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BUILDING FOR THE YEAR 2000: REPORT OF THE PRESIDENTIAL TASK FORCE ON SCIENCE & TECHNOLOGY DEVELOPMENT

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Yesterday, July 11, there was an all-day forum at the Department of Science and Technology Executive Lounge in Bicutan on the Report of the Presidential Task Force on Science and Technology Development. I know that many of you were there so I shall not redo that presentation. In this talk, then, I would like to focus on three aspects of the report and follow-up:

1) Content and overall assumptions and philosophy of the work of the Task Force.

2) Aspects of the Task Force report which are of special importance to the scientific community.

3) Structure of follow-up and implementation.

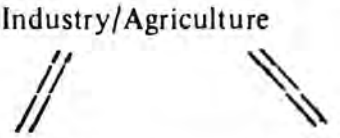
I. Content and Overall Philosophy and Assumptions of the Task Force

In the very first meetings of the Task Force, the Executive Committee (Chairman and two vice-chairman) presented the following overall guiding framework:

A. The output of the Task Force should be a concrete, programmable plan, not another "wish list".
Comment: In a couple of the discussion of the Task Force, the question was raised as to how this Task Force plan relates to the NEDA five-year plan. Some of us pointed out that at least the S&T portion of the NEDA plan is not a plan at all. It is a collated "wish list" from various groups and agencies with no clear commitment with regard to resources and implementation.

B. There should be a "carrier" for this plan, i.e., persons, institutions, who not only do the planning, but will also take (at least partial) responsibility for the implementation.
Comment: One of the phenomena of our culture, which needs some study and reflection, is our habit of forming resolutions committees and presenting resolutions at the end of a conference without designating responsibility for seeing to it that the resolutions are carried out. In fact, it is rare that the next conference reports on the record of implementation of the previous conference's resolutions.

C. This "carrier" should be mainly a *linked network* of the following:



Science & Technology Institutions (R & D institutions in government private sector, academe) ═══ S & T Manpower (Academe)

The point of view taken by the Task Force is that the first key moves in developing a Science and Technology Plan have to come from leaders in government and the private sector. They have to answer the following questions (perhaps with the help of academics and scientists, but they have to give answers together with the requisite commitment to resources and implementation):

– What is to be our path of industrialization going into the next century?
– What are our priorities and policies in agriculture?
– What path are we to pursue in developing aquatic and marine resources in terms of our forests and forest products?

It is true that initiative and invention in S&T may actually be the "push" factor for plans and decisions in industry and agriculture. But if we are in the process of developing overall plans and priorities, it is difficult to make decisions on investing in laboratories and manpower training without some idea of the priorities of government and the private sector.

It should also be noted that the Task Force focused mainly on the needs of industrialization and productivity. The Task Force realizes that this is only part of our S & T concerns:

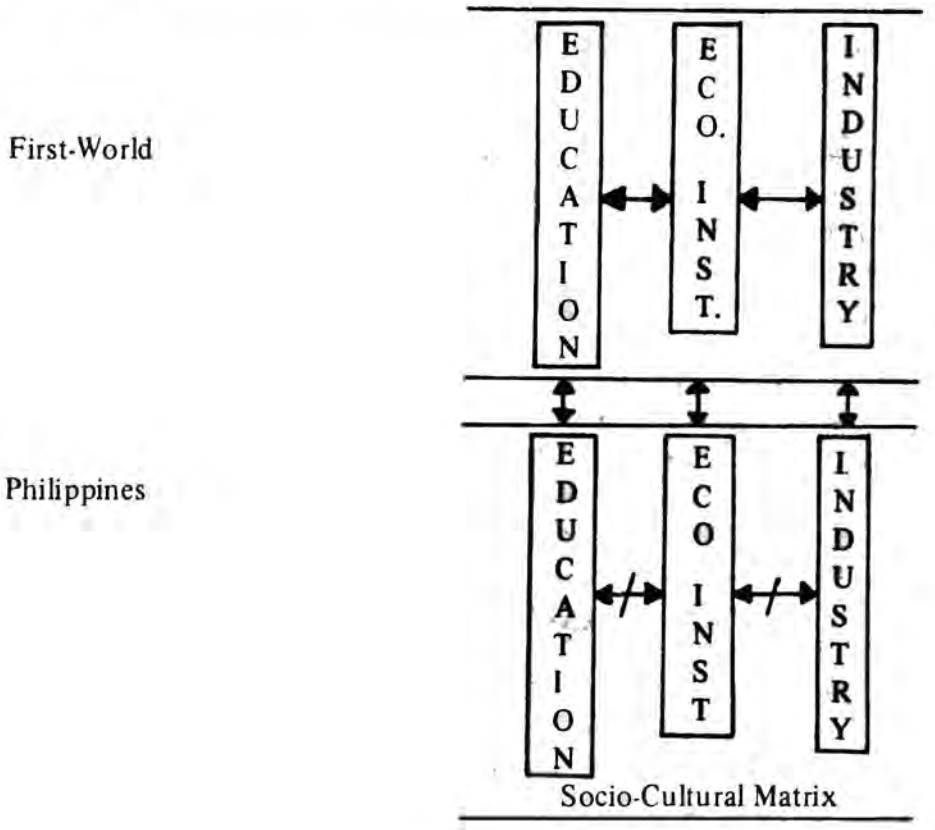
"Many have asked and many more will be asking why important S&T areas such as environment, health, and hazard management are not discussed in the report. The focus of the Task Force was specific: to dialogue with industry and agriculture and to identify the S&T areas needed for us to move to NIC status by the year 2000, then to work out the manpower, S&T infrastructure, policies, and organizational structure needed to make rapid progress in these identified S&T areas. The other concerns should be taken up soon in a different study and report." (Task Force Report, p. 4).

