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THE ROLE OF ACADEME IN SCIENCE AND TECHNOLOGY UTILIZATION*

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The increasing awareness of the crucial role of science and technology in accelerating economic development has changed the attitudes and perceptions of many countries toward scientists and technologists. In the Philippines, science and technology (S&T) have been regarded both as a sector for development and a tool for development. In the Five-Year Development Plan of the National Economic and Development Authority (NEDA), a separate chapter is devoted to S&T, as if it were a separate sector like agriculture, housing, transportation, and industry. S&T requirements for the development of the other sectors are discussed separately from the science and technology chapter. This gives the impression that the development of science and technology in the Philippines is the sole responsibility of the Department of Science and Technology. Whatever the purpose of having a separate chapter on science and technology, one certainly gets the impression of the gap between the development of science and technology and the needs of the other sectors. The "Philippine Development Report of 1987" also separates S&T from the other sectors. The shortfalls in agricultural production, for instance, are discussed in one chapter while a litany of highlights of successful research results is listed in the science and technology chapter taking no cognizance of the serious technological problems that faced Philippine agriculture that year. A preferred view on science and technology is its being a tool for development. This would mean integrating the science and technology requirements of each sector within the specific chapter to indicate the concurrent development of the sector and the support that science and technology gives to it. A discussion on

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fundamental research may justify a separate chapter on S&T to indicate the level of development of the science base and also to portray its being a part of industrial development.

The Academe in the Philippines

In this paper, the academe refers to educational institutions which are traditionally the institutions of higher learning or tertiary level institutions. Primary and secondary institutions certainly have a role to play in science and technology development, but their very nature restricts them to institutional activities with very little involvement, if at all, in research and development. Institutions of higher learning are expected to conduct a significant level of activity in research and development. This discussion will therefore focus on the tertiary level institutions, giving occasional reference to the primary and secondary levels particularly their role in science education.

In 1984-85, the Philippines had a total of 1,078 institutions of higher education. In terms of enrolment, 72 percent of the students took their college education in private schools ; a minority (28%) were enrolled in state colleges and universities, including institutions supervised by the Department of Education, Culture and Sports (DECS).

Out of these tertiary institutions, probably only five to eight universities, both public or private, were reported to have adequate facilities and teaching staff to handle baccalaureate, masteral, and doctoral programs in science and technology. This situation must be corrected if we are to undertake accelerated development.

Role of Academe in S&T Development

The academe has always been expected to facilitate the development of manpower resources through quality education. Yet, this expectation has been more realized in developed countries than in developing countries where qualified manpower resources are more needed.

The academe in developed countries

The academe in developed countries that are also scientifically advanced have a vibrant and dynamic educational system to boast of. Their educational institutions do not only provide training in skills but also mould the world outlook. Advanced countries always have several, if not many, highly developed institutions of higher learning. Thus their manpower requirements in S&T are adequately met by their indigenous resources.

There also exist high-quality research and development activities in these institutions from which their graduate programs draw strength. These R&D programs are of sufficient quality and quantity that they can help propel development in agriculture, industry, and health. Thus, in advanced countries, the academe does not only provide a base for high-level manpower development but also serves as a source of new knowledge through research and development.

The presence of a strong research and development in the private sector in these countries also generates new knowledge and new technologies, and complements the efforts of the academe. There is, therefore, strong collaboration between the academe and industry in many of these countries.

The academe in developing countries

The picture is different in the developing countries where there is a dearth of institutions able to provide high-quality education especially toward graduate degrees.Consequently, the academe can only partially fulfill the national needs for trained manpower in science and technology. The level of activity in research and development is also low. This severely limits local capability to respond to the S&T requirements for development.

Most private industries in developing countries also do not conduct research and development; they depend on imported technology usually transferred on a turnkey basis. The only other sector able to conduct R & D is the government which maintains some research institutes not administered by the academe.

Under these circumstances, the academe is unable to train enough people. Many bright, young people from developing countries take their advanced degrees in developed countries. A significant number of them do not return to their home countries, a phenomenon now called the "brain drain."

The low level of research and development activity has also marginalized local scientists. Scientists who have chosen to pursue their careers in their home countries continue to work under great constraints, but nevertheless manage to produce some good science. In the meantime, trained manpower continues to be a premium in developing countries. Since a high concentration of these trained manpower exists in the academe, these institutions are under heavy pressure to provide services to both the government and the private sector to the point of even losing some of these people permanently from the academe.

The Philippine experience is similar to those of other developing countries but is aggravated by the fact that many trained and skilled manpower have been committed into the international labor market espe-

cially in the Middle East. Low salaries continue to be a major problem in retaining competent scientists.

In addition, the local environment to do R&D still needs to be improved and could easily discourage people from staying. In effect, teaching becomes the main, if not the sole, activity of highly trained scientists who stay in the academe.

These developments are certainly deplorable and a nationwide effort must be undertaken to improve the capability of the academe to provide S&T support to national development needs.

The Academe and Manpower Development

A strong S&T support to national development efforts requires an increase in quantity and an improvement in quality of scientific and technological manpower. And the academe is primarily responsible for meeting this requirement. As indicated earlier, the great majority of our college students are trained by private schools.

Constraints in S&T offerings

No reliable data is available on how many of the private schools have strong S&T curricular programs. In public schools, 58 out of 78 state universities and colleges including UP, have programs in engineering and technology, agriculture, forestry, and fisheries, as of 1987. High level training is expected of these institutions of higher learning but due to inadequately trained teaching staff and poor facilities, the quality of graduates has deteriorated.

