

LET'S BRING S & T TO THE SERVICE OF OUR PEOPLE

By Emil Q. Javier, Academician

Honorable National Scientists, Fellow Members of the Academy, Distinguished Members of the Scientific Community, Beloved Guests, Friends, Ladies and Gentlemen:

Allow me, first of all, to express my personal thanks to the venerable members of the Academy for admitting me to the select circle of our country's most outstanding scientists. It is an undeserved honor which I would nevertheless cherish and shall strive, to my utmost, to live up to, the rest of my life.

I am tempted to address you on the discipline I have been most associated with professionally, i.e., plant breeding and genetics, its prospects and continuing contributions to man's well-being. However, I have the feeling that the Academy would rather prefer that I speak on my views on the state of science and technology of our country and, now that I am Director-General of the reorganized National Science and Technology Authority, express publicly what I intend to do about it. I still hope though that I will be given the privilege to address the Academy on the first topic at some other opportunity.

Technological Development

Let me begin by underlining the very utilitarian view of science which perspective I must perforce adopt in my current official capacity. I have been appointed director-general of the Authority with the equivalent rank of minister of science not to expand further the frontiers of knowledge *per se* but primarily to bring science and technology in the service of the Filipino people.

This is not to deny that the pursuit of science for its own sake is a calling worthy of the talent and effort of the best among us. As a professor of the university, I used to enjoy the privilege of looking at science from the perspective of a mental adventure, an exhilarating experience which one shares with fellow academics and students. Like many others I pursued our vocation as scientists with dedication and commitment comfortable in the thought that a better understanding of the world we live in could not but help people. That our contributions, however modest, shall in time find their way in the marketplace of ideas and eventually in the marketplace of goods and services for people.

The issue in its most simplistic presentation boils down to whether science could and should be directed. I am afraid it will take us the whole day to explore the pros and cons. But to make it brief, my position is: for most of our scientific effort, yes. However, there ought to be a residual effort where our scientists could be encouraged to give free rein to their imagination and creativity.

I will speak, therefore, of technological development instead of science development, fully conscious, however, that technological development is not possible without science.

Technological development means essentially the building up of a basic capability for decision making and implementation in the generation and application of scientific knowledge in the daily lives of people and in the affairs of enterprises and the state. It is a continuous process which includes the stages of generation (research), diffusion (technology transfer), and application of knowledge (technical innovation).

Technological development takes place only when the three stages are harmoniously developed and linked.

Creation of new knowledge constitutes a "supply" that should be followed by their application. The capacity to apply knowledge, on the other hand, exerts a powerful "demand" effect that promotes internal creation of knowledge and importation of technology.

Preoccupation with the "supply" function is a sterile exercise unless the knowledge is incorporated into the production system. On the other hand, exclusive concern for the promotion of technological change to the exclusion of developing a domestic capacity for generating knowledge will only lead to total dependence on foreign technology and inability to adapt technology effectively under local conditions.

In the past we have tended to look at our lack of technological progress in terms of "insufficient application of science and technology." This follows the classical supply-push approach that has dominated science policy thinking in developed countries.

We have tended to equate "science policies" with "research policies"; the premise being, if we promote research, the economy will sooner or later absorb the new knowledge into the production system.

We have for the most part given insufficient attention to the diffusion, innovation and application stages much less to the regulation of transfer of foreign technology.

We have assumed that knowledge would automatically find its way with the marketplace. We know now that it is not necessarily so. And that we have to work as hard generating knowledge as making use of that knowledge.

In the current reorganization of NSDB into the National Science and Technology Authority we have therefore attempted to incorporate features into the system which would provide impetus to a *demand-pull* approach to technological development to complement with the present *supply-push* efforts.

The demand-pull orientation will manifest itself in many forms. To begin, our activities should start from what private industry and what our people demand or require. Our individual researchers and our R & D institutions should be in close touch with the sectors they are supposed to serve. To this end we are asking each R & D institution in the system to establish technology transfer units to provide a link between the institution and the private sector. Where appropriate, each R & D institution is encouraged to have an advisory board composed of representatives of lead agencies of government and representatives of private industry to provide direction and feedback to the programs and activities of the R & D institution.

