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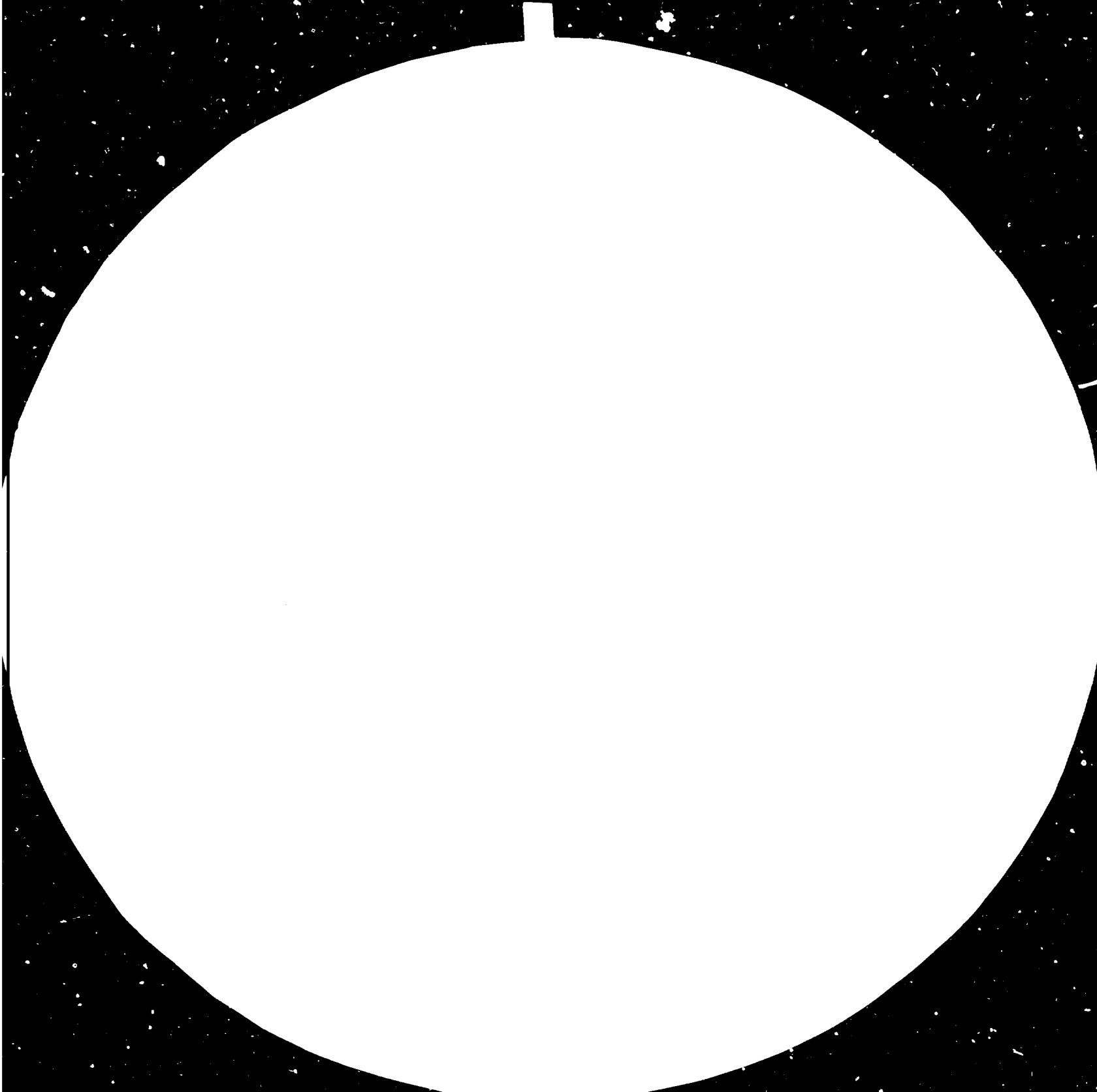

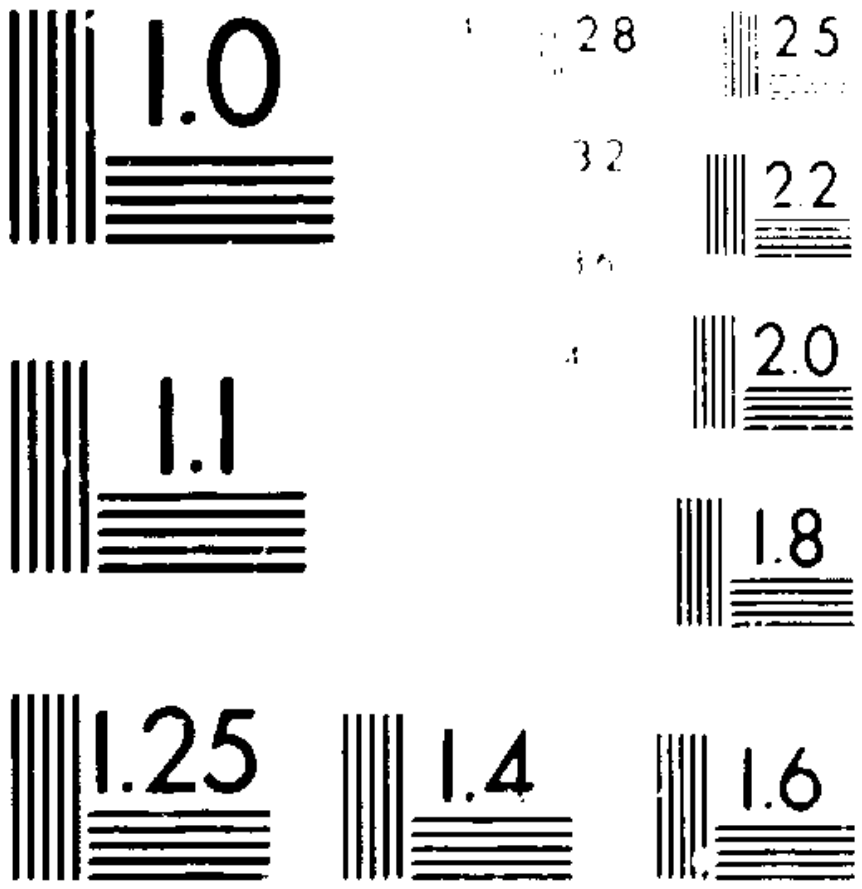

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ASSESSMENT AND EVALUATION OF TECHNOLOGY NEEDS IN RELATION TO NATIONAL AND SOCIO-ECONOMIC PRIORITIES*

by

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Government officials, UNIDO staff, distinguished participants and guests :

It is a very great pleasure and honor to be here, today and have this opportunity to speak on Korea's economic development and also on some of the parellel experiences of Korea Institute of Science and Technology(KIST) that I represented as its President (Now, KIST and (1)KAIS have merged into (2)KAIST). And I hope my brief review on our past experiences may be of some help to the Malaysian Government in its effort to devise effective measures for the development, transfer and management of technology at the national level.