The low salaries paid to many graduates of science and technology degree programs also discourage young minds to pursue careers especially in basic sciences. The consortium arrangements have been a modest achievement in pooling expertise, now dispersed among several universities, to contribute to well- designed graduate programs in mathematics, physics, and chemistry and, soon, in biology. However, these graduate programs are still limited by the lack of vigorous research and development programs in the participating institutions. Thus, graduate students have to be sent abroad to undertake thesis research, after which they return to obtain their degrees. Also because of lack of research facilities and programs, PhD graduates of local universities are given the opportunity to conduct post- doctoral research abroad. However, other modalities should be tried to improve the quality of both undergraduate and graduate training in S&T fields. Graduate programs in S&T should also be backed up by strong R&D programs; otherwise, we will continue to implement substandard programs that depend primarily on foreign benevolence for thesis research.

S&T education in high school and elementary

A matter of serious concern is the improvement of science education in primary and secondary schools. The academe can contribute to this need by instituting well-designed teacher training programs where both content and method can be taught. There are now programs in some universities that respond to this need but they are still not enough to produce the numbers necessary to significantly improve science teaching at both primary and secondary levels. Due to the poor preparation of students at the primary and secondary levels, remedial courses and topics have limited the breadth of coverage of courses in the tertiary level programs.

Technicians' training

Another aspect that needs attention is the training of technicians. Although not a direct concern of the academe, a body of well-trained technicians is crucial to the success of any national R&D program.

The Academe-Government Relationship

Many aspects of the Philippine experience in the relationship of academe and government have been discussed by UPLB Chancellor Raul de Guzman within the context of UPLB. UPLB has always responded to the challenges of national development and has showed its expertise and resources in many ways to all branches of government, even to the point of allowing university professors to occupy concurrent positions in government. At UPLB as well as in other universities, some curricular programs and units have also been the result of legislation or executive fiat. Moreover, private universities have been regulated by the DECS while many professional curricular programs are supervised by the Professional Regulation Commission. Private universities have also contributed expertise to the government.

Academe's independence from government

In the context of science and technology development, academe-government relationship can be viewed in the same vein as that of providing expertise and, in some instances, doing contract research and development work. However, since government programs are always planned within short-term political timeframes, quick responses from the academe are always demanded. This puts a strain on its resources; in some cases, the academe may have to sacrifice some of its regular functions. In these circumstances, the academe must guard its academic freedom as provided for in the Constitution and continue to assume its role as a social critic; it

must assert its independence from government control to the maximum extent possible.

Academe's comparative advantage in strategic studies

Realizing the difficulty of maintaining autonomy in a resource-poor environment, the academe must then take up its comparative advantage of conducting long-term strategic studies in the field of S&T. Thus, fundamental research is an activity that is well-suited to the academe, provided long-term funding is available. Likewise, the mental habits developed among academics, including critical thought and breadth of perspective, must be shared with the government and be allowed to permeate the halls of officialdom. Offering training programs constitutes one way of achieving this.

While there are several other modes of academe-government relationship, it must always be made clear that the academe cannot substitute for the government machinery; it must not, therefore, perform functions which government offices should do.

Long-term financing and other autonomy measures

New directions should be provided for more institutional autonomy and deregulation especially to some S&T related professions in order to allow each of them to develop as a science rather than as a profession. This will encourage innovative approaches in producing trained manpower in S&T. Furthermore, government must provide for long-term financing of strategic studies and fundamental research through an independently managed trust fund, insulated from the whims and caprices of current officialdom. The frequent changes in the direction in which the R&D "wind" blows does not augur well for S&T development.

The Academe-Private Industry Relationship

The academe-private industry relationship in fostering S&T development has become an urgent agenda for serious consideration. This is because of several recent pronouncements pointing to the private sector as the motive force in the economic recovery program. Although initiatives have been made by both the academe and private industry, a basic change in the attitudes of the two sectors toward each other must be encouraged. The following mechanisms are suggested to effect this change:

1. Technology Assessment and Orientation Programs-- Industry and academe must initiate activities that will allow reciprocal visits and discussions of its leading scientists and technologists.

2. Industry Traineeship Program-- The academe can be tapped to provide training to industry personnel for upgrading of skills or learning of new skills.
3. Industrial Research Fellowship Program-- University laboratories should be opened for use by industry scientists who may need the facilities to pursue their ideas.
4. Industrial Visitorship Program--University scientists should be accommodated in industry laboratories for a study visit.
5. Contract Research and Development-- This is now being implemented to a limited extent.
6. Technical Services-- Philippine Institute of Pure and Applied Chemistry (PIPAC) in the Ateneo de Manila University is a good example of a venue for the academe to provide technical services like chemical analysis to industry.
7. Consultancy-- Consultancy must be institutionalized so that the academe can plow back some of its earnings to the institution.

In pursuing these mechanisms, proper consideration must be given to the following issues:

1. Confidentiality of results,
2. Exclusive rights to discoveries, and
3. Intellectual property rights.

Private industry must also be encouraged to support R & D by granting incentives. Resources from the private sector will surely augment what is now available mainly from the government sector.

Conclusion

In the words of Salvador and Zella Luria, the university can be an "ivory tower, service station or a frontier post." [1] In the Philippines, S&T may be served only if the academe harnesses its capabilities to assist S&T development. Certainly, the academe cannot be isolated for it now holds the largest pool of trained manpower in S&T.

It is also important that we evolve our own model for involving the academe in S&T development. This should challenge us to make more things work faster within our constraints and limitations.

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