To make clear sectoral responsibilities, we have created under the new NSTA a system of councils composed of PCARRD, PCIERD, PCHRD and NRCP which have primary responsibility for integrating, coordinating, setting directions and priorities, funding, monitoring and evaluating S & T activities within their respective areas of concern. (Note that the word 'development' had been appended to the title of PCARR to make clear that the Council's mandate goes beyond research per se, consistent with the demand orientation.)

The former three councils are agencies of government. The fourth council, the National Research Council of the Philippines, which is a collegial body of scientists is asked to assume its place in the system of councils to take primary responsibility for promotion and coordination of research of a more fundamental nature which normally would have lower priority among the other three councils and to support the natural sciences, the social sciences and the humanities.

This configuration of councils relates back to the issue whether science could and should be directed: The first three councils shall be primarily concerned with mission-oriented, directed and for the most part applied research. NRCP is expected to fulfill the role for autonomous, self-regulated, and, for the most part, fundamental or basic research.

The deputy ministers of the lead line ministries and very knowledgeable representatives of private industry sit in each of three sectoral councils to articulate the 'demand' for research and technology support of the ministries and the private sector in the workings of the councils.

The inputs of career scientists and professionals are coursed through the secretariat and the technical panels which assist the secretariat in preparing the documentation for deliberation by the councils.

Still in pursuit of the demand approach we have opted for the establishment of authority-wide regional offices to assist in the dissemination and transfer of technology and for general science promotion activities.

Formulation of a Comprehensive National S & T Plan

We assert that technological backwardness is part of the broader issue of underdevelopment. The building up of that technological capability should therefore constitute an additional dimension of development efforts.

In many developing countries, including our own, the national science and technology plan is taken to be implicit in the economic development plan. Most of the time in effect this means there is no S & T plan at all.

In a way what we are saying is that science and technology is not an exclusive domain or concern of its practitioners — us scientists and technologists. Science and technology is everybody's concern. If we continue to allow science and technology to remain in the backwaters of our national consciousness, S & T will never get adequate support and we shall always remain backward technologically.

In fact to my mind this is the greatest challenge for us science leaders and administrators. If we look all around us, our society, our institutions, our enterprises and the country-side is undergoing technical change. The influx of machines, equipment, utilities and other amenities of modern living are evident in our daily lives.

However, the question remains to be asked whether in fact we have internalized these technical changes within our institutions and systems.

The truth of the matter is that for the most part these technological changes which come from without flow directly into the domestic production system without involving the local S & T system.

In other words, for a lot of our major industrial projects and activities, the local science community has no input and therefore irrelevant. Yes, our country is undergoing technical change. Our economy is "industrializing" but we are not "technologizing."

This, therefore, is the greatest threat to our efforts to develop indigenous technological capability.

We in the science community should recognize this tendency to marginalize the local S & T system and should make every effort to expose this trap.

Short-term "industrialization" targets are often much more attractive politically than long-term "technologization" goals. Since the local S & T community has, as yet, limited capability, it is very tempting to dismiss us as obstructive in order to hasten the putting up of industries and enterprises.

We have to point out to the national leadership, the captains of industry and to our people, that, as we are now finding out, the technological requirements increase dramatically along the path of industrialization. And as we shift from an import-substitution to an export-promotion strategy of industrialization in the absence of a realistic and determined effort to develop national S & T capability, our dependence on foreign technology can only become more acute.

The consequences of this problem can be observed in increasing pressures on the balance of payments. The cost of technology tends to increase progressively along the path of industrialization as technological requirements become more sophisticated. Thus the importation of technology by the less developed countries has been increasing at the rate of two and a half times the average of industrial growth.

As in the political field, the key is technological independence and self-reliance.

Instead of allowing the national S & T system to be bypassed or sidetracked, we should make every effort to involve the local S & T system in the technology transfer process in order to develop, in time, domestic capability to evaluate, select, adapt and to improve upon imported technologies and eventually to generate indigenous technology.