ECONOMIC DEVELOPMENT PLANS IN KOREA AND THE INNOVATION OF INDUSTRIAL TECHNOLOGY

The economic development in Korea during the past 20 years may summarily be characterized by the achievement of high rate of economic growth and rapid progress in industrialization process. During the past 20 years Korea formulated and completed a series of economic development plans for 4 consecutive terms, and the relative impacts on economy of the implementation of the development plans may be synoptically analysed for each stage as shown in the following Table 1.

The three(3) basic factors for economic development will be, as we may readily admit, the capital, labor and technology. From a parochial wiewpoint, however, the technology factor may safely be said to have rendered greater contributions than other factors did for economic growth in the industrialized nations.

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(1) KAIS : Korea Advanced Institute of Science
(2) KAIST : Korea Advanced Institute of Science and Technology

(Table 1)

IMPLEMENTATION RESULTS OF ECONOMIC DEVELOPMENT PLANS IN KOREA

Sector	1st Plan (1962-1966)	2nd Plan (1967-1971)	3rd Plan (1972-1976)	4th Plan (1977-1981)
1. State of Industrialization	Development of intermediary materials industry	Development of intermediary materials and capital equipments industries	Balanced development of intermediary materials, capital equipments and consumer goods industries	Development of export goods industries balanced with domestic goods
2. Trend of Investment	For development of export and/or import substitute industries	For structural improvement of export industry, expansion of domestic production, development of technologies	For development of mechanical industry, domestic production of materials, technology development, technology transfer and build-up of infrastructure for tech-infrasturcture	For development of technology-intensive projects and specialized industries
3. Foreign Trade	Export : Consumer goods Imports: Capital equipments Fuels & Raw Materials	Exports: Consumer goods, Semi-finished goods Imports: Capital equipments, Fuels and Raw Materials	Export: Consumer goods, Semi-finished goods Import: Capital equipment Fuels and Rew Materials	Export : Consumer goods, Semi-finished goods, Finished goods Imports: Capital equipment. Fuels and Raw Materials
4. Major Industrial Growth	Textiles & Fibres Fertilizer & Cement Oil Refining Electric generation	Synthetic Fibres Petrochemical Iron & Steels and Machines Electronics	Machines, Iron & Steels Electronics	Machines, Iron & Steel, Shipbuilding Electronics
5. Per Capita GNP (U.S.$)	96(1962) - 131(1966)	143(1967) - 252 (1971)	304(1972) - 700(1976)	965(1977) - 1,575(1981)
6. Ratio of Technology Development Investment against GNP	0.2% (1964)	0.38% (1971)	0.53% (1975)	0.62% ('980)

Economic development, conversely viewed, will create technology demand, and in order to meet the technology demand Korea launched simultaneously into dual path - to transfer advanced technologies from foreign countries and to create and develop its own technologies. These efforts were not without challenges and difficulties. In technology transfer, difficulties lay in selection of appropriate technologies for transfer, in negotiation and decision on the price of technologies, and eventually in indigenizing and utilizing the transferred technologies in a most viable manner in Korea, while in the effort of creating and developing new technologies from within, the establishment of basic infrastructure for the development activities posed a problem to be initially encountered.

In order to overcome these difficulties, Korea's economic development effort was matched with special measures for promotion of industrial technologies, which measures perceived development of technologies and technical manpower and establishment of technical cooperation tied with other institutions in advanced countries, all with the ultimate goals to see that technology development directly serves the economic development.

As illustrated in (Table 1), Korea's investment for technology development increased by 3 times in terms of ratio against the GNP in between 1964 and 1980 and in terms of the amount of money involved, it indicates a 57 times increase from 5.59 million to $320 million odd dollars. It is further significant to note that approximately 52% of the total development investment came from the government resources. These facts are indicative of the government awareness of the importance of the technology development as an indispensable pre-requisite for development of economy and that the measures for technology development have been masterminded by the government and have been led and pursued with important political considerations.

UNIQUE NATURE OF KIST AND ITS EFFECTS

Nowadays, research institute is no longer a new concept in any country. As a matter of fact, there already existed in Korea, prior to the birth of KIST, some 80 individual institutes engaged in different types of research and/or testing operations. Those existing institutions, however, were not fully capable of meeting diversified, increasing technology demands that have been generated in the course of implementation of the economic development plans. It was because of the many short-comings with them in regard to the mode of operations and environmental requirements including the research facilities. These problems will be more or less of universal nature in most of the developing countries. To cite some of the main features of those underlying problems, they are:

1. The lack of autonomy of both research and financial stability.
2. The insufficient of inadequate rewards for researchers.
3. The insufficient, or lack of, experiences in development of industrial technology on the part of researchers.
4. The inadequate research facilities.
5. The lack or short supply of technical informations.

The Institute came into being in 1966 as an independent, non-profit research institute, and in the interest of ensuring a successful operation of the Institute, the Republic of Korea government has instituted the following measures:

1. The government donates endowment funds to the Institute for its financial stability and also warrants its operational autonomy.
2. The Institute is statutorily supported by enactment of the insitute establishment law for transfer to the institute of public properties, donation of operational funds and for whatever other necessary assistance.

