide economy, continued to grow, thanks largely to expanded exports of

labour-intensive manufactured products and overseas construction projects in Middle East and Asian countries (Kim, 1984). These activities were assisted by the newly established KIEI, which provided information on the economic and business conditions of different countries and regions to help private enterprises identify trading opportunities overseas. In 1982, the Korean government merged KIEI and KORSTIC into KIET so that it could concentrate on marketing research and the dissemination of marketing and technological information to Korean industry.

In addition to KOTRA and KIET, there are some other organisations in Korea that provide marketing information to business and industry. They are the Korean Traders' Association, a private non-profit-making body of all registered exporters and importers in the nation; the Korean Chamber of Commerce and Industry; the Korea Trading Agents' Association, a non-profit entity under the control of the government composed of legally registered or approved enterprises; the Export-Import Bank of Korea; and over twenty exporters' associations authorised by MCI. All of these organisations provide certain quasi-official information services to member companies.

Implementation of Communications Policies

The present development shows that there are strong interactions between at least three axes: information, computer technology, and telecommunications, and that each axis has its own organisational structure. "What might at first sight be regarded as dispersed units, might very well fit into a multi-axis system, in which the policy would be to reveal the relationships that exist among the separate units, point out their interdependence and ensure their development along the various axes according to the priorities set" (Tell, 1976).

With the development of te unications, a computer has become a mere node in a network of computers an. als linked by telecommunications

lines. Being located close to the central processing unit is no longer necessary. A remote terminal can nowadays perform the same job for the documentation centre if one has the proper communication means. Access to a growing part of the world's stored knowledge is becoming more and more independent of time and location. The development of this independence could be enhanced by granting special rates for the transfer of information via common carrier--the telephone network--between service centres. An alternative to this could be the setting up of special information networks, examples of which exist in industrialised countries, e. g. CYCLADES in France.

Bearing such development in mind, the Data Communications Corporation of Korea (DACOM) was incorporated in 1982 as an exclusive common carrier for data communications services in Korea. DACOM is a private organisation established under the commercial code, and its shareholders include both governmental agencies and private industries. This joint participation of the public and private sectors was hoped to allow the management a ful' autonomy in responding to the rapidly changing technologies and customer needs while preserving national interests.

DACOM's primary goals are to introduce the rapid advancement in computer and communications technology to Korea and to set up a national infrastructure for an information society by actively participating in the construction of nation-wide computer networks. These consist of a packet-switched data network as the basic backbone network in which various computing systems will reside, such as electronic mail, electronic funds transfer, government administration, videotex, remote computing service data banks, and others (Lee, 1982).

The construction of DACOM-NET, a public packet-switched data network, was completed and it became operational in 1984 for both domestic and international traffic, replacing the Time Division Multiplexer which was used to provide international service only. DACOM-NET's overseas links currently stretch to the packet networks of 53 countries. As of 16 March 1985, 245 organisations

used DACOM-NET. The target for the end of 1985 is set at 500 organisations (Lee, 1985).

In 1984, the government made a revision in the Telecommunications Law, which became effective on 1 September 1984, in order to appropriately cope with the rapidly changing conditions of the telecommunications business in Korea. This has enabled DACOM to take over complete services of the leased data circuits from the Korea Telecommunications Authority throughout the nation, liberalising the information industry in Korea. In accordance with the government policy for stimulating usage, DACOM is planning to reduce its usage tariffs.

As an integral part of its varied services, DACOM provides overseas public data bank services over the DACOM-NET, enabling domestic users to access a diverse range of the world's information services. At present, this on-line data retrieval service covers such databases as Dialog, SDC, BRS, PATOLIS, QUESTEL, and JOIS. It is now preparing local databases including those for videotex. A DACOM plan shows that its first local database will be offered in 1986 and three more will be added each year thereafter.

ASSESSMENT OF NEEDS FOR INDUSTRIAL AND TECHNOLOGICAL INFORMATION

ITI policy planners should formulate their policies based on the priority programmes of the government, the level of the nation's development, the nation's industrial structure and the information habits of users, habits that may be conditioned by their activities and the kinds of disciplines involved. These may be expressed in two words--national needs. A better understanding of what the national needs are, so that a good policy can be formulated, is dependent on a comprehensive and systematic survey, of which an excellent example was seen in Australia in 1971.

The Scientific and Technological Information Services Enquiry Committee

(STISEC) set up within the National Library of Australia investigated the national need for scientific and technological information services in Australia, particularly from the user viewpoint, to "bring forward proposals which will assist in the ultimate formulation of a national policy in this area of information resources" (National Library of Australia, vol. 2). A Major survey of information needs was carried out. In 1971, questionnaires were distributed to a random 4 per cent of the members in each of the 28 major scientific and technical societies in Australia, with a combined membership of about 103,000. As well as gathering basic information on qualifications, training, age, and occupation, the questionnaire sought to establish how individuals used various sources of information and how these ranked in importance and usefulness, how often and how urgently they needed information, and how successful they were in obtaining it.

It is generally true that a national ITI policy can not be formulated without a proper knowledge of the structure and number of users. That is why empirical data on the structure of users (distribution of users by educational background), the subjects they are interested in (priorities), and their location (distribution of users by industry) have to be collected. Details concerning the information requirements of users (as well as potential users) can be obtained, for example, from institutions or persons by direct enquiry, and deduced from the national plans and budgets.

A thorough knowledge of the existing ITI resources in a country is an essential prerequisite of sound formulation of ITI policy. Every attempt should be made to prepare an analysis of the existing ITI resources. To facilitate a clear judgement on the state of the existing resources, the analysis should throw light on the following problems:

(a) The availability of important sources in existing facilities.

(b) The present role and responsibility of the government in regard to the establishment of the nation-wide ITI service.

(c) The structure of the existing ITI services in regard to branches of industry, and a distribution between public and private facilities.

(d) The staffing of the existing ITI facilities, the number of trained or partly trained information specialists.

(e) The level of education of ITI specialists and users.

(f) The degree of international co-operation.

(g) The extent to which computers and communications technologies are being applied to ITI services and relevant research is being conducted on specific problems at the national level.

These data on the existing ITI resources should be used as a basis for forecasting future needs and the preparation of a national ITI policy.

INFORMATION SERVICES GENERALLY NEEDED TO FACILITATE INDUSTRIAL ACTIVITIES

As a UNIDO monograph states, "Both large and small enterprises require technical information in order to decide whether to introduce new or improved production processes or products. They need economic information, such as data on manpower and the potential market, as well" (United Nations Industrial Development Organisation, 1969). Supplying these types of information is an ITI service. A variety of kinds of ITI services have been developed for various groups of users and various types of information. What services should be offered in a country depends on its industrial structure and the habits of users. Information services generally needed to facilitate industrial activities, particularly from the national viewpoint, are presented as follows:

(a) Reprographic services, i. e. copying and duplicating documents, can not be considered a purely technical matter. The level of reproduction techniques and facilities has a direct bearing on the effective use of information. The swift spread of new reproduction techniques is likely to

play as great a role in increasing the efficiency of R & D as the invention of book printing did seven centuries ago.

(b) Referral services. In the developing country situations, the most useful answers to an urgent question is often to be obtained from a specialist in the field concerned. Attempts have been made in this respect to effect means whereby the persons with the need can be referred to the person, document, or organisation that has the appropriate knowledge. A referral service directs enquirers for information and data to such sources.

(c) Translation services. It is an inescapable fact in developing countries that most incoming information is in foreign languages. A national technical translation service should be set up to acquire and process foreign-language documents. Whether the actual translation occurs in the processing or dissemination phase, the translation service will be expected to provide full document translations or vernacular summaries. Abstracting services tend to provide vernacular summaries for the literature they cover.

(d) Current-awareness services review publications immediately upon receipt, selecting information pertinent to the programmes of user groups served, and note individual items to be brought to the attention, by one means or another, of those groups. Current awareness services involve a combination of processes including the selection of whatever is pertinent from periodicals, reports, patents, books, and announcements of various kinds. A systematic record is made of these significant references, and they are accumulated for periodical distribution as bulletins.

(e) Selective dissemination of information (SDI) is a refinement of the current-awareness idea. It is designed to serve the individual directly. Profiles of personal interests may be formulated by selecting relevant terms from a thesaurus or written free form and later transformed into vocabulary used by the retrieval system. Those items that match the profile are brought to the user's attention. Where computer facilities are available, SDI is

performed very effectively.

(f) Retrospective searches/Bibliography compilations. Bibliographies are many and various. Retrospective searching refers to the process of obtaining a closed list of references to a particular subject, covering the information references available on a subject for a specified period of time, in specified languages, etc. In industrial situations, the search may not be a bibliography in the strict sense of the word, but may contain information in the original form in order to meet immediate user needs.