We should, therefore, project science and technology in the forefront of national consciousness. The first obvious step in this direction is to articulate a comprehensive national S & T plan which shall be a formal part of the five-year national economic and social development plan.

Even now we devote quite a bit of resources, including human, fiscal and physical resources, in S & T activities. These activities spread across the different ministries, in both public and private universities, and in the private sector. Some amount of planning is desirable to make the most productive use of the scarce resources now devoted to S & T development.

Therefore, there is an actual need for a single, coherent and comprehensive national S & T development priorities plan which could provide the overview of the total S & T effort.

In the reorganization of the NSTA, therefore, we are putting a lot of emphasis on the mandate of the Authority to provide the focus and initiative for S & T planning. Fortunately, the NEDA

and the Budget Office had been very supportive and we expect to work closely with these two bodies.

Let me take this opportunity, therefore, to exhort the members of the Academy and the members of the national science community here present to join hands with the different sectoral councils and with NSTA itself to articulate this document this national S & T plan which shall express our wisdom, our aspiration, our mandate, and most significantly, our deliverance.

Providing an Environment Hospitable to Science

One of the main issues raised during the series of workshops and dialogues we conducted late last year was the lack of proper environment for the growth of science in our country. Low salaries, antiquated equipment, lack of logistics and bureaucratic procedures were cited as contributory factors to the sad state of the science community.

We intend to attack these problems from different sides. First in the matter of incentives to scientists. The executive order reorganizing NSTA recognized the need for a career service for scientists. This is one of the topics to be discussed during this week's celebration. We are now in the process of discussing with the Civil Service Commission, the Budget Office and the Reorganization Commission the features of the scientific career service.

From our end, we have in mind at least three prominent features: first, a parallel career path for scientists and research administrators; second, fixed tenure for research administrators like in academe; and third, a more realistic wage scale for scientists.

We also intend to push for a policy whereby R & D institutions in each of the different ministries shall be treated as largely self-regulating, autonomous entities, attached to a ministry for purposes of coordination but not supervised and controlled directly by the ministry.

We also found strong justification to bring together R & D agencies into residential scientific communities where they could share facilities, libraries, computers and equipment and scarce personnel. And where scientists could have ready access to their laboratories and ample opportunity to react with like-minded colleagues.

We intend to pursue the development of initially three residential scientific communities, i.e. an energy, atmospheric and earth sciences complex in Diliman; an industrial research community in Bicutan, and a food, agriculture and life sciences complex in Los Baños.

Finally, most of the woes we have been experiencing could be traced directly to the insufficiency of resources. Our latest figures indicate that the total R & D budget from the public

and private sectors amount to approximately 0.26 per cent of GNP. We intend to keep pushing for one per cent of GNP for R & D purposes.

Basic Research and Manpower Development

I said at the outset that the greater part of our efforts ought to be mission-oriented, directed research. This point of view derives from the conviction that the crushing problems of poverty, disease and hunger still afflicting substantial sectors of our people, the lack of productivity and uncompetitiveness of some of our industries, and the escalating deterioration of our physical environment which challenge the very survival of our people and integrity of our nation demand answers not tomorrow or some distant future, but NOW. And I believe, as I know all of us here now believe, that a greater part of the answers to these problems will have to be based on superior and more appropriate technology.

And yet we are only too aware of the fact that some of the greatest contributions in science did not come about from some purposeful search to existing problems. Rather they came as original contributions from scientists who had for their purpose simply advancing the frontiers of knowledge and exploring further the depths of the unknown.

It is really a matter of arriving at a judicious balance between our efforts to meet present challenges and to build up our intellectual capital for the future.

I propose, therefore, that we set aside a certain proportion of our resources to basic research. I propose further that the conduct of basic research be undertaken in conjunction with training of high level manpower in the sciences.

Our requirements for high level manpower will have to be supplied mainly from within. We will continue to send people abroad for formal advanced training for selected fields. But the bulk of our high level expertise will have to be trained in our national universities. The cost of sending too many people abroad for long-term formal degree training will strain further our all-too-meager resources.

