Journal of Philippine Development
Number Twenty-Nine, Vol XVI, No. 2, 1989

PLANNING FOR SCIENCE AND TECHNOLOGY*

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The advancement of Science and Technology (S&T) is a priority thrust in the present national development plan. S&T programs, therefore, form a prominent part of the overall national development efforts. Recently, the Presidential Task Force on S&T was created to formulate a strategic S&T plan which will hopefully catapult the country to the status of a newly industrialized country (NIC) by the year 2000.

S&T Planning

National S&T efforts require careful planning. A well- developed plan is vital in any S&T organization because it provides the organization its direction and ensures that organizational objectives are maintained and pursued.

Planning is an interactive process of anticipation; it provides the blueprint for achievement. A plan is both a communication device and a precalculated course of action. It involves these three dimensions that differentiate it from goals, standards, forecasts, and decisions:

1. It implicates the future,
2. It involves action, and
3. The action will be done by the planner or a person designated in the organization.

In most respects the plan provides the detail and the means for achieving the objectives with the least expenditure of resources.

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*This paper was presented during the PIDS-DOST Seminar on S&T Policies, 5 May 1989, NEDA sa Makati Bldg., Makati, Metro Manila.

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Variables Involved in S&T Planning

Planning for science and technology is very sensitive to many internal and external variables. Technology, community pressures, and politics are examples of external influences affecting S&T planning.

The state of the art of technology acts as a significant variable that can drastically affect S&T plans. The failure to anticipate the direction of technological change and the rate by which it advances, for instance, places the Research and Development Institution (RDI) in a very weak position. Emerging technological developments can also make existing programs, facilities, and even personnel redundant and obsolete.

The community constitutes an external force exerting pressure for good S&T planning. Since RDI still forms a part of the community it cannot simply ignore this demand. Thus, the transfer of appropriate and successful technology that could improve the people's way of life is always an expectation of the community from the RDI.

Political factors also exert a strong influence on S&T planning. National concerns must be addressed in planning S&T programs, projects, and activities, specifically along areas related to vital state problems such as the need to provide shelter, to eradicate disease, or prevent hunger situations. Internal political forces at work, affecting different S&T institutions in varying degrees, must also be recognized in the planning process. Some of these concern personnel resources, people's morale, and the capability of management and/or quality of leadership behavior.

Resource constraint acts as a limiting internal factor. No doubt some physical resources are readily procurred. However, others may not be so easy to acquire, owing to high cost and long lead time. Moreover, plans are often more constrained by the number and skills of the personnel available, especially technical people. To achieve an optimum combination and integration of people and physical resources is therefore an objective of S&T planning.

Morale in the organization is an intangible but important factor influencing S&T planning. In an S&T organization, morale affects productivity. Leaders of S&T organizations must earn the respect of their peers here and abroad. Members of S&T organizations should be esteemed by the community. Respect and esteem are reflected in the confidence given to management; they also depend in part on interesting projects and adequacy of resources.

Management is probably the single most critical factor in the success or failure of S&T organizations, since it provides the vision, the capability, the energy, and the philosophy behind S&T planning.

Basic Features of S&T Planning

S&T planning is a less than ideal working concept. It may be an imperfect tool. But it is infinitely better than no tool at all. Without planning, responsibilities can be assumed and hence, cannot be fulfilled. Current commitments may also be aborted because resource requirements were not predetermined. In the end, the resulting confusion and communication failure will breed inefficiency and low morale. Thus, organizational cohesion suffers.

Since S&T planning requires an extensive interplay of interdependent factors, it must be established on a comprehensive basis and within a framework of a technology plan. Furthermore, it must guarantee that S&T efforts cater to the identified priorities of the economy.

Because technology changes are very unpredictable and are frequently radical in R&D, the management of an S&T organization must be aware of basic factors which create change and must incorporate flexibility into the planning mechanism. Plans must be open to modification or change at any time, particularly when the actual performance is not within expectation, or if external or internal factors arise which were not anticipated.

To have an effective scientific and technological organization, therefore, it is necessary that a well-planned program of organized and disciplined S&T effortsshould be in place, designed to meet national needs and priorities both in the short and the long term.

