

APPROPRIATE HEALTH TECHNOLOGY¹

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A major health issue for developing countries today is how technology and health can contribute to development, and vice-versa. This article explores that subject by examining some of the fundamental relationships involved, and outlines a new approach to the technological improvement of health conditions that would seem well-suited to meeting a developing society's true present and future needs.

Introduction: Technology and Development

Technology cannot be analyzed alone, as an isolated occurrence. Rather it must be viewed as a cause or consequence of other phenomena, within a framework well-defined by theory and practice. In particular, technology is intimately bound up with development. So before going further it would seem desirable to say something about development.

If we consider development as a whole, we can say that it is an integral process, one rich in meaning, that embraces our natural environment, social and cultural relations, the educational process, economic production and consumption, personal well-being, and of course, health. This being the case, there can be no single universal pattern of development. Instead prevailing social, cultural, and environmental circumstances will shape the pattern and style of the particular development process involved.

In this regard, we can say that the development of a people is "authentic" when it is endogenous, when that people exercises its sovereign will and chooses its

own future—in cooperation with societies that share its problems and aspirations, but otherwise unencumbered by outside influences. It should be observed, however, that such development, a comprehensive endogenous process through which a society determines its own future, must tend toward integral satisfaction of the needs of that society or fall into contradictions.

In Latin America, development has not taken place in a style that can be regarded as "authentic" because there has been an attempt to imitate the development style of the industrialized countries—which have optimized some elements of the process, but which have restricted its benefits and have thereby failed to satisfy majority needs. By trying to impose their models they have eliminated the endogenous component in the less developed countries, subtly in some cases and overtly in others, in order to maintain their position of leadership.

This stress on "authentic" development is important. As stated by the 1975 *Dag Hammarskjöld Report (1)*:

The crisis of development lies in the poverty of the masses of the Third World, as well as that of others, whose needs, even the most basic—food, habitat, health, education—are not met; it lies, in a large part of the world, in the alienation, whether in misery or in affluence, of the masses, deprived of the means to understand and master their social and political environment...³

A 1974 report by the United Nations

³Reference 1, p. 5.

¹From a paper presented at the Sixteenth Meeting of the PAHO Advisory Committee on Medical Research held in Washington, D.C., on 11-15 July 1977.

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Research Institute for Social Development (2) said more or less the same thing:

The problem faced by the project has been the highly uneven character of development within developing countries: its limitation to certain areas and certain categories of the population, especially to areas and categories of the population already better off; its failure to resolve mass poverty; the apparent increase of income inequalities and growth of unemployment even as economic growth has taken place.⁴

UNICEF (3) has concluded that:

In the developing world as a whole, some three-quarters of the population is not being effectively served. New generations are being born, growing up, and living out their lives without minimal services or basic education, contributing much less than they could to national development, and with some becoming a burden to themselves and to society.⁵

This development style is aimed at the well-being and development of every man, woman, and child—not merely at the growth of things that are only means to an end. Its purpose is to meet needs (starting with the basic needs of the population) and at the same time to assure humanization of the individual by providing him with needed avenues for self-expression, creativity, and control over his own destiny.

Achieving Authentic Development

How is development to be given this style? The answer is by adapting development naturally to the ways in which men and communities wish to shape the material basis of their lives; by basing development on the technologies they now use and on the relationships existing between their social systems and their natural environments; and by gearing development to existing forms of social organization and values.

The limitations on development of this kind are not strictly defined in terms of abundance and scarcity, or even (as some would have us believe), in terms of

education and ignorance. They are defined, first of all, by our own capacity to set out freely on a new road of our own choosing. That is, as things stand now, these limitations are chiefly social and political. And in this regard, major structural changes will be needed to promote equality and to liberate the true creative energies of the communities involved.