The scholastic rigor and academic discipline which high-level scientific training requires are best developed into the young scientists through fundamental research. In order to maximize therefore the use of scarce resources, we intend to encourage and support the universities both public and private to engage in basic research in linkage with training of masters and doctoral students.

Private Sector Involvement in Science and Technological Development

If one compares the sourcing of funds for research and development between developed and developing countries, the most obvious difference is the degree by which private industry supports R & D. In the U.S., Japan and the Western European countries, as much as 50 per cent of funds come from the private sector.

Whether one could establish a cause-and-effect relationship between private sector investments in R & D and technological progress is immaterial at this point. But what is obvious is that it is a desirable state of affairs.

We shall, therefore, explore further possibilities of providing additional incentives to the private sector to set aside corporate funds for local R & D activities. Where desirable and mutually advantageous we intend further to go into joint R & D ventures with the private sector using government research personnel and facilities. Alternatively we may commission research by the private sector subject to certain protocols.

A significant source of funds for S & T development at present are the research foundations. For the past two years the foundations had been providing about ₱90 million annually for various S & T activities. We intend to help the foundations locate relevant, viable projects through linkage between them and the universities and research institutions. And likewise assist them expand and make more stable their capital base.

Science Promotion

Finally, I would like to mention briefly the need to strengthen science education at the primary and secondary levels. It is common knowledge that except for some well-run church schools and few public institutions, the level of science education at these levels are woefully inadequate. No less than the MEC itself had recognized the problem and had accorded top priority to the improvement of teaching at the primary level.

Our support to MEC would come by way of training science and mathematics teachers and the development of more appropriate science teaching materials and scientific equipment. The NSTA had been supporting projects along these lines for a few years now. And we are now anxious to have these projects evaluated, improved upon and expanded.

The promotion of science consciousness among our people particularly the young continues to be a primary concern of the NSTA. As you know the old Science Foundation of the Philippines had been abolished but in its place we created the

Science Promotion Institute with expanded responsibilities and additional funding. The conduct of science fairs and quizzes and the organization of science clubs have proven to be a very stimulating medium through which we could promote science awareness.

We are enlisting the support of non-government entities, the school system and other organizations in this enterprise. Just yesterday the MEC, the Jaycees and the SPI launched the search for TOYS — the outstanding young scientists — a promotional effort comparable with the TOYM.

SUMMARY

Finally, allow me once more to thank the members of the academy for the signal honor they have conferred on my person and for this excellent opportunity to express publicly my thoughts and predispositions regarding the manner by which we should organize and direct our efforts to move science and technology in our country.

Summing up, the following are the major issues/considerations which to my mind ought to influence our national efforts in S & T.

1. Our primary task is to bring science and technology in the service of our people.

2. Generating new knowledge is not an end by itself. We should work as hard acquiring knowledge as making use of that knowledge.

3. The present reorganization of the NSTA draws inspiration for the pressing need of providing the strong link between our scientific base and innovation and productivity.

4. It is incumbent upon us academic leaders and administrators and practising scientists to bring to the forefront of our national consciousness the importance of science and technology. If we allow S & T to remain in the backwaters of our national consciousness, S & T will never get adequate support and we shall always remain backward technologically.

5. To this end we should strive to make organic into the national development plan, a formal declaration for S & T development.

6. The national S & T plan should include positive steps to provide an environment hospitable to science, incentives to scientists and academicians, increased logistics to S & T efforts and incentives for private sector participation in the R & D.

I deliberately refrained from speaking out on research priorities. Obviously I have my own personal opinions on where our

priorities may lie. But I firmly believe that these priorities ought to be discussed thoroughly and openly among the different sectors in order to arrive at the optimum direction and allocation of the priorities. I trust that each of us will make serious attempt to make a contribution in this exercise.

(The above remarks were taken from an address, Dr. Emil Q. Javier gave to the National Academy of Science and Technology during the Investiture of its new Academicians and its 4th Annual Scientific Meeting. This was held at the Philippine International Convention Center on July 14, 1982.

Chancellor Javier of the University of the Philippines at Los Baños is currently Director General of the National Science and Technology Authority. — The Editor)