Financial requirement of the Institute operation, however, is not derived from the government budget. Instead, the income derive from

management of endowment fund and the money received from research sponsors in reward of researches performed consitute the necessary financial resources. The sponsors of research contracts widely cover the private industry, government-invested business, government and government agencies and also alien organizations of foreign countries, and for the institute the entrusted research activities are carried out in such a manner as to safeguard the sponsors' industrial secret and proprietary rights.

The Institute organizes different laboratories based on the field of specializations, and the individual laboratories are independently operated under the control of Principal Research Scientists. Each laboratory operates on a responsible accounting system based on prior calculation of research costs, and the Principal Research Scientist who heads each laboratory is responsible not only for the full range of activities needed for execution of contract research but also for the research results. This system of operation is intended to enable the capable researchers to fully display their research capabilities based on their own creative ideas through autonomous operations which simultaneously entail authority and obligation.

To organize or disorganize any particular laboratory is guided by the principle of necessity. New laboratories are added whenever necessary, while laboratories having no research projects to perform or lacking project leader to control the research operation are to be closed. This practice is also considered to have been instrumental in enhancing the effectiveness of self-control of each individual laboratory in clear perspective of performance evaluation.

The main business of the Institute as an integrated research institute is to develop applied industrial technology. Hence the unit laboratories dealing in different fields of applied science constitute the basic ingredients of the Institute. In addition, however, there is an industrial economics group to perform the task of prior evaluation of economic feasibility of applying the research result to practical indus-

trial production. This system is intended to minimize the commercialization risk through prior evaluation of both technical and economic soundness in the early stage of research conception. The evaluation service of the group is not limited to the precommercialization stage, but is extended into manufacturing operations on an industrial level in the form of management consultations and assistance. This is in the interest of seeing to it that the R&D activities, while still remaining the basic objectives of the Institute, go beyond the intrinsic realm of R&D into the practical reality of business enterprises. For example, the economic feasibility study coupled with R&D on Ethambutor Process and the technical assistance and management services for an Optical equipment company in Korea may be cited for the case in point. In the case of Ethambutol synthesizing project, techno-economics group's study on the economic soundness of the project including market surveys and study into the patent implications was initiated already in the early stage of project definition. This has had the effect of producing a satisfactory exploitation of research result in the industrial application, that is, a successful case of commercialization on the research outcome. In the case of the optical industry, the Institute techno-economics group implemented the management and technical assistance services for an existing business firm in the trade which was in the red with chronic management inefficiency.

The services by the team were so effective that the company was refurbished into a viable profit-yielding business in a comparatively short space of time of a year or so. Those are the examples intended to demonstrate the fact that the business of the Institnte while recognized as primarily concerned with science and technology, has come to assume the complex role of technological development assistance all at once in the interest of the industry.

SELECTION OF RESEARCH FIELDS

One of the important tasks the Institute had to do to achieve its goals of establishment in its initial stage was the selection and evaluation of its R&D fields and projects at both industrial and national level. As the year when the Institute was established in, was the last year when the

1st 5-year Economic Development Plan ended in, the status analyses and forecasts for the industries was necessary not only for the related government agencies and industries but also for specifie orientation of the Institute activities. So, the Institute organized the Industrial Status Survey Team composed of experts of science & technology and industrial economics from the Republic of Korea and U.S.A.

This Survey Team of fifty seven(57) experts from Korean industries, universities and government, and twenty three (23) from BMI, visited about six hundred of companies, the related government agencies and universities for ten months. The seventeen(17) fields surveyed by the Survey Team are : food, electrical, electronics, oil and chemistry, polymer, pulp and paper, construction materials, transportation, mechancial, metallurgical, ceramic, packing, casting, computer utilization, analytical chemistry, science and technology information and anti-corrosion.

Among the above seventeen fields, the Survey Team decided the five industries, i.e. materials, mechanical, electronics, chemical and food industries as a core R&D fields, and selected the technology information, computer utilization, industrial economics, materials testing and chemical analysis as the supporting R&D fields.

The Survey Team considered the following survey results as the criteria for the core R&D fields and the supporting R&D fields.

1. At the industry level
   - A. Industries desire easy access to efficient utilizatin of technology information.
   - B. Industries recognize the necessity of the import of advanced science and technology, and seek for the prospective fielts.
   - C. Industries need urgently the pilot production activities.
   - D. Industries have a difficulty in materials processing such as alloying and electropiating etc.

2. At the government level
   - A. The Government reflects the iron and steel, electronics, mechanical and oil & chemical industries as intensive promotion fields during the 2nd the 3rd Economic Development Plan.

B. Food industry is fundamental to the National Policy.

After the selection of R&D fields, the Survey Team chose the R&D projects, the principal Researchers, R&D equipment, and estimated R&D budget and implementation schedule. For example, the following R&D projects were selected in their order in the electronics industry.

	Projects	Scores
1.	Ceramic processing Technology	89
2.	Overseas technology information	88
3.	Establishment of information center	84
4.	Alnico manufactruing	80
5.	Raw materials for condenser	80
6.	Ferrite manufactruing	77
7.	Q.C. and testing	77
8.	P.C.B. development	74

The processes for choice of projects/technology were as follows :

A. General consideration for choice of technology

Regulatory agencies in the developing countries are often faced with the task of choosing one of set of competing technologies relating to a particular project. Business risk is not always associated with the technology itself. It could lie in demand, estimates of investment, legal constraints and political and social factors. So, the function of a regulatory body can only be construed as that of :

(a) Reviewing the process by which the enterpreneur has selected a particular technology :

(b) Reviewing the technology in terms of the national economy, for example, taking into account the :

i) Appropriateness of the national infrastructure :

ii) Value added and other contribution to the economy :

iii) Capability of the buyer of technology

iv) Cost of the technology :

v) Source of the technology :

vi) Terms that will control the use of technology.