As all this implies, authentic development is a process that fosters self-confidence and self-reliance by applying science and technology, not to existing consumption patterns, but to the bulk of the population's present and future needs. This naturally requires a good measure of reorientation—and hence control—of science and technology; for it is only a slight exaggeration to say that he who controls science and technology can control development.

In sum, for Latin American development to acquire a more authentic style, new direction must be given to science and technology. But once we can control science and technology (as indeed we must), we can control our own development.

Controlling Science and Technology

The term "control" in this context means social control rather than control by any individual or restricted group. For real as our cultural dependence is, it will do no good merely to react emotionally against it. What we must do is throw off the present image of ourselves and create the conditions needed for generation, adaptation, and social control of a science and technology that will genuinely serve our countries' needs.

Strictly speaking, technology is the application of science. Though today we are increasingly inclined to equate the two, we must acknowledge that they have not always traveled the same road. Indeed, a good number of analyses have lately shown that science and technology progress more or less independently of one another. The

⁴Reference 2, p. 3.

⁵Reference 3, p. 5.

tendency to lump them together is based on the explicit understanding that scientific research (which has new knowledge as its ultimate goal) lays the foundations of technological progress. For its part, the scientific community has recognized this intimate connection as a way to justify financial support for scientific research. As a result, science is coming increasingly to share the blame for problems caused by technology, but has not always shared the credit for technological gains. Contradictions of this sort invariably arise when science and technology fail to work together toward a higher goal: the forementioned satisfaction of social needs.

There is a fundamental difference, however, between the technology of earlier eras and that of today. The difference lies in the capacity to make quick and practical use of new scientific knowledge. That is, present-day technology can absorb the most recent findings of basic research and quickly turn them to practical account. So even though technological progress has heightened our awareness of the lack of a direct interrelationship between science and technology, new scientific knowledge is more speedily put to use.

Specific Problems

This point underscores two basic problems facing Latin American development. The first is an inability to use available knowledge and resources. The second, intimately bound up with the first, is a perennial insufficiency of economic resources.

Consider the first problem. Modern science and technology are descended from the Industrial Revolution that began in England and much of Europe in the 19th Century. In those countries and their European and North American offshoots, science and technology grew within a certain socioeconomic context, in the course of fast-paced industrialization. In Latin

America, on the other hand, science and technology were acquired at second hand, through a cultural process. In this regard, the science and technology of health are no exception. Many of the anomalies that amaze us today spring from the merely cultural introduction of health knowledge and methods that evolved elsewhere to meet other conditions.

The second problem, insufficient economic resources, compelled us to import capital goods just as we imported culture. This, in turn, saddled us with costly science and technology which were inadequate to solve problems for which they were not designed. The interaction of these two problems thus created a vicious circle, one that prevented us from creating adequate science and technology, and even from effectively adapting science and technology to our particular conditions.

What we require is thus contrary to what we have. Instead of science and technology that actually generate needs, we require a science and technology that is generated in response to present and future needs.

In the developing countries, cultural importation of science and technology meets the felt needs of relatively small "developed" groups. The great majority of the people, though co-existing with these small groups, have not yet been brought into the development process. However, exposure of this majority to imported science and technology generates new felt needs that the majority would like to satisfy, but which it usually cannot satisfy for lack of money or purchasing power. Thus a new problem is created. To the generation of needs is added the majority's frustration at being unable to acquire the products of a technology to which it has been exposed.

In contrast, a development style geared to meeting a developing country's present and future needs starts by striving to eliminate misery. And it behooves us, working within a multidisciplinary and

intersectoral framework, to seek this elimination of misery by concentrating upon satisfaction of health needs. This job of satisfying health needs, of course, is quite different from merely helping those who are ill to recover the health that they have lost.

A New Approach to Health

The sources of human health are diverse (4), but they certainly include the following: (1) environmental factors, (2) social factors, (3) group behavior patterns, (4) individual behavior patterns, and (5) health care.