(g) Information analysis. The information analysis operation has been particularised in the oft-quoted Weinberg Report (Science, Government and Information ... 1963): " ... retrieval of documents is not the same as retrieval of information; a technical specialist really needs the information contained in the published literature, not the published literature itself. To retrieve information, as contrast to documents, the technical community has devised the specialised data and information [analysis] center. A specialised information [analysis] center ... collates and reviews the data, and provides its subscribers with regularly issued compilations, critical reviews, specialised bibliographies, and other such tools ..."

(h) Depository collections are central lending collections of final resort for those materials unavailable elsewhere within the country. Such collections should be built in the fields important to the nation's industry, e. g. in the fields of patents, standards, trade literature, etc. A depository collection should acquire and preserve discards from other collections in the field concerned for which there is a continuing need elsewhere.

(i) A national lending system. Any type of nation-wide ITI services requires an hierachical system for obtaining documents found in various ITI facilities. Within the framework of such a system, every ITI facility would have what copies it needed of those documents most useful for its clientele. These ITI facilities would be supported by regional centres which also would

have those documents, together with those used fairly frequently within the region as a whole, but not regularly by individual service units. In turn, the regional centres would be supported by the central depository collections discussed above which include those documents less frequently used, but for which nationally there would be enough use to justify preservation of at least one copy.

(j) Union catalogues. The object of a union catalogue is to record the location of books, journals, and other materials, mainly to facilitate access to a particular, known item, whether in the original or in photocopy, by an ITI service unit that does not hold it. The advantage of creating a single computerised union catalogue of holdings in the nation's ITI facilities should be examined. Such a computerised catalogue would lend itself to sectional or regional print-outs and could be developed with an on-line capability permitting interrogation on demand from remote terminals.

(k) Abstracting, indexing, and reviewing. A pool of subject experts may be needed within a national ITI centre to provide abstracts and indexes for supplementary files of data created internally, as well as to create user interest profiles for searching databases. A desirable function of this group could be the production of reviews of information for small and medium industries.

(l) Enquiry services. In addition, a highly trained reference and research staff would be necessary to provide information from the literature, to conduct literature searches, and to compile bibliographies and verify obscure references. Generally, this staff would be expected to have language and subject competence besides bibliographical and reference library qualifications.

(m) Collections of patents. One source of information that is almost totally ignored by technologists in many developing countries is patent literature. In spite of difficulties with their use, patents contain valuable technological and commercial information. They should be widely used in developing countries as they are in industrialised countries. Close co-operation

among a national ITI centre, the patent office, and other bodies is needed to permit easy access to a comprehensive collection of patents with consequent benefits, especially to industry.

(n) Collections of standards. Information about standard specifications and related publications constitutes another specialised source of information which appears to be neither always available nor adequately used in many developing countries. A national ITI centre should maintain close liaison with the national standards association to help ensure that comprehensive sets of overseas standards are collected, kept up-to-date and made available.

(o) Trade literature retrieval services. The various types of publications put forth by industrial firms principally for advertising purposes comprise what is in some situations a very important resources commonly known as trade literature. These often provide accurate technical information about products or materials that are offered for sale, and a collection can be so useful that retrieval services for continually acquiring and providing such information have recently been developed in some countries.

(p) Information on conferences, meetings, seminars, etc. Subject mainly to budgetary limitations, industry encourages its staff to keep up-to-date by attending conferences, meetings, seminars, etc. which are the sources of information about latest developments. This is also a means of promoting the personal contacts which are recognised as most effective sources of information. A service unit should be set up within a national ITI centre to comprehensively register data on important international and national conferences, meetings, seminars, etc., and the conference preprints, reports, and proceedings, together with travel reports.

(g) On-line database retrieval services. Computers and telecommunications provide the means for instantaneous access to the world's specialised databases from any location. The most significant development for ITI services in some developing countries over the past years is the exploitation of those computerised

databases created by important national and international indexing and abstracting organisations, which should be taken into account by ITI policy makers in all developing countries.

INFORMATION SERVICES DESIGNED PARTICULARLY FOR SMALL INDUSTRY

Larger firms are able to make effective use of information services and turn this information into profit. Such is, however, not the case of the majority of small firms. Most of them have no engineers or graduate technologists. They do not know what they need, nor how to ask for it. They can not therefore be linked directly to traditional sources of information. This suggests a need for special types of information services for small industry.

It is essential that small firms receive information adapted to their individual needs, and to their level of knowledge and understanding, and also the advice they require on how to implement it. Some national governments in the developing countries paid close attention to this problem for many years, which has led to the appearance in those countries of the "industrial liaison services" that serve as the coupling mechanism between industry and the existing information facilities.

Appropriate institutions that provide the liaison services, probably differing from one country to another, would be industrial associations, industrial R & D institutes, or productivity centres. In Korea, this work has been taken over by SMIPC, a government-supported institution, since 1978. Whatever the type, the institution should possess certain features. Its raison d'être should be to service the industrial community. It should know the needs and problems of small industry, and the information required to meet them. It should be a potent organisation, national in scope, and closely coupled to industry.

The first task of the liaison services must be to convince industrialists

and managerial staff that new techniques exist, that new methods of manufacture and management have evolved, and that industry can profit from applying these techniques. It is only when these services have established a climate of progress, in which firms are ready to innovate, that they can fulfill their second role as coupling mechanisms with the various information services.

The mission of the liaison officers may be summarised as follows:

(a) To promote in small industry an appreciation of the value of technical innovation and to encourage the maximum use of advisory facilities established in public and priviate institutions.

(b) To establish a routine for visiting small firms and to maintain records and enquiries.

(c) To provide practical assistance in the framing of their technical enquiries and in directing them to the best sources of information available.

(d) To take measures to ensure that the local and national ITI facilities and the industrial liaison operation are widely known to small industry by using every practical publicity medium.

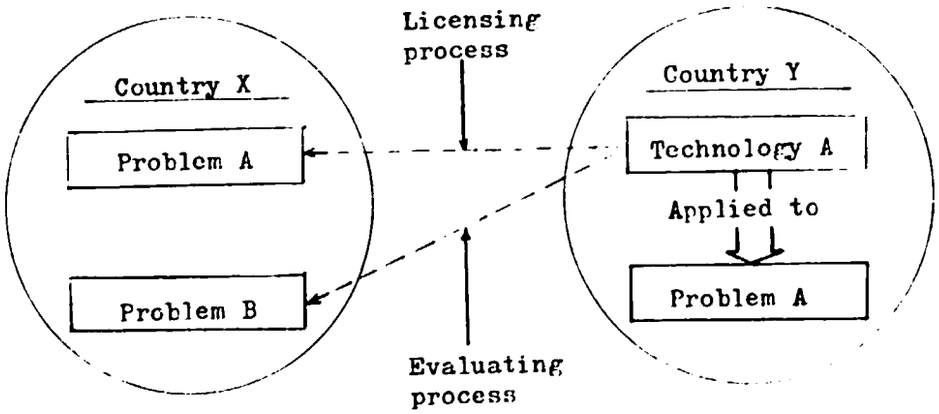
(e) To prepare and maintain a directory of local and national sources of information and to continually expand the industrial liaison officer's personal knowledge of such facilities.

Particular care must be taken in selecting the liaison officers. These engineers should have a broad educational background and wide practical experience in production and management. They should also receive additional training in the information field.

The industrial liaison services require not only a team of engineers but also sufficient supporting staff (management, secretariat, library, and a strong information and documentation back-up service). This is why it does not seem appropriate to decentralise such services since the decentralised operation would use the special skills of the engineers less effectively and also require a duplication of support services.

IMPACT OF TECHNOLOGICAL INFORMATION SERVICES ON THE TECHNOLOGY TRANSFER PROCESS

An important part of international exchange between countries of different levels of development is concerned with technology, comprising the international exchange of technological knowledge and experience. In this, effective information relations and the exchange of technological information play an outstanding role. Since the developing countries are in a position to turn to the industrialised countries to obtain much of the currently available technological know-how needed for development, industrial growth of the former would be more or less accelerated and influenced by the latest advances in technology in the latter. Two distinct conceptions of the international technology transfer process exist, and the figure presented below will assist in the discussion of these.