A second point of view which needs emphasis is the concern of the Task Force that the process of work and implementation stress and strengthen linkage between industry/agriculture – S & T institutions in government, private sector, academe – academic institutions. To help us understand the concern which underlies this preoccupation with linkage, I would like to refer to a section of a paper I gave in 1985 entitled: "A Framework and Premises for the Development of Science and Technology in the Philippines Today".

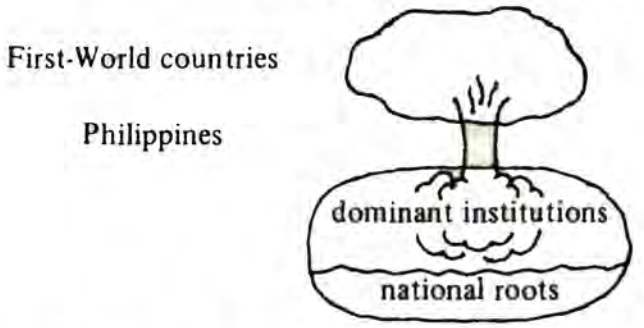
"(An earlier paper) points out several problematic observations about science and technology in the Philippines:

- very low government investment in science and technology
- lack of integration/complementarity in S & T
- expensive fiascos like the Bataan nuclear power plant
- lack of coordination between the different institutions and agencies
- low priority in agriculture
- little linkage between education and industry.

I would like to locate the primary cause of these problems in the history of our social and cultural institutions. I note two types of relationships between institutions. The first I would call vertical, that is the relationship between similar institutions, like banks, in different societies. The second I would call horizontal, that is, the relationship between different institutions in the same country. I would also add a third relationship of rootedness, that is, the integration of these institutions within the socio-economic-cultural matrix that underlies the given society.



To understand our situation, we should note that the history of our social, industrial, educational institutions in the Philippines has been guided almost exclusively by vertical relationships. For example, to understand our school system it is less necessary to understand the social and cultural situation in the Philippines than it is to understand the American school system and to note the adaptations that have been made here. The same can be said about the major hospitals like big medical centers and the Heart Center.



If we were to picture the development of institutions like that of a tree, where the institutions are represented by the leaves, branches, fruits (that are the visible developments in society) then we would picture our institutions like upside-down trees. They are rooted not so much in the socio-cultural matrix of the Philippines as in the socio-cultural matrix of model countries abroad. This whole pattern of development of institutions according to vertical relationships has produced what we call the modernized sector, of which Makati is the main exponent.

What are the consequences of this development guided mainly by vertical relationships:

(1) The development of our institutions is directed by their sources abroad, not by complementary institutions or needs in our society. For example, we come back with our PhDs from the United States or Europe and we want to teach immediately what we learned there, whether or not it has a serious relevance to the Philippines today.

(2) The horizontal relationships between different institutions are either non-existent or undeveloped. For example, the relationship between research and development in universities and industry. Several times in the past, it was pointed out to me by our scientists in PIPAC (Philippine Institute for Pure and Applied Chemistry) that they have the expertise to do a lot of chemical analysis for companies, but these companies have these analyses done in their mother institutions abroad. Senator Diokno once gave an example of the shoe industry, we find that it also is guided by vertical relationships. That is, most of the components that they use for manufacture are imported and the best shoes are exported.

