"Science is a product of its own internal logic and external non-scientific factors."

The Problems of the Practice of Science in the Philippines*

by

Fabian M. Dayrit, Ph.D.

The neglect of the sciences in the Philippines continues to be the major criticism of the nation's development strategies (1, 2). It is plain to see that economic progress can never proceed in the absence of a well-developed science and technology. At this basic level of argumentation and analysis, the key role of science has been established as a necessary prerequisite. The logical solution to this deficiency is for the Philippines to commit itself to a significant degree to the development of its own science capability.

It is at this junction that I wish to inject a word of caution and this is what this paper is about. The way out isn't necessarily the way up: science pursued uncritically will not contribute to national development and may, in fact, sidetrack our progress.

This paper will discuss the problem of science in the Philippines by analyzing the nature of this science upon which we are trying to build our own science. Admittedly, it is an analysis which begs for more data and refinement but I wish to propose it as a starting point for further discussion.

The basis of this analysis is the Kuhnian thesis that science is as much a product of cultural, historical, social and economic factors as it is a determinant of these (3). Science progresses according to its own logic and, simultaneously, according to non-scientific factors which push science in certain directions. However, it is often difficult to separate developments which are due to the logic and ideals of science from those which are due to the non-scientific factors.

What this paper analyzes is not the logic of science but the actual practice of science. In order. to do this, one must go back in history and study the development of this science that we wish to analyze. Susantha Goonatilake, in a pioneering and thought-provoking treatise, presents the predicament of science and creativity in the Third World from the point of view of the Third World (4). Starting with historical accounts of pre-colonial science in the Third World (though mostly South Asian) and in Europe, he establishes the fact that science flourished in Asia and the Americas prior to the encroachment of colonialism. He cites numerous evidences for the superior practices of metallurgy, astronomy, mathematics, chemistry and medicine in Arab, South Asian and Chinese societies. In many instances, the Europeans that we acknowledge today as pioneers in various fields were preceded by many years by non-Europeans. Many ideas were borrowed from the East, and much cross-fertilization has been documented. To say then that science is a distinctly Western product is to present a false picture.

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Western colonial expansion, coupled with the flowering of European science during the 16th and 17th centuries assured the suppression of non-Western thought, the ascendancy of only one type of science and one acknowledged society of scientists. As a result, the paradigms of science, the priorities of science and the ruling elite of science all tend to be western in orientation.

Science in the colonies took on the characteristic of being a "satellite science": it derived its rationale, ideas, inspiration and legitimacy from the center. Goonatilake calls this "science in the periphery": dependent and imitative of the West, and irrelevant and alienated from its own society. To this day, these qualities describe much of Third World science, though to varying degrees.

The accepted norms and tenets of science today emanate from a few definite centers. As it were, the validity or legitimacy of scientific theories can be so recognized only after it is given the imprimatur of the scientific elite. While some degree of controls in science is necessary, it is not without its disadvantages. Where the criteria applied are the products of specific historical, cultural, social and economic factors that are not shared by all, these criteria can stifle. Having established that this particular practice of science is not necessarily valid for all, Goonatilake argues for the possibility and desirability of a different practice of science that is rooted within the Third World situation.

An important distinction should be made here: the crux of the argument is not whether the logic or data or techniques of this science are right or wrong. Rather, what concerns us here is whether or not different types of sciences can claim validity of its own right. Is it possible for a different practice of science to flourish? Or to put a hypothetical question forward, what would have happened if the heavy hand of colonialism hadn't destroyed the sciences that other cultures had built up?

GLIMPSES OF THE EARLY PHILIPPINE EXPERIENCE

What is the Philippine experience of pre-colonial and colonial science? Unfortunately, documentation of early science in the Philippines is scanty. A few observations from anthropologist F. Landa Jocano and Jose Rizal are quoted below.

Jocano (5) writes that "we were taught that our ways of discovering things were traditional and unsystematic. Our beliefs were considered superstitious, our practices unscientific." To prove the contrary, Jocano cites numerous technological achievements of early Filipinos which could have come about only through a systematic study of nature. He singles out successes with ceramics, metallurgy, glass making and chemistry. To this should be added our extensive traditions in agriculture and other plant uses such as herbal medicine.