In a hypothetical situation shown in the figure, "Technology A" is already being applied to "Problem A" in an industrialised "Country Y". The technology transfer occurs when the same "Technology A" is applied to the same "Problem A" but in a developing "Country X". One of the major implements for effecting this

type of transfer is the licensing process and supporting information services are likely to be concerned primarily with the efficient handling of patents and associated documentation. The other type of technology transfer involves the application of an existing "Technology A" to the solution of a new "Problem B" in "Country X". Here supporting information services are more likely to require the attributes of the specialised information centre, in which development engineers work co-operatively with the information specialists in conducting the necessary analyses of the information to bring it to bear on the solution of the new problem.

The climate is now favourable for international co-operation in the information field, both multilateral and bilateral. Signs abound of the world-wide interest in technological information services as an essential component of the growth in developing countries. The United Nations Industrial Development Organisation has decided that priority should be assigned to the promotion of international exchange of technological information needed in developing countries (Schwoerbel, 1973).

In the process of ITI policy formulation, policy makers in the developing countries should give careful consideration to this favourable international climate and the role of technological information as one of the most important mechanisms for the transfer of technological know-how.

METHODS USED IN TRANSMITTING INDUSTRIAL AND TECHNOLOGICAL INFORMATION

It is worth according the highest priority to ensuring effective communications in any interactive information network. Slowness of communication is a common complaint by information users even in countries with a soundly established and carefully articulated network. It is all too often forgotten by administrators that frequently in the sphere of technological information

time is of the essence. An engineer in industry who needs a particular piece of information to enable him to solve a problem, unlike an academic chemist at a university, is not prepared to wait for more than the absolute minimum period.

It has rightly been said that the successful information network must have its base in communications technology. Many would go further and assert that the true network concept has only become feasible as a result of advances in telecommunications. The comparative inflexibility and slowness of response of some of the early scientific and technological information networks has been attributed to the technological lack of adequate communications.

The use of telex to speed interlibrary loan and photocopy requests is a matter that will need consideration at some stage. If, however, postal and telephone communications are swift and reliable, this need is perhaps less urgent than in some other countries, but a close watch needs to be kept on the situation. Telex is certainly used much more for international communication. KIET, for instance, regularly sends photocopy requests by telex to the British Library Lending Division to obtain copies of scientific papers and reports. An average waiting time is said to be ten days to two weeks.

There has been a remarkable development recently in the computer/communications field. In the cross-fertilisation between the two advanced technologies, the computer contributes mass-memory storage of unforeseen capacity, ease of access and a terrific ability to process and order information; and telecommunications remove the restrictions to which time and distance have hitherto confined us. Computers and Telecommunications can provide the means for instantaneous access to the world's commercially available databases from any location.

These computers and telecommunications have now reached most developing countries, and national computer-based information services to technologists have been introduced on a limited scale in those countries. Formulation and

implementation of an appropriate national policy would ensure that rapid progress is made towards the establishment of computer/telecommunications networks which will considerably extend the value and use of such information services. Nation-wide computerised information services using tape-based information should be introduced in the developing countries at the earliest possible stage. This information, as a Hungarian expert sees it, "has the advantage of being readily available in the world languages and in many fields; only services for selection and retrieval have to be organised" (Levai, 1970).

SDI services have been found to be particularly appreciated by, industrial firms, which in many countries, normally have no information services of their own. SDI services retrieve from computerised databases current information relevant to the interest profiles of a number of customers, who receive the appropriate references (usually in the form of cards or slips) at regular intervals, e. g., weekly or fortnightly. KIET and some other government-supported research institutes in Korea now have several years' operational experience with such services.

A national information service in its service to customers is interested in telecommunications facilities which aid in locating where wanted information can be found, and in getting the desired information or relevant documents to the customers. Computer-controlled databases have been established in many countries which are serving the role of the traditional card or printed catalogues. Visual display units are becoming familiar information equipment as the means of interrogating such databases via the telecommunications network. Telecommunications services are now available in some developing countries including Korea to allow nation-wide access to such a catalogue. The public packet-switched data network, DACOM-NET, which is better suited for this task in a national information service, has been operational in Korea since 1984.

The computer-based information service can provide a database of factual information as well as a central catalogue. The telecommunication facilities

cater for enquiries and responses with such a database. Rapid telecommunication among ITI facilities could turn out to be a great benefit to the national distribution of ITI, provided that its charges are reasonable. Efforts should be directed to explore every possible avenue leading to reasonable communication rates for the purpose of ITI exchange. The government may be in a position to give ITI services an in tial impetus by subsidising low-cost rates till the entire scheme reaches a level of usage that ensure its economic viability.

Facsimile equipment is available for the transmission of documents over the telecommunication networks and many units are in use in most developing countries. However, the facilities which would be of interest in information work are costly and slow. Facsimile is therefore not economically practicable at the present time for general distribution of documents nor would it achieve much, if any, saving of time over the postal service when a large number of pages are involved. However, it offers a useful facility for distribution of very urgent documents.

CHAPTER IV

TOWARDS A NATIONAL INDUSTRIAL AND TECHNOLOGICAL INFORMATION NETWORK

A national ITI network is a closely co-ordinated structure which interconnects existing and future ITI facilities at a national level to collect and process information and disseminate it through a convenient local outlet and with a minimum of delay to development engineers, production engineers, technicians, and managers in the industrial field who need it. From the structural point of view, therefore, a national ITI network may be regarded as an interconnection of industrial libraries, information service departments of industrial research institutes, and other related institutions within a country. One tends to think of networks in terms of the telephone or the radio. However, these networks are primarily communication grids, whose wires and waves carry messages back and forth. Telephone and radio networks are independent of the content or purpose of the messages they carry and serve merely as arteries of communication.

Where interdependence for information exists among a group of participants and there is a common function or purpose to be served, such network becomes an information network. An information network usually consists of a formal arrangement whereby data, information, and service provided by a variety of types of information facilities are available to all potential users. Information facilities may be in different jurisdictions but agree to serve one another on the same basis as each serves its own constituents. Telecommunications and computers may be among the tools used for facilitating communication among them.

The time is obviously ripe in most developing countries for a more closely co-ordinated network to collect and disseminate it (Choi, 1982). It remains to determine what kind of network would best serve the needs of a nation. It

should first of all be stated plainly that the developing countries can not always solve their information problems by methods copied from more affluent countries. It is all too easy to assume that what is good for one country must be good for another. And when the country that is being taken for a model is as wealthy as the USA or as carefully structured as the USSR, it can be folly to try to copy it.

The solution probably lies in the establishment of a co-ordinating agency at the national level, which would set up a nation-wide network formed by the ITI facilities existing in each country. Such networks would be interconnected in a regional network, linked in its turn to the world network. The co-ordinating agency is essential because, characteristically, the network is not rigid hierarchical structure but a flexible grouping. One of its important features is its capacity to adjust and evolve constantly in response to changing demands and national ITI policy.

THE NEED FOR A NATIONAL INDUSTRIAL AND TECHNOLOGICAL INFORMATION NETWORK

ITI officers in developing countries are vitally concerned with network development for a number of reasons. Two principal reasons are service and economy. The network concept implies removal of all institutional and geographical barriers to ITI. Further, it would have the additional benefit of encouraging those who bemoan the extensive duplication of materials among information facilities in the developing countries. Until an efficient ITI network functions, the blanket provision of more and more information will not of itself solve their problems. It might make them worse.

Hutchings points out the need for networking in providing library services in developing countries: " ... in newly emerged countries it would be something of a tragedy if library development were to take the form of so many independent

bibliographical empires, each trying to do similar things and none surpassing mediocrity, when with foresight and intelligent specialisation, they could collectively build bibliographical resources which would encourage the advanced research which is the condition of intellectual and material progress" (Hutchings, 1969).

An ITI network imlies equal access by any industrial worker for any industrial purpose to the sum total of the nation's ITI resources. In other words, an ITI network implies a degree of democratisation of information, a steady increase in the ability to serve at all points of service, and co-poerative sharing without constraints of time, distance, or its forms. ITI officers are professionally motivated to pursue the network idea because of these potential service advantages.

Economy of scale is the other reason. Financial pressures are forcing ITI activities to consider ways of sharing rather than duplicating resources. The publishing rate and the cost of printed materials are rising steadily, and information officers are well aware that they cannot afford the luxury of open-ended purchasing for their individual collections but are required to buy more restrictively. This means that appropriate local collections ought to be built to meet immediate needs, and a network ought to be devised to make readily available the resources of distant, specialised collections.

ADVANTAGES FOR A NATIONAL INDUSTRIAL AND TECHNOLOGICAL INFORMATION NETWORK

Some advantages likely to be gained through a national ITI network may be summarised as follows:

(a) Promotion of the orderly development of the nation's ITI services by implementing a consistent national programme of equalisation which will remedy inequities in ITI resources and services existing both in different geographical

areas and in different industrial branches.