The data show that in both developed and developing societies the first four elements' impact on health tends to be decisive. In comparison, medical techniques for disease prevention and treatment are much less important and have much less priority in disease eradication than measures tending to improve nutrition, sanitation, and housing. Therefore, the critical health problem for any society is to develop the cultural values and social and political relations that make these sources of health available to all.

Keeping these points in mind, if we take a closer look at existing possibilities we find that satisfaction of health needs has been limited by the same causes that have prevented our countries from adopting a more effective development style. Logically, then, this new approach to health calls for a new approach to technology. And this new approach to technology implies a fundamental shift from imitation to innovation.

Innovation, however, implies not only creativity but also adaptation of the resources we already have in order to arrive at a new and appropriate technology. In the health field, such a technology should (1) tend to satisfy the health needs of the majority; (2) foster a humane and creative health service; (3) make the best possible

use of local resources; and (4) involve extensive public participation.

These basic guidelines for an appropriate health technology should be used in formulating alternatives, which should be weighed in terms of their effectiveness, efficiency, acceptability, simplicity, and feasibility. To adopt the reverse procedure is incorrect. That is, if we put this last set of criteria before the first we might ignore such fundamental needs as development of new alternatives and fostering of self-sufficiency through community participation.

In sum, appropriate technology should be developed in a manner suited to the present and future resources, capabilities, and needs of the different communities and societies involved. Such technology should of course be closely linked to science; but at the same time it should be broadly participatory, inspired not only by the contributions of professional specialists but also by the contributions of laborers, farmers, and their communities. As Charles Susskind (5) points out in his book *Understanding Technology*,

One of the requirements of a satisfactory system of technology assessment would thus seem to be more active involvement of those "whom it may concern." The term *participatory* technology has been coined for this concept.⁶

The concept of appropriate technology is intimately bound up with the concept of "pre-transfer." It is no longer acceptable to consider unlimited transfer of technologies from the industrialized or developed countries to the developing countries. Pre-transfer offers a country the opportunity to analyze its present and future needs, to utilize an information system that can tell it about technological experiences in other countries—successes, failures, the approaches taken and the results attained—and to choose the technologies most appro-

⁶Reference 5, p. 128.

appropriate for the style of development desired. Naturally, such pre-transfer activities also include allocation of funds for research and development directed at adaptation or creation of appropriate technologies.

Within this framework, an appropriate health technology should be directed at dealing with problems that impede its new approach to satisfaction of health needs. At present we can say that the resources required to meet these health needs are not scarce so much as they are badly distributed, and that this circumstance is aggravated by uncritical imitation of imported models. In this regard, the introduction of "universalistic" criteria has only served to stimulate further the rise of health care models that are economically, socially, culturally, and ecologically unsound.

We are thus faced with an either/or proposition: We can try to meet health needs either by applying "universalistic" criteria or by applying what might be called "architectonic" criteria tailored to actual, specific situations. Therefore, the new approach described for meeting health needs depends not only upon the socioeconomic considerations previously discussed, but also upon the following: (1) reallocation of resources to meet real present and future needs; (2) integration of the health services with other development services; (3) adaptation of these development services to specific circumstances in such a way as to place maximum reliance on local resources; (4) adoption of a strategy of decentralization that fosters community participation and is in harmony with the political structure of the country involved; (5) dedication of research to the solution of specific community problems—without neglecting opportunities to generate "new knowledge"; (6) training of manpower resources for the health field in accord with these new strategies.

It should be noted, of course, that the degree to which these activities are carried

out will depend largely on the political course selected by each of the sovereign nations involved. In addition, it would seem worthwhile to mention a few other points about the first three activities listed:

1) Reallocation of resources to meet present and future needs. This reallocation is limited by various circumstances. Among these are the cost of many scientific and technological innovations (such as renal dialysis and intensive care units) that can at times result in spectacular life-saving triumphs. Adding to this problem, the cost of curative medicine in general can be expected to rise even further, in concert with the high cost of providing and maintaining such innovations; and the technologies involved can be expected to continue promoting increased medical specialization. Taking all this together, it would seem that if the curative side of medicine remains predominant (6), and if treatment-oriented professionals continue to dominate medical practice, preventive health will remain a sickly stepchild (7); and the climate for public debate and decision on the question of transferring resources from expensive health care to other cheaper and more effective measures will never be any better than it is today.