In this respect, the National Science and Technology Plan provides the direction for the country to become an NIC by the year 2000. It focuses on the harnessing of S&T in the economic sectors, principally through the use of leading edge technologies. The plan identified 13 leading sectors that would provide maximum socioeconomic benefits.

At present, the country is still an agricultural nation. To attain industrialization and sustained accelerated growth by the year 2000, it must adopt a developmental strategy based on the effective and aggressive use of technologies. The problem at hand, therefore, lies in the formulation of effective S&T developmental strategies that would optimally harness the available S&T resources of the country in addressing, among others, the problem of scarce foreign exchange, shortage of raw materials, low productivity, and uncompetitive products and services. Scientific and technological efforts pursued and applied with singleness of purpose must be undertaken to contribute to the solution of the current problems that confront the nation.

The Council System in S&T Planning

In the DOST, planning for S&T is mainly done through the council system. To illustrate this process, we will discuss the planning system of the Philippine Council for Industry and Energy Research and Development (PCIERD).

The DOST, through one of its research planning and policymaking bodies, the PCIERD, was tasked to pursue a science and technology development package for industry, energy and utilities, housing and infrastructure, communication, and transportation sectors in support of the country's socioeconomic development efforts. The PCIERD was then instrumental in preparing the National S&T Plan, being the Secretariat of the Task Force.

Specifically, the PCIERD is mandated to serve as the leading arm of the government in the planning, monitoring, and promotion of scientific and technological R&D and its applications in industry, energy and utilities, housing and infrastructure, communication, and transportation sectors. PCIERD is also incharge of developing a hardcore mechanism for the harmonious formulation of S&T policies and programs in research and development in the abovementioned sectors. In brief, the PCIERD has the following general functions and powers:

1. Formulate research plans and programs;
2. Identify priority research areas and targets;
3. Allocate resources according to priorities; and
4. Direct, coordinate, and monitor R&D activities in industry and energy.

In its desire to put into more productive and meaningful activities the country's limited resources allocated to technological research and development projects, the PCIERD has long recognized the need to come up with an S&T plan particularly for industry and energy, that would be responsive to the national development efforts.

A system of planning was therefore developed through which the Council translates its strategies. The planning system was designed in such a way as to ensure the maximum participation of all sectors concerned in the decision-making process for industrial development. PCIERD's standing policy is to establish its scientific and technological programs and priorities on the basis of broad consultations involving industry, government agencies, research institutes, and the academe.

In formulating its yearly S&T priorities plan for the industry and energy sectors, the Council organizes consultative meetings, workshops, and seminars with the different sectors of industry as well as with other govern-

ment research institutes. These meetings focus on various technical problems confronting industry and their possible solutions; they also seek to identify the technical input requirements of the sector and the applied research priorities needed to upgrade productivity and develop industrial self-reliance. These meetings also try to match government and private sector resources for research and development activities beneficial to the various sectors of the economy.

The following groups are involved in the consultation process for S&T planning in industry and energy:

1. DOST Research Institutes:
   a. Industrial Technology Development Institute
   b. Forest Products Research & Development Institute
   c. Philippine Nuclear Research Institute
   d. Technology Acquisition and Promotion Institute
   e. Philippine Atmospheric, Geo-Physical & Astronomical Services Administration
   f. Philippine Institute of Volcanology and Seismology
   g. Philippine Textile Research Institute

2. Government Departments:
   a. Office of Energy Affairs
   b. Department of Agriculture
   c. Department of Trade and Industry
   d. Department of Environment and Natural Resources
   e. Department of Transportation and Communication
   f. Department of Public Works and Highways

3. Other Government Agencies/Corporation:
   a. National Power Corporation
   b. National Productivity Commission
   c. Philippine Cotton Corporation
   d. National Food Authority

4. Private Sector:

   The private sector groups in industry and energy are as follows:
   a. Food Processing Industry
      - Crop-based
      - Livestock
      - Fishery-based
   b. Electrical and Electronics Industry
      - Electrical & Machinery Apparatus
      - Electrical Appliances