(b) A nationally combined store of ITI resources which will more effectively meet the specific requirements of various user groups including those for the solution of problems, and new alternatives and approaches to the solution of technical problems, and options for minimising future ones.

(c) Access to special types of ITI including internal and external patents, standards, trade catalogues, progress reports, data compilations, and translations from any location.

(d) Reduction of duplication and costs of purchasing and processing, and increase in the service to users through rapid interlending, improved reference support, and the outright distribution (rather than loan) of certain kinds of material.

PROBLEMS IN ESTABLISHING NATIONAL INDUSTRIAL AND TECHNOLOGICAL INFORMATION NETWORKS

The barriers and problems summarised below are, in part, a result of the independent growth which has characterised the ITI services in most developing countries. These must be overcome to achieve the increased co-operation required to implement a nation-wide ITI network.

(a) There are complicated legal, political, and economic problems in establishing nation-wide ITI networks. For example, answers must be found to such questions as: By what legal authority does the ITI facility of one jurisdiction serve the people of another jurisdiction? Who pays for inter-institutional services and according to what formulae? Under whose direction does a national ITI network operate, and what is the extent and nature of his authority over the individual facilities in the network? Problems of this nature can only be solved at the highest level. It may be recommended that a co-ordinating committee for the ITI network be formed under a ministry covering

the domain of science and technology or of commerce and industry. Its first task should be to consider and approve the detailed network plan, and its continuing function should be general oversight of the functioning of the network.

(b) The ITI community in the public and private sectors is growing more diverse, and the component part--information centres, industrial libraries, the publishing industry, the indexing and abstracting services, the education community, and the various governmental agencies--have had little or no experience in working together towards a common national goal. The success of an ITI network must, therefore, have the fullest involvement and co-operation of all the elements of the ITI community. It is also important that the functions and relationships of all segments of this community be carefully studied and integrated into the network.

(c) It is no use having a network of information facilities which are capable of generating high quality bibliographies, if there is not an adequate document back-up and delivery system in the country concerned. The user of the network will soon become frustrated by knowing of the existence of a document and then not being able to get access to it. The national ITI resources must be adequate to meet the national need. In particular, the document back-up facilities and delivery systems must ensure maximum information responsiveness.

(d) There are constraints and problems associated with bibliographical materials. As various overseas databases should be used to support the national ITI network, there is a need to develop multi-lingual thesauri and also to overcome the problem of the lack of standardisation of the various databases.

(e) Local, institutional, and private funding for ITI activities is often unstable and insufficient. Funding is not planned to foster inter-institutional co-operation in a major way, and consequently, no mechanism exists whereby local and national funds can be made mutually reinforcing for a co-operative national purpose.

(f) A major difficulty in improving access to the ITI resources in a country often arises because the organisation responsible for a service is

financed by or for its members only. The question of how such organisations should be financed to provide a service to others is one to which the co-ordinating committee for the ITI network should give special attention.

(g) The extensive and specialised ITI resources of governmental institutions, and various nongovernmental industrial libraries and information centres must become an integral part of the nation-wide network. Such integration will require that these adopt a more open policy towards serving the general public in addition to their respective organisations, and willingness to form or join ITI networks.

(h) In establishing a national ITI network, it is necessary to consider the existing services in relation to each other. This raises the problem of considering to what extent the existing services should be supported by central services. For many services the unit cost per demand falls as the demand increases, but centralising to benefit from this may result in the service to the user deteriorating due to an increase in the supply time. It may be possible to avoid this by the adoption of new procedures.

(i) The human resources required to plan, develop, and operate the national ITI network are, of course, the most important element of the co-ordinating committee for the national ITI network to consider. New approaches to education for ITI specialists will be necessary, if professionals, paraprofessionals, and other perso nel are to be equipped to function in nontraditional ways.

(j) The current pattern of bibliographical services in most countries consists of a multiplicity of organisations, in the public and private sectors, providing a variety of products and services (Choi, 1985). National bibliographical control is needed to identify items of recorded information stored in the various elements of the national ITI network, to provide intellectual access to each such item of information, and to standardise the processing and communication of relevant data.

(k) There is a need to develop a means of overcoming an apparent

indifference towards information. Not only must the users be made aware that the ITI network exists, but every potential user must be instilled with the desire to find out and to know. Every technique known to the teaching profession and to the television, radio, and newspaper media should be used to educate the users about the ITI services available to serve their needs.

THE INFLUENCE OF TECHNOLOGY

It is not necessary here to repeat in detail the recent development in the world in the field of computer technology and in the field of communications technology. Thanks to an unprecedented development of components, there has been a dramatic increase in performance, linked with an equally dramatic reduction of costs for computers and computer equipment. Telecommunications is likewise undergoing a dramatic development. Satellite technology, which is now emerging, offers long distance, high-capacity communications, the costs of which are essentially independent of the distance of the link. This has made possible a rapid installation of global high-quality communications at reasonable cost, and the linking of computers and communications equipment provides information networking with a highly sophisticated technical tool.

In these technological developments, it is not surprising that computerised information systems and their linking into communication networks receive a great deal of attention from the governments in the developing countries as well as those in the industrialised countries. A nation's future capability to handle information effectively will to an important degree, depend on how well and how rapidly it is able to integrate new technological methods and devices into the mainstream of its information activities. Each nation will need to decide at some juncture, which technological methods and devices to introduce in the functionings of its ITI network, and how.

One difficulty for policy developers arises from the rapid pace of advances in these technologies. As a consequence of the rapid advances, a policy planner is always in danger of running behind the advances that he is attempting to design, with the result that by the time a policy is implemented, new changes may have invalidated the assumption upon which it is based.

In Korea, the main emphasis is to interlink the existing ITI facilities which will form nodes in the nation-wide ITI network. From the user's point of view, this offers possibilities of access to a broader spectrum of databases. Man-machine communications which are conducted by means of cathode ray tube or display terminals often coupled with printers or by hard-copy teletype terminals, are increasingly familiar to ITI users in Korea. By using inter-active on-line terminals time-sharing a single computer over telephone lines, they get immediate delivery of selected titles and postal service delivery of large search bibliographies and source documents.

Research is being pursued to find ways of using the computer to answer reference questions. The information system of the future is probably a network in which queries inappropriate to one system can be shifted over to another, in which specialised user requirements can be met by special adaptations, and in which experimentation and innovation can go on in parallel.

Since the main purpose of a nation-wide information network is to place the user in contact with his materials, finding ways of speeding up the delivery of information constitutes one of the more important aspects of the network concept. A national ITI network must incorporate appropriate means of communicating rapidly and effectively with the facility at which the desired material is located. It is in regard to the techniques which allow optimal interconnection between user and resource that the greatest change in current thinking and practices will be required.

Of all the different kinds of equipment used by ITI facilities for inter-institutional communications, the one which has received widest acceptance,

other than voice-grade telephone, as a low-cost practical tool, is the teletypewriter. Teletype communications between and among ITI facilities are generally used to augment their holdings on a reciprocal basis, to provide for general communications with other information facilities to serve as a channel for querying union catalogues, and to accommodate reference questions and services.

A future telecommunications system to be used for a nation-wide ITI network will eventually need to integrate teletype, audio, digital, and video signals into a single system. This concept is an important aspect of the design of a modern communications system for information exchange, to which ITI policy planners in developing countries will need to pay early and close attention.

CHAPTER V

TRAINING OF INDUSTRIAL AND TECHNOLOGICAL INFORMATION SPECIALISTS AND USERS

It is clear that no information service can be provided without information resources on which the service is based, but without trained staff no service can be effective and any money spent on resources may quickly be wasted. Therefore, one important element of any national programme for ITI services is to train personnel at all levels to work in the field. The extent of training of ITI specialists is an important factor in the ability of the nation's ITI services to adjust to new demands which will be placed on them in the future.

Of all problems facing the ITI policy developers, particularly in the developing countries, manpower provision is most critical because the time lag between the identification of the need and its satisfaction is the longest. Books, if bought from a local supplier, can be acquired in a matter of days; a new building can be constructed in months; but qualified manpower takes years to produce. The policy planner must devote early and earnest attention to the staffing implication of any new or improved service.

It would be a mistake to confine training in this field to the ITI specialists. Users, too, need training if they are to derive maximum benefit from increased services. In many countries, even though information is available in various information facilities the potential users of these facilities are unaware of their existence and the advantages they offer. The voluntary co-operation and understanding of all members of the industrial community is needed if a nation's ITI services are to reach their optimal efficiency. Within the framework of users' education, every industrial worker should, therefore, be aware of his right to the information he seeks--and of

its importance--whether it be for professional advancement or performance of his duties.