2) Integration of health services with other development services. I concur with Gunnar Myrdal (8) when he stresses the importance of integrating health initiatives with other socioeconomic, institutional, and political initiatives.

3) Adaptation of services to specific circumstances so as to place maximum reliance on local resources. This adaptation is intimately bound up with a decentralization strategy that promotes community participation. In fact, adapting and using local resources without such participation reduces this innovative feature to just another way of making the community play the role of patient, instead of

recognizing that it is an entity capable of shaping its own destiny.

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If we reduce the definition of technology to "the way to make things"—encompassing the knowledge of how to make things and the instruments for making them derived from science or from unscientific but fruitful experience, failures, and successes—then an appropriate health technology will be a new and proper way to introduce needed changes in the factors mentioned above. Introduction of appropriate technology will also offer an economical method for reallocating resources—a method that enlists community participation and relies chiefly on local resources.

The effectiveness of such actions will depend not so much on the instruments available as upon a knowledge of how to make the specific changes involved. Hence appropriate technology is not synonymous with either high-cost technology or with unsophisticated low-cost technology. It is synonymous with the technology best-suited to meet overall present and future needs. Other key features of appropriate technology include the following:

- Besides being economically feasible, an appropriate technology must be adaptable to social and cultural conditions.
- An appropriate technology must be socially as well as economically cost-effective.
- An appropriate technology must acknowledge the existence of alternative approaches for satisfaction of health needs.
- An appropriate technology must foster self-reliance and self-confidence.

Implications for Research

As previously noted, while basic research generates new knowledge, technological research places this knowledge at the service of society. To accomplish the forementioned

aims, encouragement must be given to the designing of national research policies that will promote both basic and applied research directed at providing for majority needs. A national policy on technological research, for instance, should emphasize the need to design machinery for identifying, choosing, modernizing, and creating appropriate health technology. Such a research policy—seeking the development of appropriate health technology—must direct its attention to meeting the following basic requirements:

(a) Establishment of a simple and easily accessible system for acquiring, recovering, and distributing information. Development of an appropriate technology requires improvement of information systems. Countries, communities, and citizens must be able to inform others and be informed about the facts of development, development styles, the implications of science and technology, and the inherent conflicts involved. At the international level, an effort should be made to communicate the experiences of other peoples—their successes and failures—as objectively as possible, recognizing cultural, social, political, and economic diversity, so as to facilitate genuine cooperation among peoples. At the national level, information and education work should be directed at building up public awareness of what is being considered so as to achieve maximum citizen involvement in the decision-making process.

(b) Development of human resources in the field of technology, chiefly through support to research programs that will provide training for research workers. Research is fundamental to the technological process. Nevertheless, it is sometimes asked whether the technological process is compatible with so-called basic research. We can answer "yes" if we regard basic research, like art, as being carried on by individuals who are driven in that direction by interest and ability. But if we consider

basic research only in terms of salaries, contracts, and administrative obligations—that is, as just another professional undertaking, then we must answer “no”. In fact, basic research is somewhat analogous to biological mutation: the results are difficult to foresee.

To carry the analogy further, however, applied science acts rather like the environment: It selects discoveries and places them at the service of the community. Without basic research there is no discovery, and without applied science there is no service to the community. In our view, basic research is an essential component of the work to improve health; nor is research confined to biology, for social research—social epidemiology, social anthropology, etc.—is also essential to the style of development that we propose. It is equally important, however, that this research be as comprehensive as possible, and that it have the interdisciplinary character typical of modern scientific research.