General considerations for choice of technology were as follows :

- *Technologies freely available within the country*

  - *Contracts or agreements cover technical know-how that a local research institute is able to provide,*
  - *It covers the continuing supply of technical services that buyers could perform without additional cost,*
  - *The object of the contracts or agreements covers exclusively the exploitation of a patent that is no longer valid in the country.*

- *Points to be considered on royalty payments*

  - *The manner in which the payments are to be effected,*
  - *Estimated sales volume of production during the period of the contract or agreement,*
  - *The specified dates when payments should be made,*
  - *The effect of payments for technology on the buyer,*
  - *The effect of the payments on the cost of the goods and services produced.*

- *Points to be considered on the rights to use patents*

  - *When a patent has been requested but not yet granted,*
  - *Infringement on licensor patent rights by a third party,*
  - *Limiting the field of use of a patent.*

- *Points to be considered on the technical assistance*

  - *Payments on a continuous basis for the technology assistance,*
  - *Limitations other than those pertaining to confidentiality,*
  - *Any restriction concerning the use of nonpatented know-how.*

- *Points to be considered on basic and detailed engineering*

  - *Defining the degree of responsibility of all parties involved,*
  - *The type and scope of guarantees,*
  - *The type and scope of services.*

- *Points to be considered on managerial assistance*

  - *Service, such as planning and programming, research and development, inventory control, financing, accounting, purchasing, and marketing, involved should be clearly defined.*
  - *Training programme,*
  - *The responsibility and functions of the supplier.*

- *Points to be considered on intervention of supplier with the management of the buyer*

  - *Decision-making position of the supplier in the business,*
  - *Limitation on the production volume and price.*

- *Points to be considered on the buyer's research and development*

  - *Undertaking research, development and improvement concering new products, processes, equipment, etc.*
  - *Granting back to the supplier the results of the buyer's research development and improvement,*
  - *Access to other sources of complementary technology.*

- *Marketing factors*

  - *Demand size and stability,*
  - *Product volume, estimates of market share,*
  - *Product mix, utilization of production line,*
  - *Product quality, pricing,*
  - *Break-even point operation,*
  - *Distribution system, marketing channel.*

- *Investment factors*

  - *Trade-off in investment and operation costs for technologies of same products for comparison of production cost,*
  - *Discounted-cash-flow for the calculation on the performance of the project as a whole,*
    - *Net Present Value*
    - *Internal Rate of Return*

- *Qualitative factors concerning investment.*
  - . *availability of management skills*
  - . *use of economic data (asset life estimation, competitive price)*
  - . *Potential deficiencies in technical area (the qualities of inputs and outputs).*

o *Economic factors*

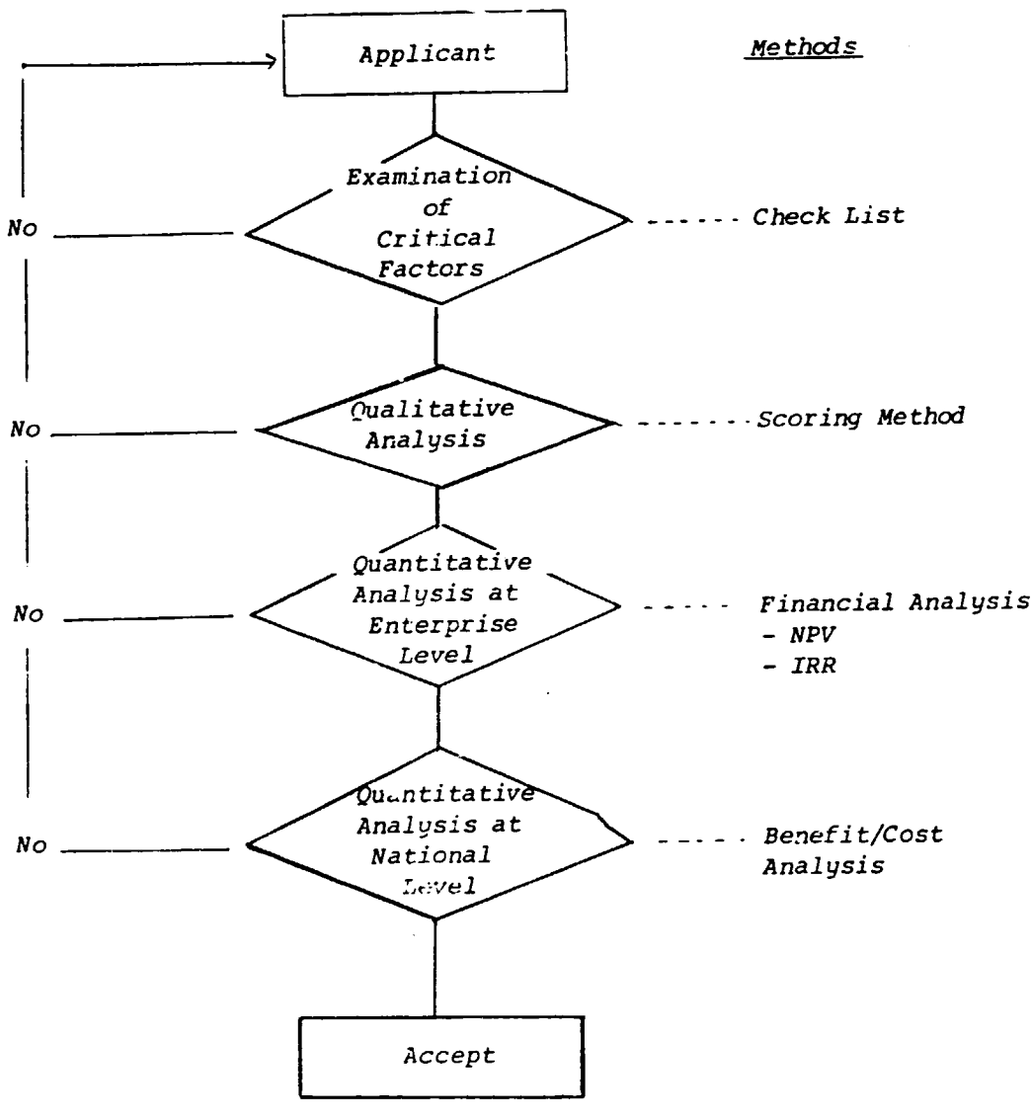
- *Contribution to the improvement of the country's balance-payments position,*
- *Increasing employment of local labour,*
- *Utilizaing local raw materials to a maximum degree,*
- *Contribution to the development of a well-balance economy,*
- *Cost-benefit analysis as a method of evaluation.*

B. *Procedures of Evaluation and Selection of Technology*

Diagram below shows the procedures for selection of technology whose price exceeds a certain amount, say US$100,000 of lump sum royalty. Four step approach is suggested in the Diagram. That is, we have four decision points for the finanal acceptance of a technology to be selected.