TRAINING OF SPECIALISTS

The education and training of information design and operational personnel constitutes one of the foundations of an ITI policy because the effectiveness of all ITI services ultimately depends on the skill with which they are designed, operated, and used. The basic needs for an adequate supply of ITI specialists are, firstly, to enable students to train in ITI work, and secondly, to enable them to update and extend their knowledge of the ITI field. The forecasting of requirements, the provision of theoretical and practical training facilities, the continuous updating of curricula, study grants and loans, improvement of status, career guidance and international co-operation in this field are part of such a policy.

One of the most important tasks of policy planners in relation to manpower is to devise as sophisticated a mathematical model as is feasible in the light of the nation's circumstances in order to match the output of appropriately qualified people to the needs of the nation's ITI services. In order to do this, it is necessary to arrive, first of all, at means for collecting the necessary information on manpower requirements in a standardised form, to enable predictions of the necessary levels of recruitment to be formulated with reasonable accuracy. Of course, it will never be easy to do this, even in countries where the central government exercises a considerable control over the planning of economic and social development.

In developing countries, in particular, the situation is further aggravated by these factors: (a) the labour market as a whole is likely to be in a state of severe imbalance; (b) various controls are likely to be in force in an attempt to correct this imbalance; (c) a ready-made pool of trained ITI

service manpower is unlikely to be available. Nevertheless, planning is absolutely necessary if wastage of skilled manpower or lack of it when it is required is to be reduced to a minimum.

There are three elements in a satisfactory scheme of the education and training of ITI personnel, i. e. (a) initial academic education in the field of information, documentation, and library science; (b) advanced professional education, including study and observation abroad; and (c) in-service training and continuing education.

So far as the first element is concerned, it is important to ensure that any such programmes are taught in a university institution. There are a number of reasons for this, of which perhaps the most important is widespread understanding and recognition of university degrees. This is crucial for the status of ITI profession. Korea is fortunate in having thirty established university schools of library and information studies, whose graduates together with those educated overseas are making a distinctive contribution to the professional staffing of the nation's ITI facilities.

Apart from documentation and librarianship, it would be a good thing for future ITI specialists to learn how to advise a craftsman or an industrialist and how to inform him otherwise than by presenting him with exceedingly long and irksome bibliographies. Some of those who will be responsible for national information centres should learn how to do this. It is still more important for those who are to be in charge of information service units of R & D institutes, which are constantly dealing with questions of industrialisation and handicrafts.

That is not something that can be learnt in schools, especially as many schools do not deal with this aspect of the information profession. In training the first students, arrangements should be made for them to take practical courses in small industrial firms and technological information centres. As d'Olier recommends, "a sort of course in the art of informing

people properly should be introduced, in which students would learn, in addition to modern information techniques, how to find and use ... the scientific, technical and commercial information ... " (d'Olier; Delmas, 1975) needed by small and medium industries.

A national probramme for ITI services should not only include initial courses and advanced studies but also specialised courses to provide for continuing education and training. In Korea, the latter are offered by KIET and the Korea Institute of Information Scientists (KIIS). KIET's Information Dissemination Division organises a variety of short courses at various levels. Such courses concentrate on special themes. One category covers work in special types of ITI services, e. g. business information, aid to exporters, part-time units, etc. Another category is concerned with special types of materials and includes patents, trade literature, etc. A further series concentrates on special techniques, e. g. mechanisation, indexing, etc. In spite of its relatively short existence, KIIS has made some progress in convincing industry of the need for utilising on-line database retrieval services through a series of workshops on the subject.

TRAINING OF USERS

To achieve their objectives, a nation's ITI services require an appreciation of the importance of information, particularly amongst those responsible for the educational programme, the administration of existing ITI services, and the allocation of national resources. An initial objective should be to educate the educators so that they aim to make students, future scientists and engineers, information conscious and to provide them with the know-how to use information services.

Training of information users is done in many countries on a regular basis primarily at engineering schools, to a certain degree in universities,

and to a small extent in facilities engaged in practical work and schools providing general education.

All measures directed to the systematic training of users must harmonise with the integrated educational system. In a relatively short time, the necessary measures must be taken at economically justifiable cost to supply thousands of information users with the knowledge they require about information resources and services. It will be desirable to carry out the preparatory work in this connection centrally because this will greatly reduce the overall cost, in particular by avoiding duplication, and also because the requisite uniformity in respect of aims and content can best be ensured by this means.

If the necessary knowledge is to be channelled to the users in such a way as to afford maximum practical effectiveness, however, these centrally prepared measures must in general be put into effect in a decentralised manner, i. e. at all appropriate centres of instruction, including those for in-service training.

The knowledge provided in regard to information resources and services must be suited, as regards both form and content, to the educational level and field of activity of those for whom it is intended. Apart from basic knowledge, the industrial users will require specific knowledge about information resources and services relevant to the job they are doing at the moment and their technical field.

The procedures adopted must be conducive to maximum uniformity in the education of all ITI users, as regards the content of such education, the steps taken to provide it, and the ways in which it is organised. It will be possible to produce uniform skeleton curricula and teaching materials for all the ITI users who stand in much the same relationship to the information services. It therefore seems to be expedient to classify ITI users by main categories and then break down these main categories into individual categories, in order that specific peculiarities within the main categories may be taken

into account for purposes of training.

Efforts should further be made to have users realise that they too have information tasks, namely (a) collecting information concerning the degree of development of their special fields, whenever new tasks are taken up; and (b) passing on their own findings and experiences to other users.

CO-ORDINATION OF TRAINING PROGRAMMES

The systematic training of ITI specialists and users requires a central co-ordinating body, which would co-ordinate and supervise the education and training, including training overseas, in close co-operation with the Ministry of Education and related institutions such as universities and engineering schools. Although most of the programmes of professional training for information workers are implemented by universities and other educational institutions, the primary responsibility for elaborating such training programmes and profiles for the national training system ought to be assumed by the co-ordinating body, which is best informed of the national needs in terms of number, quality, and time.

Such overall co-ordination of training programmes at national level is essential both to ensure an adequate supply of qualified personnel to meet increasing national demands and to avoid over-production. The major tasks and functions of the central co-ordinating body should include (Choi, 1982):

(a) Co-ordinating, guiding, and sometimes organising the training of ITI specialists and users in co-operation with the Ministry of Education and educational institutions.

(b) Undertaking, in co-operation with other facilities, such major work as elaboration of training programmes.

(c) Planning such training in close co-operation with library schools. (In developing countries, it might even be advisable to make the

fullest possible utilisation of existing training facilities for librarians.)

(d) Organising continuing education programmes for the information specialists working in various ITI facilities, on the recent problems and developments in the field.

Although the central co-ordinating body for education and training of ITI specialists and users organises some of its programmes, for example, by arranging courses, its major functions are to take centrally co-ordinated measures to be applied in various suitable training facilities. In many cases, such a co-ordinating body is a functional unit rather than an organisational one. It is established commonly as a department or a departmental function within a national information centre (Choi, 1982).

As the final report of the Intergovernmental Conference on the Planning of National Documentation, Library and Archives Infrastructures held in Paris in 1974 proposes, the co-ordination of training activities for information specialists and users should be carried out by the central information co-ordinating body (Intergovernmental Conference on the Planning ... 1975). In about a third of the developing countries, the central information co-ordinating bodies include such functions in their terms of reference (Choi, 1982).

FID/DC working group, however, suggests that "the training of documentation and information specialists and scientists ... should be copordinated and supervised by the national documentation centre" (International Federation for Documentation, 1975). As this particular co-ordinating function involves close co-operation with the Ministry of Education and institutions of higher learning, the former, i. e. the central information co-ordinating body appears to have many attractions to the developing countries. However, in a country where the former does not effectively work, the latter would probably be better. Where the co-ordinating body for training is organisationally placed does not really matter as far as it performs all its assigned functions effectively.

CHAPTER VI

INTERNATIONAL LINKAGE AND CO-OPERATION

Scientists proclaim that scientific truth is universal, transcending national boundaries, and while such a view needs some modification if it includes technology, and particularly enterprise-owned know-how, it remains true that when we speak of scientific and technological information we really mean all the information that is available throughout the world. Thus, it is essential that the person responsible for the provision of information has the widest possible range of contacts in the outside world.

A fairly simple kind of international co-operation already exists in the form of international loans and exchange of recorded information between information institutions. In certain multi-national regions, such as Scandinavia, internationally co-operative programmes are being effectively implemented in the field of library and information services. In general, however, international links of information facilities are relatively undeveloped.