This concentration on vertical relationships and the neglect of horizontal relationships as well as of rootedness in our national situation is, I think, at the heart of the problem that we are discussing today. There is a lack of fit between our social, financial, cultural, political institutions because their growth has not been guided by complementary needs, but rather by the effort to make vertical fit between our institutions and similar institutions abroad. This overemphasis on vertical fit has resulted in a lack of rootedness (even in uprooting, as we may see in brain-drain). It has also resulted in a lack of relationship and complementarity between the different institutions in our society. It should be no surprise to us then that these institutions are all out of joint and that it is extremely difficult to establish linkage among them. This for me defines the task for the future, that is, to develop better horizontal fit and a better rootedeness in the national situation."

The above long reference presents my analysis and point of view on the importance of insisting on linkages.

II. Important Aspects of the Task Force Work and the Task Force Report

The above considerations guided the composition, process and report of the Task Force.

The composition of the Task Force reflects the concern that the directions of S & T planning fit into a larger national plan. Thus the role given to key government departments and to the private sector. The composition also reflects the concern for linkage. Thus the almost even representation from government, private sector, and academe.

The process, which gave the first round to sectoral technical panels, reflects the concern that we need to know where different industry/agriculture sectors wish to go, before we can rationally plan for S & T needs.

At the same time, the Task Force was painfully aware that there were fundamental problems that need attention no matter what priorities may eventually emerge from the sectoral technical panels. These have to do with:

- a better career environment for scientists, engineers, and technicians
- manpower development
- building needed S & T infrastructure.

Thus, parallel to the work of the sectoral technical panels, the Task Force gave much of its attention to these concerns.

As I said at the beginning, I do not intend to repeat the detailed discussion held yesterday at PCIERD, but to give some idea of the summary results from the sectoral technical panels, let me cite some portions of the report. Let me note also that the Task Force report is simply a summary (not always adequate) of a voluminous report from the sectoral technical panels. It is also important to note that the level of detail and adequacy of the reports from the different panels is uneven.

A. Some Potential High Growth Sectors Recommended for Development

(1) *Electronics*

The main thrust of the industry is to increase the value added of electronic products by increasing the local inputs in the form of components and engineering content, and to increase exports of non-semiconductor products. The three areas of concern are:

a) *Semiconductor Electronics*

Development of IC design capability in custom or application of specific, integrated circuits utilizing current technologies

b) *Consumer Electronics*

Development of a wide range of consumer electronics products to include toys, clocks and watches, video/audio accessories and other such products within the capabilities of the electronics and support industry

c) *Computers, Industrial Electronics, Telecommunications and Others*

i) Increase in the local content of locally assembled/manufactured industrial and commercial products in areas such as computers and computer peripherals, telecommunication equipment, industrial control and instrumentation

ii) development of the use of automation such as computers, controllers, instrumentation, networks and similar areas in domestic manufacturing industries

(2) *Process Industries*

The country remains heavily import-dependent for its chemical requirements. Hence, the significant contributions of this sector to the economy may be measured in terms of utilization of indigenous raw materials, production of import substitute chemicals, and export of high-value added chemical products. The process sector has the following products as leading edges, including their technological requirements:

a) *Coconut Processing*

i) Development of downstream oleochemical products

ii) Development of coir industry and coco-food products

b) *Sucrochemicals/Fermentation Products*

i) Diversification of sucrochemical products

ii) Improvement of process efficiency in alcohol production

c) *Polymers*

) Development of polymer products from oleochemicals and sucrochemicals

ii) Improvement and adaptation of polymer acquired technology from foreign sources to local conditions

d) *Acids and Bases*

i) Development of pollution control equipment for factories producing acids as well as those using these materials

ii) Development of heat recovery systems and utilization of non-conventional fuels as a source of heat

e) *Agrochemicals (Fertilizers and Pesticides)*

i) Technology transfer of biofertilizer and biopesticides, e.g., rhizobia, azospirillum

ii) Development of organic and inorganic fertilizers and pesticides from locally available raw materials

f) *Industrial Gases*

i) Development of an appropriate container for industrial gases

ii) Improvement of product purification technology

g) *Industrial Salt*

i) Development of production of soda ash and bicarbonate from concentrated brine

ii) Development of the manufacture of sulfates, sulfites, and sodium metal and cyanides from locally produced industrial salt and recovery of other chemicals

h) *Fine Chemicals*

i) Adaptation of foreign technology through joint-ventures for the manufacture of active substances from indigenous sources in the pharmaceutical industries

i) *Plastics Industry*

i) Improvement of the quality of plastic products manufactured in the country

ii) Diversification of the range of products manufactured

iii) Reduction of external technological dependence through local development, adaptation, and innovation of production technologies and applications

j) *Coal-based Ammonia and Urea*

i) Development of coal as feedstock for industrial chemicals, e.g., urea, ammonia