If the result of evaluation in the first decision point which examines "critical factors" by a check list, which will be presented, is "no", the documents return to the applicant. In that case, if the applicant changes the contents of contracts or agreements as required, those doduments could be reevaluated : if not, finanlly rejected.

Diagram, Decision-making Flow for Choice of Technology



If the result of evaluation in the first decision point is "yes", the documents go to the second step for the qualitative analysis by experts in the corresponding technology field. One of the qualitative analysis methods will be discussed in detail. Courses of action on the result of evaluation are the same as those of the first decision point.

If the result of evaluation in the second decision point is "yes", the documents go to the third step for quantitative analysis at enterprise's level. If the result of evaluation in the third step is "yes", the documents go to the fourth step for quantitative analysis at national level.

If the result of evaluation in the fourth step is "yes", the proposed technology is finally accepted.

Check List

If proposed contracts or agreements have the contents against law, it can not go further, definitely. So, this check list should contain "critical factors", like legal factors, which do not permit the contracts or agreements to be accepted.

Some of the critical factors are listed below.

Violation of Law

- *readily obtainable technology in Korea*
- *unreasonable price of technology*
- *supplier's intervention in the management of buyer*
- *restrictions on the buyer's R&D activities*
- *Tie-in conditions such as equipment procurement and selling of products.*

Other critical factors

- *Very limited availability of raw materials*
- *licensed products are infringing on third-party patents*
- *licensee is indemnified against third-party claims of patent infringement*

- the patent has a sufficiently long unexpired life
- the patents have been issued in the licensee's market territories.

Scoring Method

For the evaluation of any proposed project, the technology involved will be examined by technical advisors or experts in the field concerned in order to have different views on the same project.

The experts will base their analyses on the factors listed in the fcllowing questionnaire, namely, strategic factors, technological factor, manufacturing factors, and economic factors and modulate their scores according to the potential impact of the project concerned on these various scores.

The various scores given by each expert will then be summed up and the average computed for overall evaluation of the project. If the number of points scored is below a certain average, say 60, the projects will be rejected : otherwise it will be adopted or submitted to a new evaluation if the average number of points scored is not conclusive.

However, a project with a below-average score can still be adopted if the technology invloved has an important impact on the strategy of the country.

Questionnaire for Evaluators

Factors	Score				
	1	2	3	4	5

Strategic Factors

1. Technology relating to political stabilization (national defense)
2. Improvement of social welfare (medical technology)
3. Enhancement of cultural level (printing)
4. Educational objectives (education by broadcasting)

Technological Factors

1. Ripple effect
2. Accumulation effect
3. Manpower development effect
4. Utilization effect of existing technology/facilities

Manufacturing Factors

1. Utilization of existing experiences
2. Availability of raw materials
3. Availability of manpower

Financial Factors

1. Demand Stability
2. Import substitution
3. Export possibility

Economic Factors

1. Increase of rural income
2. Employment effect
3. Foreign exchange earning ratio(balance of payments)

Financial Analysis

In general, NPV and IRR methods are used for the financial analysis of a proposed project. Followings are the key elements of these methods.

1. The basic assumptions in NPV analysis are :
   (a) the applied discounting rate is correct :
   and
   (b) this rate remains unchanged over the project life.

If a proposed project may anticipate the following pattern of expenditures and income.

Project life	1st year	2nd year	3rd year
Income	X1	X2	X3
Expenditure	Y1	Y2	Y3
Net Income	(X1-Y1)=A	(X2-Y2)=B	(X3-Y3)=C

the present value of future net income, at a discount rate r, is

$$Z = \frac{A}{(1+r)} + \frac{B}{(1+r)^2} + \frac{C}{(1+r)^3}$$

Z is considered to be the net present value (NPV).

Any proposed project will be profitable if its NPV is above zero (positive) at the assumed discount rate.

The discount rate does not provide for inflation. It represents the net impact of the cost of raising various types of capital(equity, loans etc) in the context of the demand and supply of funds and risk factors in the environment.

2. However, knowing the NPV of a proposed project gives no indication of whether the project is close to the margin of acceptability. For this another measure of profitability is needed. This is supplied by calculating the internal rate of return (IRR), which can be compared with accepted

norms (say, dividend expectations on leading stocks) of yield in a particular industry or economy.

The IRR is calculated by setting NPV equal to zero and calculating the rate r, of the following equation :

$$NPV = \sum \frac{Future\ income}{(1 + r)^n}$$ *The IRR is the rate that equalizes expenditures to income.*

3. When we choose one between proposed projects A and B, even if project A has NPV higher than that of project B, project A should meet the acceptance criteria. That is, project A would also have to have an IRR above the prevailing yield rate. Both NPV and IRR have to be compared.

INFRA-STRUCTURE FOR THE R&D ACTIVITIES

As noted earlier, the formation of laboratories based on specific field of specialization may be the part and parcel of any industrial research institute. However, the internal service operations to support the R&D activities may be of no less importance. Being mindful of the neccessity of service operations, the Institute has formed a satisfactory array of the so-called infrastructure for the R&D activities. The follwing is a brief review on those service operations :

ENGINEERING SERVICE

The eventual goal of operation of an industrial research orginization will be to help achieve a satisfactory adaptation of R&D result on an industrial level, which may further lead to the logic that the Process Engineering is no less important than the R&D activity itself. The problems to be initially considered in the process of physical applications will usually include : The optimum manufacturing facilities, until process test operations, and technical and other operational retardations attendant upon mass production operations. For an advance clearance of all these

problems, the Institute has the Engineering Department to undertake pilot Test Operations. The major functions of Engineering include :

- To define appropriate process, and to design and designate effective manufacturing equipments and facilities.
- To evaluate marketability of products, and to induce informative data for assessment of business profitability.
- To develop pilot equipment and system that will fit into special process technology or special method of treatment involved.
- To render in-house engineering consultation services.

Some of the outstanding exemplary achievements of the Engineering Department include : Fabrication of pilot equipments for improvement of Red Jinseng Processing Facilities : Plant Designing and Supervision for Single Cell Petro-protein manufacturing plant : Construction of pilot plant for synthesizing Ethambutol and Amino-butanol : etc.