Endeavours to facilitate and co-ordinate the international exchange of information resources generally have been sponsored by various governmental and nongovernmental international organisations, frequently as joint efforts. UNESCO, for instance, has long been concerned with the international exchange of publications and is currently concerned with promoting the elements of an international information network to make available to all countries the rapidly expanding body of recorded information of all kinds.

As an OECD ad hoc group on scientific and technical information concludes, " ... international co-operation to share ... information is not merely a fortunate world tradition but a human necessity. National self-sufficiency in scientific and technical information is not, and never has been, a realistic policy alternative, even for the largest nations" (Organisation for Economic

Co-operation and Development, 1971). Australia, for example, noted for its independence and by no means a developing country industrially, has publicly proclaimed that it produced only two per cent of the total world output of information in science and technology for its annual R & D expenditure of A$300 million, and therefore "like most countries, is vitally dependent on outside sources of information (National Library of Australia, vol. 1).

This is why the research community and information specialists who serve it have been pioneers in international co-operation. So that a nation's ITI facilities can operate effectively, their constant and close contacts with similar facilities overseas seem to be essential. In the case of developing countries, this international dimension ought to be included in any plan for the development of ITI services. As the national ITI resources can not be self-sufficient in developing countries, they have to be extended over a large region for common utilisation of the international ITI resources.

THE NEED FOR THE IMPORT OF EXTERNALLY GENERATED TECHNOLOGICAL INFORMATION

As was made clear in the preceding chapters, the provision of technological information is a major prerequisite for industrial growth. But there is great disparity in the quantity, quality, and degree of sophistication of the technological information available in the countries of the world. This is one of the basic reasons for the great disparity in industrial development between industrialised and developing countries. For the most part, developing countries have limited capabilities and resources, both human and financial, to devote to the production of technological information. "It has been estimated that they now produce less than five per cent of the world's scientific literature and perhaps an even smaller proportion of the total technical information" (U. S. National Academy of Sciences, 1972).

If these disparities are to be reduced substantially and eventually minimised, the import in developing countries of externally generated technological information will need to be greatly strengthened. Industrial growth in developing countries is dependent to an important degree on a vigorous intake of technological information from industrialised and other developing countries. Improved accessibility to externally generated technological information would reduce a country's need to undertake time-consuming R & D for which its finance, facilities, and personnel are inadequate.

Import of technological information is, however, often restricted for proprietary or other reasons. Thus, it may be necessary to conduct research in a given area so as to gain entree to restricted sources of related information. Access may be attained by affiliation with international companies that possess large amounts of proprietary technology, which will be discussed in detail in next section.

Computer and telecommunications technology have recently made the concept of a world-wide information network a practical reality. In this situation, developing countries should direct their maximum effort to articulate their national technological information services with broader international services to draw on the accumulated information store of the world.

PROMOTING THE USE OF EXTERNALLY GENERATED TECHNOLOGICAL INFORMATION

In most developing countries, there are a limited number of clients in the field of industrial technology who could use mechanised SDI or retrospective search services with profit. At present, the number is too small for each of the countries to be able to create the numerous databases to provide such services it needs. The best solution would therefore seem that its major ITI centres reach agreement with overseas processing services, prepare interest profiles for its users in machine languages, and ensure that each client reaps the

maximum benefit from these services.

There seems to be little doubt, however, that the future successful ITI services in the developing countries including those which are now creating a limited range of databases of their own, will be reliant, to a substantial extent, on their capabilities to search the databases created in other countries. Satisfactory exploitation, of course, depends very much on the local ITI specialist having an adequate understanding of the system--its structure, its indexing languages, and shortcomings.

To be able to search the externally generated databases, it is vital that the ITI facilities in the developing countries have computer terminals connected with appropriate foreign national or international networks and so serve as access points to those networks for the nation's ITI users. Every effort should be made to arrive at such an interlinkage with other countries, even by so called "network parasitology" (Törnudd, 1975). This is to upgrade the available techniques from ordinary mail, airmail, telex, telephone calls, interactive terminals on dial-up bases to leased line interconnections, so that a country could consider itself to be a node in the information/computer/telecommunications network, and not a self-contained, bureaucratically run national "information empire".

The use of externally generated technological information, particularly in developing countries, is still in a relatively primitive state of development, both in organisation and the application of technology. With so much technological information being produced in the industrialised countries, why is more not being transferred to the developing countries, more fully, more efficiently, and more quickly? The principal reason is that many difficult problems have not been fully considered or resolved.

The general problems in international transfer of information, which seem applicable for the use of externally generated technological information in the developing countries, are well summarised by Day. He points out that

strong international systems can be built only on a foundation of strong national systems, and very few of these exist yet. Language remains a key problem since a large proportion of technical information is produced in languages not readable by many segments of the technical community. Existing laws and national policies inhibit the transfer of information. National telecommunications systems are not ready for the volume and complexity of the job to be done. There are critical problems of organisation and provision of resources to implement joint international programmes. The need for international standards for indexing and classification as well as standards for hardware and software is still largely unmet. And lastly, there is the shortage of trained manpower to operate computer-based systems (Day, 1968).

Despite these problems, however, some progress is being made largely under the programmes developed and implemented by some international organisations to assist developing nations in setting up and strengthening their national information systems and to co-ordinate the information transfer process within the international network. An Industrial Information Service has been established at the United Nations Industrial Development Organisation Headquarters in Vienna "to assist in the industrialization process in developing areas by acting as an international clearing-house". Its principal function, both at headquarters and in the field, is "to establish channels of communication whereby information consumers in developing countries are linked with readily accessible sources of industrial information in a world-wide information transfer network" (United Nations Industrial Development Organisation, 1969).

Unesco advises its member states to establish scientific information and documentation centres and has rendered practical assistance for their creation in the form of provision of experts, fellowships, and equipment within the framework of the United Nations Programme of Technical Assistance. Under this scheme, UNESCO has collaborated with local governments in the establishment of scientific and technological information centres in many developing countries.

One of these centres--that in Yugoslavia --is devoted exclusively to information for industry.

The International Federation for Documentation has been adopting and advocating new ideas to meet the ever-increasing demands of the scientific and technical community for quick access to relevant information. Besides its Promotion of the Universal Decimal Classification, the main tasks of the Federation include:

(a) The co-ordination of the documentation activities of international and national organisations.

(b) The study and evaluation of forms of communication used in providing technical information to industry.

(c) Assistance to developing countries in the creation of their national information and documentation services.

In connection with international transfer of technological information, mention should be made of the role of international sub-contracting, which has a significant impact on the transfer, assimilation, and adaptation of technology, particularly in developing countries. The main attraction here is that:

(a) International sub-contracting can provide for transfer of technologies and equipment which are low-cost and labour intensive;

(b) Agreements for "specialty" sub-contracting can be based on the use of local techniques which could in time be improved with assistance from the principal and lead to intermediate technologies;

(c) International sub-contracting is normally accompanied by considerable technical and financial assistance, since it implies strict specifications for the products of the production operations, whose observance is controlled directly by the entrepreneur; and

(d) The technical assistance concerns not only the assimilation of productive techniques, but also some initiation into techniques of

organisation and management (Experts' Meeting on International Sub-contracting ... 1977).

DATA COMMUNICATIONS SYSTEMS FOR THE DEVELOPING COUNTRIES

A distinction must be made concerning the data carried on international computer/communications systems. On the one hand, there are data of a purely commercial character sent to and received from private organisations. In this case, strict confidentiality and exclusive rights to the data are guaranteed. On the other hand, data on these networks are offered by data banks, which form the modern repositories of human knowledge in dynamic form. This global pool of electronically accessible information being built up on an international scale is an open system, to which large and small firms, rich and poor countries have equal opportunity of access.

However, equal opportunity of access does not mean a completely free (no cost) access to this information, since databases on computer-based systems are expensive to run and maintain. If no financial incentive is provided to the "information entrepreneurs", they will not take the risk of establishing such data systems. It appears to be difficult to strike to right balance between the equal opportunity access principle and the interest of the database vendors. But experience shows where a good equilibrium can be found.

Today, the development of computer/communications systems have significant effects on the "data trade" between all the countries of the world. Though in the past, the main market for data communications developed inside and between the industrialised countries, there seems to be a fast increase of data communications to and from the developing countries, especially with the use of telecommunications satellites. This, however, presupposes thet developing countries improve their telecommunications systems, so that they can maximise the use of this data exchange. The problem is that the building up of such a

data communications system requires vast capital resources with a high proportion on investment in fixed assets.