Who can forget Jose Rizal's parody of "A Class in Physics" under the Spanish friars in "El Filibusterismo"? (6): "For years and years Physics had been taught without laboratory experiments. . ." They had to be content with watching whatever equipment they had from behind locked glass cabinets. Besides, "the students were convinced that the equipment had not been bought for their benefit. . . but to be shown to foreigners and high officials from the Peninsula" who would mockingly write that "either from apathy, laziness, the native's mental deficiencies, or other causes, ethnological or beyond comprehension, the Philippine-Malay race has yet to produce a Lavoisier, a Secchi, or a Tyndal, even in miniature!"

There can be no doubt that our colonial experience under Spain, herself one of the more feudal and less scientifically progressive of European states, inflicted great harm on whatever science was being nurtured in the Philippines when they came to colonize. The Philippines thus entered the 20th century with the handicap of scientific backwardness.

NON-SCIENTIFIC DETERMINANTS OF SCIENCE

The directions of science are determined by many external factors apart from its own criteria and logic. Goonatilake identifies three levels of external influence on the development of science.

1. On the broadest level, the various stages of history as described in the "isms" demand different things from the sciences. Thus, feudal states hardly had any need for science and, in fact, tended to discourage it. Merchantilism prized astronomy and gunnery. The birth of capitalism during the industrial revolution needed thermodynamics and calculus.
2. On a narrower level, national priorities also determine the directions of science. Numerous examples can be cited: the role of agriculture in Stalin's 5-year plans; the importance of chemistry in providing Hitler with synthetic rubber; the role of physics and computers in Reagan's Star Wars games.
3. The social dynamics of the science community are also able to influence the directions of science. Among scientists it matters where you came from, where you studied and under whom you studied. To stay in the forefront of science, one must be able to break into the inner circle. Not all the information and insights can be found in books and journals so the lectures and conference circuits become important social, as well as scientific events.

The reality of these various levels of influence on science should lead us to analyze and question the practice of science. Science, despite its adherence to rigid protocols, does not always advance because of purely scientific reasons alone.

SMALL SCIENCE AND BIG SCIENCE

For purposes of the following analysis, it is convenient to divide the history of the development of western science into two phases: pre-World War I and post-World War II.

Pre-World War I is the era of "small science". Science developed around small, intimate groups and respected individuals, the epitome of which were the gentlemen scientists. Science was accorded the respect of a neutral discipline. Thus were Charles Darwin and TH Huxley given free passage to study the flora and fauna of the world. During this period, the idea took root that science was neutral and was for the benefit of all. WW I signalled the start of the fall from innocence of science. WW I, dubbed as the Chemists' War, saw the systematic government sponsored development of chemical poisons. Hilary and Steven Rose (7) document how it dawned on the British government that they had to sponsor and oversee the development of British science lest other countries overtake them militarily or economically. Thus began the rise of Big Science.

This shift was by no means uniform. In 1934, the Research and Development (R & D) expenditure of the UK was only 0.1 percent of GNP and that of the US was 0.3 percent. Stalinist Russia, on the other hand, had always seen science and technology as the catalyst to achieving Socialism. JD Bernal, the noted science historian, recorded that by 1934, the R & D budget of the USSR was already 1.0 percent of GNP (8). The Soviets funded 3,000 science institutes and demanded allegiance to State-sponsored science — the most infamous being the "Socialist Biology" of Trofim Lysenko.

World War II, dubbed in turn as the Physicists' War, signalled the full emergence of the modern phenomenon that we call Big Science. Several factors necessitated this development: 1) on the national level, it had become apparent that national security and defense depended on a country's independent scientific capabilities; 2) the bigger scientific and technological problems necessitated the skills and coordination of large groups of people; and 3) such projects required Big Money, which could be provided for only by big government or large industries. Big Science was no longer regarded as neutral: nuclear physicists and computer wizards become national possessions; projects of "national security" are hidden from public scrutiny. Thus today, we can distinguish between the relatively open exchange of "international science" and the secrecy and intrigues of Big Science.