TECHNICAL INFORMATION SERVICE

A Technical Information System represents a vital part of the overall operation of any research organization. Naturally, the Technical Information Department at the Institute represents one of the facilities which came into being from the very outset of the Institute foundation.

The modern world of today may be termed as a society inundated with overflowing tide of "informations". To cull, collect. Select, assort and arrange the technical data out of the sea of informations for ready use by scientists and engineers will be an indispensable part of R&D operations.

The Technical Information Departament has been in operation with great emphasis on speedy and effective survey, collection and alalysis of advanced technical informations from abroad for distribution among the in-house laboratories and among the industrial organizations. It also established the channel of exchange of industrial technology informations between the Institute and the industry, simultaneously undertaking various study projects related to information processing system.

PROJECT DEVELOPMENT SERVICE

The Institute was the first concept of contract research organization in Korea. The conventional way of thinking in Korea was that the term of research means something mandatory to the government to public institutions and that the fruite of reaearch are to be dispensed free of charge for industrial applications. In order to convince the idea of contract research, it was necessary for the Institute to launch a decisive project development activities. It was to convince them of the necessity of sharing the burden of research cost in the interest of solving their technical difficulties both current and future. To perform this important function, the Institute organized the Project Development Department. The Department is performing the role of both project development and research sales through contracts with sponsoring industrial organizations.

The Department also provides assistance in formulating long and short term R&D program of the Institute in cooperation with top management in controlling preproposal activities involving definition of R&D subject in preparing formal contract agreements in submitting interim and final research reports, and also performs other administrative duties relative to the sales of research results. In sum total, the Project Development provides functional assistance throughout the entire process of project development and control of R&D activities in close coordination with management and laboratory heads.

KOREA TECHNOLOGY ADVANCEMENT CORPORATION (K-TAC)

One of the mafor goals of the Institute is to see that the results of its R&D activities are transferred to the industry for practical applications. In putting the developed technology into practical production operation. there are other non-technological factors to be taken into consideration. Such as the financial sufficiency and management caliber and it is often the case in technology transfer that these supplementary factors of non-technological nature would present serious obstacles that hinder the successful commercial operations of the new technology. To

alleviate such difficulties standing in the way of commercialization of R&D results, the Institute organized a business corporation under the applicable laws in the name of K-TAC (Korea Technology Advancement Corporation) with the thought that the Corporation could devise the means whereby to secure a successful exploitation of R&D results on an industrial level and then to transfer the business to the industry in a readily workable form on a turn-key basis.

Though K-TAC is in itself a business corporation fully eligible for profit-making, the real significance of its raison dêtre is to see that the developed business is eventually released to the industry for public good. Seen from this angle, therefore, K-TAC is an intermediary body between the Institute and the industry working on the philosophy of ensuring a smooth and effective switch-over of the Institute developed technology on to the industry in a viable manner. Naturally, K-TAC evaluates the R&D results in the business eyes in order to prepare an effective working plan for an enterprise. In this process, K-TAC will either seek for a potential business partner from among the existing industrial firms for a joint operation, or consider building and operating a model plant on its own.

The record of K-TAC business so far includes such experiences as transfer or commercializations of Fluorocarbon manufacturing technology, powder metallurgy technology, Refractory Saggar fabrication technology, etc.

To be more specific, in the case of Fluorocarbon the Institute initially developed the manufacturing technology and carried the project further on to the stage of pilot plant operation. K-TAC then came to take over the project for further brushup with detailed feasibility studies on economic and commercial soundness of the project. Once the feasibility was firmly established, the entire know-how was then sold to a business firm. This is an example of successful technology sales realized through K-TAC. In the case of metal powder. K-TAC similarly took over the the Institute developed technology. In this case, however, K-TAC elected to construct a plant of its own for self operation until it could attain the status of full industrial maturity. The case of Refracory Saggar project is an example of joint-venture business between K-TAC and the industry, where K-TAC is undertaking the obligations for operation of plant and product

productions, while the business partner is to assume the role of marketing and other related phase of operations.

In synopsis. the scope of K-TAC business may be summed up as follows :

- To undertake the intermediary or catalytic role for effective commercial exploitation of the Institute developed R&D results and know-hows.
- To propose or sponsor potential R&D projects for the Institute
- To undertake sales and diffusion of the Institute owned patents and know-hows.
- To participate in management and control of K-TAC-invested business enterprises.

The followings were the major factors which were used for criteria of commercialization of projects.

I. COMPANY DESCRIPTION

A. What is the business ?

B. Products

1. What are the major products or services?
2. Who are the major customers?
3. What are major applications?

C. What is their unique selling position?

What are the chief factors that will account for success?

II. MARKET ANALYSIS AND MARKETING

A. Industry description and outlook

1. What is the industry?
2. How big is it now? How big will it be in 5 years? 10 years?
3. What are its characteristics?
4. Who are, or will be the major customers?
5. What are or will be the major applications?
6. What are the major trends in the industry?

B. Target Markets

1. What are the major segments that will be penetrated?

2. What are the products or services to be sold?

3. For each major application. what are the following:

   a. Requirements by the customer?

   b. Current ways of filling these requirements?

   c. Buying habits of the customer?

   d. Impact to the customer of using product?

      i. User economics (how much will it save the customer per year? What return on investment will the customer get?)

      ii. Other impact (Will the customer have to change his current ways of doing things? Buy other equipment? (Change work habits? Change organizational structure?)

   e. How will these segments and applications change over the next 3 to 5 years?

C. Competition

1. What companies will you compete with (including those like you, who are not yet in the market)?

2. How do you compare with other competitive companies?

3. What competition will be met in each product line?

4. How does the product compare with others (especially in the eyes of the customer)?

5. What is the market share of each existing competitor?

D. Reaction from Specific Prospective Customers

1. What prospective customers have been talked to?

2. Have they seen or tested a realistic prototype of the product or service?

3. If so, what was their reaction?

E. Marketing Activities

1. What are the plans for:

   a. marketing strategy ("One-stop shopping", specialization, market share objectives, image?)

   b. Distribution (Direct, OEM)?

   c. Promotion (Advertising, conventions, etc.)?

   d. Pricing (Demand pricing or cost-based pricing, volume discounts, etc.)

   e. How will pricing change over-time?

   f. Sales appeals?

g. Geographical penetration?

h. Field service or product support?

i. Setting priorities among segments, applications, marketing activities? The limited human resources in a new venture cannot be all things to all people regardless of the opportunities.