Some developing countries are building up such systems which are comparable to those in industrialised countries. In Korea, for instance, the construction of a public packet-switched data network, DACOM-NET, was completed and it became operational in July 1984 for domestic and international traffic. Its overseas links currently stretch to the packet networks of 53 countries. It offers a switching service which means that users pay only for the amount of traffic they generate. The DACOM-NET comprises switching centres in the major Korean cities which are themselves computers. Terminal devices using the DACOM-NET such as computers, visual displays, and printers do not intercommunicate with each other directly but pass their messages to their parent DACOM-NET centre which then delivers the message to its destination. Various information facilities have their own parent database to which they send their requests for service. If that database could not handle a request, it would initiate a message to the appropriate database which would then transmit the reply to the enquirer. Interconnection of a number of databases would be made more convenient by this switched network.

The developing countries with a telecommunications network such as DACOM-NET in Korea would acquire good data communications capabilities, and could use them domestically and internationally. What advantages would accrue to these countries through an open access to the databases of the industrialised countries? There must be significant advantages, first of all, in the scientific and technological field.

A danger however, might consist in the waste of scarce computing and communications resources if the databases of industrialised countries contain data which are of little relevance to developing countries. To avoid such waste, it would seem essential that databases be created with information relevant for developing countries. Probably, such databases need to be set up,

operated, and distributed by developing countries themselves. This would result in a distributed data processing system decentralised on a world scale, in which databases or host computer in industrialised countries containing the latest state-of-the-art information co-exist with systems carrying information of special interest to developing countries and located there.

As discussed above, there are many problems remaining unresolved in more sophisticated international information transfer. It is probably fair to say that more is still being accomplished and will continue to be accomplished for some time in the future in the use of traditional methods in the international interchange of hard copy. The breakthroughs that have been made in using the new technology are principally in the transfer of bibliographical citations and, in some cases, abstracts of information. For the use of information in depth, access to complete documents is still frequently necessary. In the developing countries, particularly, such access will probably continue to be for some time to come a missing ingredient in the information transfer process.

THE NEED FOR NATIONAL FOCI FOR INTERNATIONAL CO-OPERATION

When international collaboration of information activities is planned, it is essential within each participating country to have a clearly recognisable and accepted national focus for information services. As an access point to, and contributing agency for, the international pool of information, the national focus interacts with those in other countries on two levels: the policy level and the operational level. The government should, therefore, designate as the national focus for information services two organisations: the central co-ordinating body for policy discussions, and the operational co-ordinating body for day-to-day co-ordination.

The central information co-ordinating body co-ordinates with international bodies in working out policies in the field of information and in drafting

joint international projects. In Korea, such co-ordinating work is undertaken by the Technology Promotion Council, which meets monthly to integrate various technological activities in the nation and to follow-up on issues raised in the quarterly Presidential Conference on Technology Promotion, the nation's highest ITI policy making body.

The operational co-ordinating body acts as the national access point to the world's store of information. In order to contribute to the world's information store, the operational co-ordinating body has to organise the national output of literature and have bibliographical control of this output. Korea is fortunate in this regard, having had the foresight to establish KORSTIC early in 1962 as a mechanism to facilitate the international transfer of scientific knowledge and technologies by collecting, processing, disseminating scientific and technological information. KORSTIC was merged into KIET in 1982, which maintains the former's co-ordinating function. KIET still needs to be strengthened further both in status and support to enable it to play its international role to the fullest effect. It is essential to monitor, and to study, international developments so that Korea can be continually aware of any relevant new techniques in ITI handling and any new services from overseas that have become available.

CHAPTER VII

CONCLUSION

In most developing countries, various ITI facilities have been set up by governmental institutions and industry to respond to their own information needs. They are, indeed, performing important services for their respective clienteles, but, as a group, they are developing haphazardly. Because of this, the developing countries, while devoting relatively large funds to ITI activities, find difficulty in coping with the mass of information and the constant growth of the number of industrial users and of their needs. The time appears to have come for these countries to change direction by henceforth treating information and knowledge as a national resource and making the benefits of ITI services available for all the industrial users. Such action would place the developing countries in a stronger position to cope with their economic and industrial problems.

Attempts in this direction have been made in some countries at the operational level either by libraries or by information services. However, lack of financial resources and of power of decision by the heads of these institutions, and particularly the problem of being heard by the government in this field, have made these attempts disappointing. There is a need to have power to act--such power including the possibility of influencing the allocation of funds to ITI services at the national level. Power of this nature would be best provided by the government's sustained pursuit of the end, i. e. a national policy.

Because of the role of industry and technology in governmental activities, and because of the number of governmental departments concerned, and the growing resources these activities will absorb, every country should have a national committee dealing with all matters of industry and technology. Some

developing countries have set up mechanisms of this type, bringing together ministries with responsibilities in these fields, to which government can delegate powers of decision on national policies and budgets for ITI services as well as for industrial and technological development. In deciding on these policies, the national committee should consider their relation with national policies for economy, education, manpower, etc.

The implementation of a workable national policy requires close co-operation between the government and the private sector. Such co-operation is most appropriately fostered through legislation that would adopt as its prime philosophical goal equal opportunity of access to the nation's ITI services. Practically, it would seek better organisation, development, co-ordination, and management of the nation's ITI facilities and services.

Some industrialised countries have published national papers which attest to the importance of national ITI policies and networks. If we, in the developing countries, fail to link our resources together nationally so that all industrial workers can use them, we shall be neglecting a very significant contribution that we can make to the quality and productivity of our industry. We may also be missing the opportunity to join other nations in sharing ITI resources on an international level.

The writer should add that no one recognises more clearly than he does the limitations of guidelines of this kind, prepared on the basis of one nation's experiences. He has not attempted to present any generalised models applicable to all the developing countries. That is a task for the policy planners in each country. What he has tried to do in these guidelines is to isolate the problems prevailing in the developing countries and to analyse them, in order that, hopefully, the way to resolve them may be better perceived.

REFERENCES

AGENCY FOR ADMINISTRATIVE DEVELOPMENT, KOREA. 1980. Sanŏb Kisul Jŏngbo Yutong Cheje'ui Hwangnib Bang'an. ("A Plan for Industrial and Technological Information System"). Seoul: The Agency, 1980. (Mimeographed).

BORKO, H. 1968. National and International Networks in Science and Technology. In: AFIPS Conference Proceedings, vol. 33, part 2; 1968 Fall Joint Computer Conference. Washington: Thompson, 1968. 1469-72.

CHOI, S. J. 1982. National Information Networks for the Advanced Developing Countries. Seoul: Sung Kyun Kwan University Press, 1982.

CHOI, S. J. 1985. Chŏn'guk Saeginji Kanhaeng Hyŏpdong Chje Pyŏnsŏng Bang'ane Kwanhan Yŏn'gu. ("A Study on the Planning of Nation-wide Indexing Services for Korea"). Tosogwanhak. 1985; 12: 39-86.

DAY, M. S. 1968. The Development of International Scientific and Technical Information Systems. In: International Technical Communications Conference, 15th, Los Angeles, 8-11 May 1968. Proceedings. Washington: Society of Technical Writers and Publishers, 1968. (Paper I-1).

D'OLIER, J. H.; DELMAS, B. 1975. Planning National Infrastructures for Documentation, Libraries and Archives: Outline of a General Policy. Paris: Unesco, 1975. (Documentation, Libraries and Archives. Studies and Research, no. 4).

EXPERTS' MEETING ON INTERNATIONAL SUB-CONTRACTING AND REINFORCING LDC'S TECHNOLOGICAL ABSORPTION CAPACITY, Paris, 8-9 November 1976. Summary Proceedings and Consultants' Reports. Paris: OECD Development Centre, 1977.

GERRITSEN, J. G. 1963. Measures Taken at a National Level to Communicate Relevant Data on New Scientific Knowledge and Technical Information to Small and Medium-Sized Industry. In: Conference on the Communication of Scientific and Technical Knowledge to Industry, Stockholm, 7-9 October 1963. Paris: OECD, 1963. 17-26.

GOLDSMITH, M., ed. 1970. Technological Innovation and the Economy. London: Wiley, 1970.

HECKSHER, E. F. 1954. An Economic History of Sweden. Cambridge, U.S.A.: Harvard University, 1954.

HUTCHINGS, F. G. B. 1969. Librarianship· A Short Manual; With Special Reference to Developing Countries. Kuala Lumpur: Oxford University Press, 1969.

INTERGOVERNMENTAL CONFERENCE ON THE PLANNING OF NATIONAL DOCUMENTATION, LIBRARY AND ARCHIVES INFRASTRUCTURES, Paris, 23-27 September 1974. Final Report. Paris: Unesco, 1975. (COM/MD/30).

INTERNATIONAL FEDERATION FOR DOCUMENTATION. FID/DC WORKING GROUP. 1975. Function and Organization of a National Documentation Centre in a Developing Country. Paris: Unesco Press, 1975.