- Semi-conductor
- Electronics Communication

c. Textile & Garment Industry
d. Wood and Wood-Based Industry
   - Pulp and Paper Industry
   - Furniture Industry
   - Wood Materials for Housing & Construction Industry
e. Iron and Steel Industry
   - Primary Iron & Steel
   - Engineering & Metalworking Industry
f. Chemical Industry
   - Pharmaceutical
   - Resins & Plastic
   - Basic Industrial Chemical, Fertilizer, & Pesticides
g. Mining and Mineral-Based
   - Non-Metallic Minerals
   - Metallic
h. Rubber and Leather
i. Major Energy Source Sector
   - Coal Resources
   - Hydro Resources
   - Geothermal Resources
j. Energy Conservation Sector
   - Building & Transport
   - Industry
k. Non-Conventional Energy Sector
   - Dendrothermal & Minihydro Resources
   - Spoale & Wind Resources
   - Alcogas Resource

5. Academe:
   a. University of the Philippines at Los Baños
   b. University of the Philippines-Diliman
   c. Adamson University
   d. University of Sto. Tomas
   e. Don Bosco
   f. Others

Based on the outcome of the meetings with the consultative and the specialized working groups, the PCIERD Executive Staff drafts the PCIERD S&T Priorities Plan for industry and energy. The Priority Plan is then matched with the National Development Plan of the NEDA to ensure that it

is consistent with and guided by the needs of the other sectors included in the overall plan.

The final S&T Priority Plan for industry and energy is submitted for approval to the Governing Council which is the highest decision-making body composed of the DOST Secretary as chairman; the Council's Executive Director; the undersecretaries of Trade and Industry, Energy, Public Works and Highways, and Transportation and Communications; and three representatives from the private sector. Upon approval, the plan is given back to the Executive Staff for implementation.

PCIERD also developed a system of criteria for determining preferred research areas of S&T development in industry and energy. The approval of research proposals for financial support under the PCIERD Grants-in-Aid depends on their commercial feasibility, socioeconomic development impact, contribution to upgrading S&T manpower capability, and high probability of success or low risk factor.

Regional Thrust

In line with the regionalization thrust of the government, PCIERD is now stressing the national effort to bring the benefits of science and technology to the regions. In pursuing its research program on technology development, particularly toward promoting regional industrialization, PCIERD has tapped the support of the DOST regional offices in –

1. Identifying strategic raw materials which, based on technoeconomic criteria, have a high economic potential and provide Philippine industry the maximum comparative advantage. The search for strategic raw materials are focused on - -
   a. Raw material substitutes;
   b. Abundant indigenous raw materials that can be processed to higher value industrial products and whose technoeconomic possibilities have not been exploited; and
   c. Agricultural wastes that can be converted into usable products.
2. Determining industrial projects or products that could play a lead role in the technological transformation and growth of the region.
3. Determining research and development programs and technical facilities that would be supportive of regional development plans.

4. Assisting cottage, small-and medium-scale industries in attaining self-sufficiency and self-reliance in the adoption or improvement of indigenous or existing technology.
5. Delivering technology packages to the countryside to contribute to the formation of viable livelihood projects in the regions.
6. Promoting technology transfer to cottage, small-and medium-scale industries through brochures, feasibility study, technical information materials, prototypes and others that would promote countryside development.

It must be stressed here that to be effective, such a program for industrial development must be viewed within the framework of the National S&T plan which integrates all S&T development schemes, maximize the utilization of available resources and technologies, and spread the benefits of S&T development efforts through all sectors of the economy. These efforts are all aligned toward making the country an NIC by the year 2000 through the aggressive and wise use of leading edge technologies in improving enterprise productivity and in expanding the production sectors.

The planning systems for the other sectoral councils are more or less similar to that of PCIERD's. The sectoral Council System ensures that all the views of participants and actors in each sector are heard and considered before any decision is made or implemented in the S&T sector.

Problem Areas

Problem areas in S&T planning include the following:

1. With a new National S&T Plan, an assessment of the capability of DOST agencies has to be done, particularly to gauge their ability to respond to the planning requirements of the new plan and their capacity to meet the challenges of leading edge technologies for the 13 top priority sectors.
2. A more relevant system of performance indicators for each DOST agency should be developed.
3. There is a need for a system of impact indicators for S&T activities as well as better evaluation and monitoring of S&T programs and projects.
4. A more systematic criteria or planning standards for S&T planning should also be established.