Another quality of Big Science which is important to its function is the availability of the technological and industrial capability with which to carry it out. Two examples from WW II illustrate this point. The Manhattan Project was the premier R & D undertaking of the US during the war. Such a project under war conditions could only have been carried out in the US because the US alone was able to gather the talents and provide them with the necessary resources. Despite the explicit cooperation of Great Britain, she was denied access to its secrets. The penicillin discovery, while a wholly British achievement, became very much an American possession during and after the war. Big Science usurps the discoveries of those who are less able to develop and protect their discoveries.

The presence of Big Science is easily evident today. On the national level, the so-called "military industrial complex" receives the bulk of R & D money in the US. The recently announced purchase by General Motors of Hughes Corporation epitomizes the scientific and economic impetus behind Big Science

The scientific literature, especially in journals which form such a big part of science, does not reflect the actual activity in science. In a random sampling of papers published in the Journal of the American Chemical Society in 1982, five of the largest American chemical companies (DuPont, Allied, 3M, Merck and Standard Oil) contributed only five papers out of a total of 208. This free exchange of scientific results is not generally true; a lot of science is not shared.

CAN PHILIPPINE SCIENCE FIND A NICHE?

In answering this question, we should emphasize the ideas that we had presented earlier: science is a product both of its own internal logic as well as of external non-scientific factors. We should recognize that the modern practice of science as seen in Big Science is not the only direction that science can take, nor is it the best. Additionally, we should realize that we are actually addressing two issues: the ideals of science and what our practice of science should be. To fail in upholding the ideals of science is to make a farce out of it; to lack in relevance is to alienate it.

Keeping these in mind, the question becomes simultaneously one of priorities and balance. Here, we should guard against the extremes of idealism of science and the dogmatism of ideologues. Translated into practice, we should support both basic and applied research but at the same time, be aware that different types of science do exist and that some may not be appropriate for us.

The rooting of science within the Philippine context is not an easy task. Recognizing that science is a product of society, our aim must be to shape Philippine science according to the needs of our own society.

A cursory survey of projects funded by the National Science and Technology Authority and its agencies, including the National Research Council of the Philippines, shows that, in fact, the bulk of research topics seem to address very relevant issues. While it is not my intention to give any in-depth analysis, some observations are in order:

1. Science does not operate in a vacuum and unfortunately, the environment in which we find ourselves has not yet awakened to the value and role of science. It takes time to establish a scientific environment and tradition. The social and cultural conditions of the Philippines must nurture science.
2. As observed by others, our science remains disengaged from industry. It does not contribute to industry, and neither does industry contribute to it. There must be an economic impetus to science.
3. In general, support by the government is sporadic and inadequate. There is little continuity and follow through.

Thus, relevance is not enough. For science to emerge from the historical, cultural, social and economic conditions of the Philippines, it must be well thought out and executed.

THE PHILIPPINE SCIENCE COMMUNITY.

How do we size up our own scientific community? Many of us were trained to do science in a foreign, generally American, setting. Our minds become easily captive to the practice of their science. The crises of many a returning PhD are those of irrelevance and alienation. Instead of recreating the setting in which we earned our degrees, we should consciously adapt ourselves to the local conditions. Instead of looking to the outside, let us look to our own situations for scientific challenges and it must be clear to us for whom we are doing this science. Precisely for these reasons, it is imperative that we continue to develop our own PhD programs.

This brings us back to the initial thesis of this paper: science pursued uncritically will not contribute to national development. We should be well aware of the nature of science; we should distinguish between the essence of science and the practice of science that has evolved because different societies have demanded such from science. Among the multiplicity of possibilities, we should chart our own course. But before doing so, we should also be aware of the situation we find ourselves in – our own history, culture, society and economic needs.

We should therefore plot our course with care, and at all times we should remember that we are not dealing with science alone, but with society as well.

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