Today the interdisciplinary character of scientific work is manifested most strongly in research (8). Educational processes are still far from interdisciplinary; but when research lacks the ability to be interdisciplinary, this constitutes a specific failing of the scientific system. As Barry Commoner (9) has pointed out:

There is, indeed, a specific fault in our system of science, and in the resultant understanding of the natural world, which, I believe, helps to explain the ecological failure of technology. The fault is reductionism, the view that effective understanding of a complex system can be achieved by investigating the properties of its isolated parts. The reductionist methodology, which is so characteristic of modern research, is not an effective means of analyzing the vast natural systems that are threatened by degradation.⁷

(c) Definition of pre-transfer mechanisms for allocating national and international funds to support research and development

of health technologies for the developing countries. Here it should be stressed that before any loans are made for development of health services, resources should be earmarked for pre-transfer activities relating to “high-risk” projects. Such pre-transfer activities, as we have already pointed out, should be dedicated to finding, choosing, analyzing, adapting, and creating appropriate technology.

(d) Promotion of both “vertical” and “horizontal” technical cooperation. To expedite creation of appropriate health technology, the developing countries must work together, communicate their experiences, share the burden of solving innumerable health problems, coordinate to obtain external financing, etc. To accomplish these things they must establish procedures to promote technical cooperation within agencies and countries (“vertical” cooperation) and between developing countries (“horizontal” cooperation).

(e) Encouragement for study and analysis of how the development of appropriate health technology is hampered by copyrights, royalty payments, hard-currency purchases, etc., so that later the developing countries may together propose a new international order in this field. For it will not be possible to adapt much of the desired technology, disseminate sufficient information, fully maintain equipment, etc., so long as the present situation remains unchanged. In proposing a “new world economic order” the Third World countries have already put forward general recommendations along these lines. What is needed now is an effort specifically geared to health.

Three Types of Appropriate Technology

It is felt that three general areas need to be covered in the course of developing appropriate technologies. These are as follows: (a) the development of appropriate technologies in the health field; (b) the

⁷Reference 10, p. 189.

development of appropriate technologies in administration; and (c) the development of appropriate technologies in education.

The health technologies (a) are used to attend directly or indirectly to the needs of persons, groups, and the environment; administrative technologies (b) are used to organize and administer combinations of resources employing health technologies; and educational technologies (c) are used to prepare and train human resources. These three types of technologies differ in accord with variations between their respective fields.

Appropriate Technology in Education

We could cite lines of research that should be promoted in each case; but since each country's true needs are distinct, we think this matter should be left for each country to resolve in its own way. However, in my own field—the training of human resources—I would like to present some general propositions that an appropriate technology in education should take into account.

First, curricula must never be predetermined or borrowed; instead they must be derived from analysis of health needs and provision of health services, and they must be the subject of ongoing consultation.

Appropriate technology in education, though itself no discipline, involves an interdisciplinary approach to the entire teaching-learning process. In this it serves as a research tool, and at the same time opens up new fields for application of available technological resources. It thus provides a viable approach to the problems of educational planning, organization, and administration.

At the same time, appropriate technology in education involves a sense of creation, invention of new procedures, discovery of new resources, and development of a new organization for accomplishing a purpose that is fully perceived in advance. It is thus

a tool for analyzing and refining the various methods, materials, types of equipment, and logistical arrangements used in the education process. Naturally, such a technology would be found at all stages of this educational process—including selection of students, assignment of tasks in analytical studies, transmission of knowledge, training in specific skills, and evaluation.

An appropriate technology in education recognizes that individuals learn at paces different from the pace of self-instruction required for development. Taking this into account, it develops learning strategies for acquiring skill, ability, or mastery in a particular activity or related set of activities.

Supporting Elements

The various areas for technological development in health that we have just mentioned all depend on common supporting elements. These common supporting elements (which themselves need to be promoted) include diagnosis and documentation of health problems, basic research, production of informative materials, training, and regional technical cooperation.