(3) *Energy*

In order to reduce the country's vulnerability to the international fluctuations in energy supply and prices, a two-pronged energy supply/demand strategy is necessary. First, the country should develop indigenous energy sources and second, utilize energy resources at the least cost and in the most efficient manner. In view of the importance of energy in our economic development and the availability of various indigenous resources, the panel classified the leading edges for economic development into three groups:

a) *Conventional Energy*

(Oil and Gas, Geothermal, Coal, Hydro, Nuclear)

i) Continued development of the country's indigenous energy resources

ii) R & D in the following areas: geology and geophysics, chemistry and geochemistry, reservoir engineering, computer applications and environmental studies in the geothermal field

iii) quality upgrading and characterization of local coal

b) *Non-Conventional Energy*

(Biomass, Solar, Small Hydro, Wind)

i) Development of manufacturing capability in the fabrication of energy-related equipment and parts

ii) Development of adaptation capability in the acquisition of technology to certain local conditions

c) *Energy Conservation and Utilization*

i) Development of waste heat recovery and utilization technologies

ii) Development of local capabilities in the design, fabrication and installation of conservation equipment

(4) *Agriculture and Aquaculture*

The objective of the sector is to improve the food availability and nutrition of the people, reduce imports through local production of import substitutes, increase traditional and non-traditional exports, and (a) agriculture-fiber (abaca, sericulture, ramie), crops (coconut, coffee, cacao, rubber, sugarcane), fruits and nuts, feed grains (corn, soybeans), livestock (hogs, poultry, beef cattle), vegetables, ornamentals, spices, (b) aquaculture-prawns and shrimps, seaweeds, milkfish, tilapia, groupers, seabass, marine mollusks (clams, oysters, mussels) and freshwater aquarium fishes. Common features of R & D are:

a) Development of integrated pest-management systems using pest and disease-resistant varieties, better cultural management techniques, and biological, botanical and chemical pesticides

b) Varietal improvement for high yield, stress tolerance, resistance to pests and disease, adaptability and better crops

c) Improvement of genetic characteristics of livestock

(5) *New and Emerging Technologies*

A fourteenth sector may be the NEW AND EMERGING TECHNOLOGIES. These are technology areas not presently developed but which

could have a substantial impact on the national economy and the global marketplace. Of the five areas identified as first priority by the PCASTRD for the country, two, namely: microelectronics, instrumentation and control and information technology have been discussed above. The other three areas are:

a) Biotechnology
b) Materials Science and Engineering (including new energy sources such as photovoltaics)
c) Laser Technology

B. *Needed Modernization of S & T Infrastructure*

(1) *Electronics*

S & T Infrastructure

a) Establishment of an Electronics Research and Service Foundation
b) Establishment of Printed Circuit Board (PCB) prototyping facilities (accepting 5-10 boards) with computer grade density, double-sided plated through holes
c) Establishment of environmental testing facilities

(2) *Process Industries*

Industry Infrastructure

a) Refurbishing of existing fertilizer plants
b) Rehabilitation of four other fertilizer plants aside from the PHILPHOS plant
c) Restructuring of the salt industry

S & T Infrastructure

a) Establishment of modernized and efficient facilities for the chemical industry
b) Replacement of obsolete/antiquated distillery equipment
c) Establishment of a sucrochemical R & D center which will be a joint venture of the government and the private sector
d) Provision of necessary financial support or assistance in sourcing of funds to implement R & D projects
e) Establishment of a Plastic Research and Development Unit (PRDU) at the Industrial Technology Development Institute (ITDI)
f) Establishment of an ammonia plant with about 2,000 ton/day capacity

(3) *ENERGY*

S & T Infrastructure

a) Creation of an applied research center for geothermal energy
b) Creation of a coal technical body
c) Establishment of an energy conservation center
d) Creation of a Philippine Energy Foundation to develop, implement, finance and monitor the various S & T plans and programs, incentives and promotion activities, regulation, and institutional linkages for the energy sector.