JONES, L. P.; SAKONG, I. 1980. Government, Business, and Entrepreneurship in Economic Development: The Korean Case. Cambridge, U.S.A.: Council on East Asian Studies, Havard University, 1980. (Studies in the Modernization of the Republic of Korea, 1945-1975).

KIM, C. 1984. Korean Industrial Policy and Technology Information System. A Report to the Korea Institute for Industrial Economics and Technology. 1984. (Mimeographed).

KIM, L. S. 1985. Science and Technology Policies for Industrialization in Korea. A Paper Presented at the International Seminar on the Process of Korea's Industrialization. Seoul, 8-21 March 1985. (Mimeographed).

KIM, S. K. 1983. Small and Medium Industries in Korea. A Paper Presented at the International Forum on Economic Policies and Development Strategies, Seoul, 1-10 June 1983. (Mimeographed).

KLINTOE, K. 1968. Report to the OECD Scientific and Technical Information Policy Group. Paris: OECD, 1968. (Mimeographed).

KOO, B. Y. 1984. The Role of the Government in Korea's Industrial Development. A Paper Submitted to the U.S.I.T.C. for Its Study on "Industrial Targeting Practices in Korea". Seoul: Korea Development Institute, October 1984. (Mimeographed).

KOREA. 1983. Che'ocha Kyŏngje Sahoe Baljŏn Okaenyŏn Kyehoek Sujŏng Kyehoek, 1984-86. ("The Revised Fifth Five-Year Economic and Social Development Plan"). Seoul: Government of the Republic of Korea, 1983.

KOREA DEVELOPMENT BANK. 1983. KDB Annual Report, 1983. Seoul: The Bank, 1983.

KOREA DEVELOPMENT BANK. 1984. Industry in Korea. Seoul: The Bank, 1984.

KOREA DEVELOPMENT BANK. RESEARCH DEPARTMENT. 1983. Chuyo Sanŏb'ui Tangmyŏn Kwaje. ("The Present Policy Objectives for the Major Industrial Sectors in Korea"). Seoul: The Bank, 1983.

KOREA DEVELOPMENT INSTITUTE. 1980. Development Strategy and Policy Priorities for the Fifth Five-Year Development Plan: Working Paper. Seoul: The Institute, April 1980. (Mimeographed).

KOREA INDUSTRIAL RESEARCH INSTITUTES. 1984. Status and Activities of Industrial Laboratories and Industrial Research Associations in Korea. Seoul: The Institutes, 1984.

KOREA INSTITUTE FOR ECONOMICS AND TECHNOLOGY. 1984a. Kisul Jŏngbo Yutong Cl.je Kuchuk Bang'an. ("A Proposal to Design the National Technology Information System"). Seoul: The Institute, May 1984. (Mimeographed).

KOREA INSTITUTE FOR ECONOMICS AND TECHNOLOGY. 1984b. KIET. Seoul: The Institute, November 1984.

KOREA TRADE PROMOTION CORPORATION. 1985. KOTRA: Its Function and Activities. Seoul: The Corporation, 1985.

LEE, Y. T. 1982. Roles and Plans of DACOM. A Paper Presented at the International Seminar on Communications and Information Industries, Sponsored by the Electronic Times, Seoul, 8 October 1982. (Mimeographed).

LEE, Y. T. 1985. DACOM-NET Overseas Links Stretch to 53 Countries. The Korea Times. 3 April 1985. 1-2.

LEVAI, S. 1970. Establishment of Industrial Information Services in the Develcping Countries. A Paper Presented at the United Nations Industrial Development Organisation Seminar on the Organisation and Administration of Industrial Services in Asia and the Middle East, Tashkent, U.S.S.R., 12-26 October 1970. (Mimeographed).

LOEB, J. 1923. Library's Place in Research. Ex Libris. 1923 September; 1:74.

MARTINDALE, E. 1966. Industrial Liaison Centres: A New Approach to the Problems of Encouraging Technical Innovation in the Smaller Firms. Bulletin of Institute of Information Scientists. 1966; 5(5): 3-10.

MINISTRY OF COMMERCE AND INDUSTRY, KOREA. 1983. Che'ocha Kyŏngje Sahoe Baljŏn Okaenyŏn Kyehoek Sanggong Pumun Sujŏng Kyehoek, 1984-86. ("The Revised Commercial and Industrial Development Plan, 1984-86"). Seoul: The Ministry, 1983.

MINISTRY OF SCIENCE AND TECHNOLOGY, KOREA. 1983. Che'ocha Kyŏngje Sahoe Baljŏn Okaenyŏn Kyehoek Kwahak Kisul Pumun Sujŏng Kyehoek, 1984-86. ("The Revised Scientific and Technological Development Plan, 1984-86") Seoul: Government of the Republic of Korea, 1983.

MINISTRY OF SCIENCE AND TECHNOLOGY, KOREA. 1984. Introduction to Science and Technology in the Republic of Korea. Seoul: The Ministry, 1984.

MINISTRY OF SCIENCE AND TECHNOLOGY, KOREA. 1985. 84 Kwahak Kisul Yŏn'gu Kaebal Hwaldong Chosa. ("A Survey of Research and Development Activities in Science and Technology in 1984"). Seoul: The Ministry, 1985.

MORGAN, T; BETZ, G., eds. 1970. Economic Development: Readings in Theory and Practice. Belmont, U.S.A., 1970.

NATIONAL LIBRARY OF AUSTRALIA. SCIENTIFIC AND TECHNOLOGICAL INFORMATION SERVICES ENQUIRY COMMITTEE. Scientific and Technological Information Services in Australia: The STISEC Report. Canberra: The Library, 1975.

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT. 1971. Information for a Changing Society; Some Policy Considerations. Paris: The Organisation, 1971.

SAKONG, I. 1983. The Korean Economy: Past Performance and Future Prospects. A Paper Presented at the International Forum on Trade Promotion and Industrial Adjustment, Seoul, 6-15 September 1983. (Mimeographed).

SCHWOERBEL, H. 1973. UNIDO, Clearinghouse of Industrial Information. In: Participation of Small and Less Industrialized Countries in World-wide Documentation Activities and Information Exchange. FID International Congress, Budapest, 11-14 September 1972. Budapest: Hungarian National Committee for FID, 1973. 32-33.

SCHWOERBEL, H. 1975. Industrial Information: A Guide to Better Understanding and Indications of How to Use Assistance and Services Offered by UNIDO ... In: Proceedings of FID Symposium on Information Systems Design for Socio-Economic Development: Retrospect and Prospect, Brussels, 30 September-2 October 1975. The Hague: FID, 1975. 52-63.

SCIENCE, GOVERNMENT, AND INFORMATION: THE RESPONSIBILITIES OF THE TECHNICAL COMMUNITY AND THE GOVERNMENT IN THE TRANSFER OF INFORMATION. A Report to the President's Science Advisory Committee. Washington: U.S. Government Printing Office, 1963.

SMALL AND MEDIUM INDUSTRY PROMOTION CORPORATION. 1985. Chŏngbo Chekong Saŏb Annae. ("Guide to the Information Services"). Seoul: The Corporation, 1985.

TELL, B. 1976. National Information Systems: Design and Planning of National Information Systems (NATIS)--A Paper for Government Planners. Paris: Unesco, 1976. (COM. 76/NATIS/7).

TÖRNUDD, E. 1975. Benefits from Network "Parasitology". In: The Interactive Library Computerized Processes in Library and Information Networks; Proceedings of Seminar Held in Stockholm, 25-28 November 1974. S. Schwarz, ed. Stockholm: Swedish Society for Technical Documentation, 1975. 67-75.

TREZISE, P.; SUZUKI, Y. 1976. Politics, Government and Economic Growth in Japan. In: Asia's New Giant: How the Japanese Economy Works, ed by Hugh Patrick and Henry Rosovsky. Washington, 1976. 753-812.

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANISATION. 1969. Industrial Information; Based on the Proceedings of the International Symposium on Industrial Development, Athens, November-December 1967. New York: United Nations, 1969. (UNIDO Monographs on Industrial Development, no. 15).

U. S. NATIONAL ACADEMY OF SCIENCES. OFFICE OF THE FOREIGN SECRETARY. 1972. Scientific and Technical Information for Developing Countries: A Report of an Ad Hoc Advisory Panel of the Board on Science and Technology for International Development. Washington: The Academy, 1972.

WHANG, I. J. 1985. The Role of Government in Korea's Industrial Development. A Paper Presented at the International Seminar on the Process of Korea's Industrialization, Seoul, 8-21 March 1985. (Mimeographed).