Depicting the relationships between these supporting elements and the various technologies they support results in a two-dimensional matrix. Then, when the program areas established by the Ten-Year Health Plan for the Americas are added this matrix becomes three-dimensional.

Concluding Remarks

In closing, it is not proposed that technological research be done, but rather that mechanisms be provided that will permit development of appropriate health technology—a process which in our view is more important than technological research at our peoples' present level of development.

Finally, we must be aware that a

“technological package” exists in our own countries that is securely tied. This package is alleged to contain the health technologies that are most adequate and important. This could help provide the basis for a package of “appropriate health technology.” However, the vested interests involved, the ideas imported, the dominant ideology, etc., constitute strong bonds that keep the

package tied. Hence, as a final recommendation, I think we should start by undoing this package in rural or marginal urban areas that are still unaffected or nearly so. Extension of health coverage to such areas could then act as a strategic springboard from which to launch an effort to redesign the entire technological component of the rest of the health system.

SUMMARY

This article seeks to analyze certain relationships between science, technology, development, and health within a frame of reference well-defined by theory and practice.

There is no “universal” style of development; rather, the development process must be adapted to a given society’s specific cultural features and to its natural environment. In addition, to be truly effective, this development process must address basic majority needs and must be directed at providing the individual with needed avenues for self-expression, creativity, and control over his own destiny.

In seeking to apply science and technology to this process, however, Latin America (as well as many other developing areas) encounters a number of major problems. For one thing, most science and technology has been acquired at second hand, through cultural “importation” from abroad, so that what arrives is apt to be ill-suited to the receiving society’s special needs. For another, the development process in Latin America confronts a very limited ability to use the knowledge and resources that are available, as well as a perennial insufficiency of economic resources. Not surprisingly, the combined result of all this has generally been importation of capital goods and technologies that are both expensive and highly unsuited to solving the major development problems at hand.

One major development problem is obviously satisfaction of basic health needs. However, data from both developed and developing countries show that environmental factors, social factors, group behavior patterns, and individual behavior patterns have a far greater impact on health than do existing medical techniques for disease prevention and treatment. Therefore, the critical problem for any society is how to develop the cultural values and social and

political relations that will tend to make good health available for all.

Logically, this approach to health calls for a new approach to technology, and this new approach to technology calls for a fundamental shift from imitation to innovation. Specifically it calls for the following actions:

- A reallocation of resources to meet real present and future needs;
- Integration of the health services with other development services;
- Adaptation of these development services to specific situations in such a way as to place maximum reliance on local resources;
- Adoption of a strategy of decentralization that fosters community participation and is in harmony with the political structure of the community involved;
- Dedication of research to the solution of specific community problems;
- Training of manpower resources for the health field in accord with these new strategies.

Appropriate health technology of this kind would seem to offer a new and desirable way to introduce needed changes into the health picture and the development process. Such technology would also offer an economic method for reallocating resources, a method that enlists community participation and relies chiefly on local resources. Of course, the effectiveness of such action will depend not so much on the instruments available as upon knowledge of how to make the specific changes involved. Hence this appropriate technology is not synonymous with either high-cost technology or unsophisticated low-cost technology. It is synonymous with the technology best-suited to meet a given society’s present and future needs.

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Children Under 5, Adults 65 or Over

The needs for child care services in Latin America have been rapidly increasing and are likely to continue to increase. In 1975, children under 5 years of age comprised 16 per cent of the population in Latin America, and 8 per cent of the population in Northern America, over 51 million and 19 million, respectively, for that year.

Although the proportion of the population aged 65 or over is relatively small in Latin America, the number in this age group is expected to increase from 12 million in 1975 to 28 million in the year 2000. The need for substantial increases in services for chronic diseases and disabilities associated with old age, and general geriatric services is clearly indicated by this trend.