(4) *AGRICULTURE AND AQUACULTURE*

S & T Infrastructure

a) Strengthening research-management program to enhance technology-planning development and utilization process in the region
b) Strengthening applied communication programs in order to bring research-based technologies and information closer to the target clientele
c) Strengthening the information and data-management systems
d) Strengthening the technology, utilization and commercialization program
e) Rationalizing and strengthening the agencies in agriculture and fishery systems
f) Upgrading/expanding post-production facilities

(5) *New and Emerging Technologies*

a) *Biotechnology:* The most immediate need is to develop and strengthen the biotechnology programs in several institutions
b) *Materials Science and Engineering:* The main need is for semiconductor materials characterization and testing. A building to house all the equipment will have to be constructed and this can be a center for all research activities in the area of material science and engineering.
c) *Laser Technology:*
    i) The acquisition of facilities and equipment needed for the rapid and accurate testing and characterization of lasers and laser systems, and for the faster and reliable collection and processing of spectroscopic information
    ii) The establishment and maintenance of optical shops with coating facilities at both the Ateneo and NIP, a machine shop capable of high-precision work, and a glass-blowing

shop, side by side with the training of skilled technicians to man shops.

iii) The establishment and maintenance of a laboratory with facilities and equipment for epitaxial growth (LPE, MBE, or CVD) of semiconducting crystal compounds, with clean room and other facilities for device processing.

C. *Manpower Development*

The report provides some details from the different sectoral panels on their needs. But it may be sufficient to cite the overall goals and directions of manpower development to support S & T priorities and the needs of R & D institutions.

Required by the economy for development over the period 1989-1992 is manpower with definite skills and expertise in S & T. The following are the targets of the S & T manpower sector:

1. To increase by 50% the present 8,000 R & D professionals over the period 1989-1992. This means producing quality scientists and engineers for R & D according to the following ratios: PhD:MS:BS = 1:2:5. That is, for every PhD produced, there should be two MS and five BS graduated correspondingly. Twice as many technicians must be trained to achieve the desired ratio of one R & D professional for every two R & D technicians.
2. To designate key institutions to conduct/support massive S & T faculty/staff development/training programs in order to upgrade their capability in the natural sciences, agriculture, and engineering.
3. To designate key secondary schools in the different provinces and regions and upgrade laboratory facilities and initiate science-honors programs in these schools.
4. To promote the inclusion of scientists and technologists outside of DOST in an improved and expanded scientific career system; to develop other incentives for a scientific career.

III. *Structure of Follow-up and Implementation*

A major concern of the Task Force was the mechanism for validation of its work in consultation with key sectors, a continuing process of correcting and improving the plan, and a structure for implementation. After the presentation to the President on March 27, 1989, most of the discussion focused on these needed mechanisms and structures.

The most important result of the discussion was the decision of the President, embodied in an administrative order dated April 4, 1988, to establish the Science and Technology Coordinating Council (STCC). Its composition is similar to that of the Task Force and its mandate is contained in Section 2 of the Administrative Order:

Section 2: The Council shall:

a) recommend appropriate systems and procedures for the effective implementation of the report of the Presidential Task Force on Science and Technology, hereinafter referred to as the Task Force.
b) coordinate the science and technology activities of departments, agencies, private sector organizations and the academe to accelerate science and technology utilization in accordance with the report of the Task Force;
c) monitor the implementation of the recommendations of the Task Force and the results thereof;
d) recommend measures to update, revise and enhance the Science and Technology Plan based on the report of the Task Force;
e) recommend mechanisms, structures, and measures to link technology sources, intermediaries and users to hasten transfer of technology, develop the countryside, attain high productivity and increase export potential;
f) constitute national, regional, sectoral and other subcommittees as may be necessary; and
g) perform such other functions as may be assigned by the President.

Note also Section 6:

Section 6: The Council shall submit quarterly reports to the President and such other reports that may be required from time to time.

This provision allows ongoing dialogue with the Chief Executive on crucial S&T concerns.

What is to be done now? For this body, composed mainly of the scientific community, I would like to end with the recommendations on *Human Resources and Scientific Infrastructure Development:*

1. Identify and strengthen key secondary schools in each province and region and upgrade facilities and initiate science-honors programs in these schools.
2. Establish a PhD Engineering Program and provide support infrastructure such as laboratory facilities and offering of a more attractive compensation package for engineers.
3. Strengthen the higher level scientific manpower programs in different universities and consortia and give priority to the upgrading of their facilities.
4. Support the implementation of the Science Education Development Plan.
5. Revive, improve, and expand a National Scientific Career System and develop other incentives to enhance careerism and professional growth among scientists and other personnel involved in S & T.

6. Develop a program to provide incentives to Filipino scientists abroad to return to a scientific career in the Philippines.
7. Strengthen existing and develop new national centers of excellence for science and technology.
8. Promote needed competence in technology.

I am Vice-Chairman of the STCC with specific responsibility for academic institutions. What we need to do is to hammer out specific plans, programs, proposals, especially in these areas of scientific manpower and scientific institutions. I hope that the work of the Task Force and the establishment of the STCC has helped in providing a better environment for our plans and programs. The challenge for us then is to help build these concrete programs and institutons.