F. Selling activities

1. How will you identify prospective cusomers? It is important to identify not just the companies but the relevant decision-markers who can spend money on your product, either discretionary or budgeted funds?

2. How will you decide which to contact and in what order?

3. What level of selling effort will you have (For example, the number of salesmen)?

4. What efficiency will you have (For example, how many calls per salesman)?

5. What conversion rates will you be able to obtain (For example, how many calls per demonstration: how many demonstrations per sale)?

6. How long will each of the above activities take in man-days? In elapsed time?

7. What will your initial order size be? What is the likelihood and size of repeat orders?

8. Based on the above assumptions, what is the sales productivity of each salesman?

9. What is the commission structure for the salespeople? Does it have increasing or decreasing rates for exceeding quota? What will the average salesperson earn per year and how long will he/she have to wait to receive commissions, e.g. sales cycle milestones?

10. What evidence do you have to back up your answers to the estimates above?

III. TECHNOLOGY : R&D

A. Current Technology

(Idea, prototype, small production runs, etc.)

B. Patent or Copyright Position

1. How much is patented or copyrighted?

2. How much can be patented or copyrighted?

3. How much comprehensive and how effective will the patents or copyrights be?

4. Which companies have technology that is superior or equal to yours?

5. *Are there additional means of protechting your technology (such as secrecy, speed in-putting or the product or service)?*

C. *Future Technologies*

What new technologies or scientific approaches exist that may become practical in the next five years? What factors limit their development or acceptance?

D. *Research and Development Activities*

What are key R&D activities and related milestones and rksks?

E. *New Products*

What new products, hopefully derived directly from first generation products, do you plan to develop to meet changing market needs.

F. *Regulatory Requirements*

Are there any regulatory or approval requirements

IV. MANUFACTURING/OPERATIONS

A. *Production Operation*

How will you accomplish production or conduct service operations?

1. *How much will you do internally and by what methods?*
2. *How much through subcontracts, both initially and ofter one or two years?*

B. *Advantage*

What production or operating advantages do you have?

C. *Capacity*

What is your present capacity for level of production or operations? How can this be expanded?

D. *Critical Parts*

What are critical parts? Are any of these parts "single-sourced" or do you have backup vendors? What are the lead times of these parts?

E. *Costs*

What are the standard costs for production of different volume levels.

V. MANAGEMENT AND OWNERSHIP

A. Key Managers

Who are key managers?

B. Future Managers

How do you intend to attract and compensate key people(i.e.stock, incentive bonus, etc.)?

C. Skills and Training

D. Staff Additions

E. Non-Compete Agreements

Do any managers have outstanding "non-compete" agreements with previous employers? If so, get opinion of counsel regarding the validity or applicability of the agreements.

F. Board of Directors

G. Stockholders

VI. ORGANIZATION AND PERSONNEL

A. Employees

How many people will you need by job type?

B. Compensation

What compensation method will be used by job type (salary, stock, profit-sharing, etc.)?

C. Organizational Chart

Show sample organizational structures for formative years and thereafter.

VII. FUNDS REQUIRED AND THEIR USES

A. Present Requirements

How much money do you require now?

B. Future Requirements

How much will you require over the next five years, and when will it be required?

C. Use of Proceeds

How will these funds be used?

D. *Debt vs. Equity*

What portion of the funds are expected to be raised from debt rather than equity?

E. *Terms*

What terms do you ask? If this is a first request for outside investment, you should prepare a scenario for the attraction of required capital, approximate price per share and timing, and show dilution or percentage ownership of the initial and subsequent investors.

F. *Option of "Going Public"*

VIII. FINANCIAL DATA

A. *Financial Statements & Projections*

Present historical financial statements and projections for the next three to five years, including:

1. *Profit-and-loss of income statements by month at least until breakeven and then by quarter.*
2. *Balance sheets at the end of each year.*
3. *Cash budgets*
4. *Capital budgets for equipment, etc.*
5. *Manufacturing/shipping plan*

B. *Assumptions*

What key assumptions have been made in your proformas, and how good are these assumptions?

STARTUP CHECKLIST

I. INTRODUCTION AND BACKAROUND SUMMARY

A. *Company and its principals, including all key personnel*

B. *Product or service-photo or illustration*

C. *Company objective and philosophy*

D. *Market and opportunity*

E. *Capital required initially and in first 3 years : ROI first 3 years*

F. *Team preparing this plan*

II. *MARKETING PLAN*

A. *Definition of the market in the industry*

1. *Customer : who he is. Where he is.*
2. *How the customer buys. Point of sale*
3. *Usual channels of distribtuion*
4. *Advertising and sales promotion practices*
5. *Price ranges*
6. *Total market size, actual and/or potential*
7. *Market survey information available*

B. *Competition : others already active in the industry.*

1. *Who and where*
2. *Nature of operations, products and prices, etc.*
3. *Shares of market*
4. *Strengths and weakenesses*
5. *Basis for competing, your opportunity*

C. *Your product or service specific plans for :*

1. *Product design and packaging*
2. *Promotion and advertising*
3. *Channels of distribution and selling methods*
4. *Company salesmen*
5. *Share of market*
6. *Volume to sell (optimistic, expected, pessimistic: address all three)*
7. *Pricing*

D. *Contingency*

1. *Possible marketing problems*
2. *Ways you expect to handle those problems if they arise.*

E. *Marketing Timetable*

1. *Three years (first by month, second, and third by quarter)*
2. *Time on horizontal axix, action on vertical axis*

III. *PRODUCTION AND OPERATIONS PLAN*

A. *The production or operation process*

1. *Drawing of your product, or description of service*

2. Technology : type of operation to produce or perform
3. Raw materials to be used
4. Process,
5. Ouality control and test data
6. Packing and shipping

B. Raw materials and supplies
1. Sources, timing and reliability
2. Prices at different quantity levels
3. Inventories : cost, storage, and handling

C. Facilities and Equipment
1. Building : cost, availability, sources
2. Tools and machinery : cost, availability, sources
3. Plant layout drawing
4. Maintenance, spare parts, and backup capability

D. Labor
1. Type required
2. Cost, direct and indirect

E. Contingencies
1. Possible production problems
2. Ways to expect to handle those problems if they arise.

F. Production and operations timetable
1. Three years (first by month, second and third by quarter)
2. Time on horizontal axix, action on vertical axis

IV. FINANCIAL PLAN

A. Resources needed
1. Marketing, initial costs
2. Plant and equipment
3. Personnel
4. Working capital
5. Other (further R&D, etc.)

B. Resources Available
1. Capital
2. Materials, equipment, etc.

3. Latest financial statements (balance sheet and income

IV. FINANCIAL PLAN

A. Resources needed

1. Marketing, initial costs
2. Plant and equipment
3. Personnel
4. Working capital
5. Other (further R&D,etc.)

B. Resources Available

1. Capital
2. Materials, equipment, etc.
3. Latest financial statements (balance sheet and income statement)

C. Analysis of revenue, cost, and capital (at least three levels : optimistic, expected, and pessimistic)

1. Revenues, gross and net
2. Fixed and variable costs
3. Breakeven analysis
4. Capital structure analysis
5. Return on investment analysis

D. Contingencies

1. Possible financial problems
2. Ways you expect to handle those problems if they arise

E. Financial forecasts and timetable (three levels : optimistic, expected, pessimistic)

1. Cash flow
   a. first year by month
   b. second and third years by quarter
2. Pro forma income statements, three years by year
3. Pro forma balance sheets, three years by year
4. Sources of capital, including owners and outside prospects
5. Amount and form of capital to be sought at what time

V. ORGANIZATIONAL AND STAFFING PLAN

A. Personnel needed for projected operations

1. Management
2. Technical staff
3. Operating : Marketing, manufacturing, other
4. Outside services

B. Source of personnel
1. Who is now involved : resumes of principals and key personnel
2. Who is soon available - recruitment
3. Training and development

C. Organization structure and charts
1. Initially
2. Years 1,2, & 3

D. Basic Personnel Policies
1. Salaries and wages
2. Fringe benefits
3. Training and development opportunities
4. Other as needed

E. Contingencies
1. Possible organization and staffing problems
2. Ways you expect to handle these problems if they arise

F. Organization and Staffing Timetablw
1. Three years, first by month, second, and third by quarter
2. Time on horizontal axis, action on vertical axis

EFFECTS OF INTERNATIONAL COOPERATIONS

One of the important aspects of development of modern industrial technology will be the process of integrating different technologies. While the fields of engineering and technological specializations are becoming more fractional in kind and more intensive in nature, the necessity of coordinative integration of different fields of specializations is equally being stressed.

Though the Institute is in itself based on the concept on an integrated research organization embracing laboratories of different specializations,

it is also mindful of building up cooperation system with other institutions and universities at home and abroad in the effort to strengthen its research posture. For this, the Institute maintains sister relationship with a number of foreign research institutes including the famous Battelle Memorial Institute in the United States.

Above all, the relationship with Battelle Memorial Institute(BMI) is admitted to be intrinsically inseparable. At the outset of its foundation in June 1966, the Institute entered into a special technical cooperation agreement with BMI in order to draw upon their expertise advisory services beginning from construction plans and ranging up to formulation of management and operational program in the early stage of its establishment.

The outstanding BMI services rendered for the Institute so far may be summarized as follows :

- Assistance services on the foundation and construction plans.
- Assistance in recruiting and training of Principal Researchers.
- Technical services by research specialists to assist R&D activities.
- Advisory services in organizing such support units as Technical Information Department and Industrial Economics Group.

BMI initially rendered assistance services in forming and shaping the basic posture of the Institute in the early days, and in later days it assigned their experts for co-participation in the R&D activities. Their exports services may be classified roughly into these three categories :

1) Services to help perform specific research projects involving either industrial technology or economic considerations, 2) Assistance in training core research staff, and 3) Assistance in the state-of-art analysis of the prevailing industrial technology.

The inter-actions between the Institute and its sister organizations proved highly effective not only in shouldering the burden of various difficult problems that the Institute faced in the early stage of operation, but also in achieving a rapid and healthy growth of the Institute by advanced management system and sophisticated research control mechanism developed by those friendly organization. Another important effect of such

international cooperative pracitice was the advantage brought forth in the area of technical manpower development. For illustration, as many as 38 individual core research staff have had tour of training at BMI in varying periods ranging from 3 months to a full year. The training operation was highly conducive to have the trainees thoroughly acquainted with complex mechanism of operation of unit laboratories and performance of contract research, as well as to develop their own research capabilities.

The development of manpower by means of international cooperations has a most significant bearing with the developing countries in view of the fact that they simply lack in experience of having the so-called applied research institutes in operation. For that matter, the Institute was no exception. The contract research was still a new concept in Korea, hence the researchers themselves were still to clearly understand the nature and mechanism of contract research, to say the least that they needed development of their own caliber for an effective performance of applied research. It is for this reason that the Institute has maintained and is still maintaining a positive interest in dispatching its key staff abroad on training purpose, and now it may be safely admitted that this kind of international synergism of cooperations has constituted an indispensable factor that is assuring a continual development of the Institute.

EPILOGUE

In conclusion, there have been many contributory factors that have enabled the Institute so far to do what it could possibly do in the interest of industrialization of Korea, and here it must be admitted that, of all those factors, the determined government support policy is considered to have played the most important role.

To elaborate a little more on the idea of the government support policy, the morale enhancement and environmental encouragement for the best use of the scientists and the fruits of their research efforts is considered equally important as the financial provisions. In the physical conception, the extent to which science and technology could contribute toward national development may be found on a level proportional to the

amount of investment for development of science and technology especially in the developing world, to that portion of investment absorbed by the government. And such material support must necessarily be supplemented with spiritual incentives for higher morale of science and technology and the super mechanism for skillful and effective utilization of the financial resources so invested.