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**Papers Commissioned
for a Panel
of the
National
Academy
of Public
Administration**

**THE ROLE OF THE SOCIAL SCIENCES
IN THE
INSTITUTE FOR SCIENTIFIC
AND TECHNOLOGICAL COOPERATION**

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The Role of the Social Sciences
in the
Institute for Scientific and Technological Cooperation

Papers commissioned for a panel of the
National Academy of Public Administration

May, 1979

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(202 828-6500)

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Foreword

The Institute for Scientific and Technological Cooperation has been proposed as a means of expanding knowledge and increasing availability of technology to meet the needs of people in developing countries. A small planning office attached to the Interagency Development Coordination Committee has been charged over the past year with the responsibility for shaping the program of the Institute and launching it into operation later this year.

In recognition of the fact that issues of technology encompass social sciences as well as the "hard sciences", the planning office requested the Academy to undertake a study of how the social sciences can most effectively be incorporated in planning the Institute's program. Fields such as sociology, anthropology, demography, economics, as well as public administration and management, among others, represent important resources to be tapped in efforts to apply technology to development.

Under a contract with the U. S. Agency for International Development, the Academy appointed a panel to review papers and guide the study. Four papers on key questions pertaining to the role of the social sciences were commissioned. James M. Mitchell served as panel chairman and Erasmus H. Kloman was project director. The panel, the names of whose members appear below, was enriched by a wide range of experience in economic development, development administration, and other social science orientations relevant to the concerns of the Institute. The panelists deserve special recognition for the time and effort they contributed to this effort.

The papers were written primarily to provide assistance to those responsible for planning the Institute and, after its launching, those who will take part in its operations. A larger circle of potential interest includes many who have been engaged in study of questions concerning the development, diffusion and interchange of technology and the promotion of science and technology capabilities within developing areas.

The authors of commissioned papers and the questions they addressed are as follows:

Dr. Warren C. Robinson and Dr. Irwin Feller, Pennsylvania State University.

Question--What can social science methodology offer to the better design of technology transfer? What can the social sciences add to evaluate the consequences? How can social sciences be built into the mechanism?

Dr. Donald P. Warwick, Harvard Institute for International Development.

Question--In general, what is the role of management systems in understanding development technologies? How will the internal organization of the Institute affect its possibilities for action? What management issues arise in the relationship between ISTC and its collaborators in the developing countries? How can an organizational and management perspective improve the testing of development technologies in field settings?

Dr. Edgar O. Edwards, Jones School of Administration, Rice University.

Question--What should be the nature of policy studies undertaken by the Institute? What major policy issues affect the selection, development and adaptation of technologies?

Dr. Michael M. Horowitz, Institute of Development Anthropology, Dr. David Brokensha, Social Process Research Institute, and Dr. Thayer Scudder. California Institute of Technology.

Question--Would it be worthwhile for the Institute to strengthen certain social science institutions abroad? If so, should they be encouraged to move in the direction of interdisciplinary work in the same manner that the Institute is being focused? How can the gap between research and action be bridged?

The following introduction, summarizing some of the main issues addressed by the papers, underscores the significance of the effort about to be launched. Few endeavors have more potential for influencing the course of events at this critical stage in the evolution of U.S. foreign economic development assistance.

George H. Esser
President

May, 1979

Robert E. Asher
Consultant
Washington, DC

David Brokensha
Director, Social Process Research Institute
University of California, Santa Barbara

John J. Corson
Consultant
McLean, Virginia

Edgar O. Edwards
Jones School of Administration
Rice University

Irwin Feller
Institute for Research on Human Resources
Pennsylvania State University

Walter A. Hahn, Jr.
Senior Specialist in Science, Technology and Futures Research
Congressional Research Service

Michael M. Horowitz
Director, Institute of Development Anthropology
State University of New York, Binghamton

James M. Mitchell (Chairman)
The Brookings Institution
Washington, DC

Warren C. Robinson
Professor of Economics
Pennsylvania State University

Thayer Scudder
Professor of Anthropology
California Institute of Technology

Eleanor B. Sheldon
President, Social Science Research Council
New York, New York

Donald P. Warwick
Harvard Institute for International Development
Cambridge, Massachusetts

Alfred C. Wolf
Consultant
McLean, Virginia

Staff:

Erasmus H. Kloman
Project Director

INTRODUCTION

While each of the following four papers contains its own summary or abstract, certain common themes deserve highlighting in this introduction. As a point of departure, it must be recognized that, despite the growing body of experience and accompanying literature concerning technology and cooperative efforts to develop, transfer and distribute its benefits, there still remains a vast ignorance about technology as a phenomenon. Much is yet to be learned about how technology is generated, or transferred and adopted, and how its impacts, positive or negative, may be anticipated. Technology assessment is still in a nascent state. The new Institute, in addition to having its own research and development agenda, will be an experimental laboratory to be carefully monitored for indications of what works and what does not work.

Under these circumstances evaluation assumes great significance. Programs need to incorporate evaluation components from the planning stage onwards. The techniques and methodologies of evaluation must be sensitized to the specific conditions of this endeavor. The Institute needs an institutional memory capable of recording all relevant experience and making data accessible to future experimenters. While the Institute may concentrate mainly on its R & D role in seeking to ascertain what technological approaches will meet needs in its chosen problem areas, it cannot cut off its oversight of activities as they move through stages of implementation or, in other instances, fail at some stage of the process.

The long lead-time required for the process of technology generation, diffusion and interchange poses a potential problem for the Institute. In both the United States and the developing countries there will be those who hope for quick and dramatic results. Compared with the vast magnitude and urgency of the problems plaguing the developing world, the near-term impact of the Institute may not seem impressive. The development of apt, sensitive programs which are responsive to developing country needs is what the Institute is seeking to accomplish. This represents an ambitious and highly challenging task in an area where past efforts have often failed. This new approach needs time in which to prove itself.

The Institute is being presented by its proponents as an innovative, nonbureaucratic enterprise emphasizing colleague-to-colleague linkages in problem-solving, while moving away from the customary constraints of governmental structure and processes. Success will be highly dependent on flexibility, adaptability, and an atmosphere conducive to collegial collaboration and experimentation. In his March 9 article in Science, Brewster Denny, Dean of the Graduate School of Public Affairs, University of Washington, warned of the dangers in not keeping a sufficient distance from government and making a distinct break with the past. If Congress burdens the Institute with many of the requirements it has laid upon AID, it will limit the prospects for accomplishment.

A key feature of the Institute's make-up is the emphasis on participation, mutual collaboration and partnership. Experience has made increasingly clear that a bodily transplant of a technology from one social environment to another is hardly ever workable or desirable. In many instances, relevant technologies can only be developed in the contexts in which they will be applied. The successful selection, adaptation and transfer of technologies can take place only when people on both ends of the transfer process are mutually cooperating. The process, moreover, involves learning on both sides and, most significantly for Americans, abandonment of the attitude that we know all the answers.

In the current search for "appropriate technology", we are still trying to identify what questions should be asked, far less finding answers. The Institute's staff should not begin with preconceived notions about what technology is "appropriate" for developing nations. Moreover, as much of the technology arrayed in the industrial nations including the United States appears to be increasingly "inappropriate" for their needs, we should be receptive to whatever the developing nations can teach us about the criteria of appropriateness.

The concerns of the Institute necessarily involve it in some baffling questions of ethics and equity. To what extent should a developed nation assume a mission involving efforts to develop science and technology, in a low income country? Should one nation be seeking to promote changes in the cultural, social, political or economic environment of another? In a country with large numbers of unemployed or underemployed, is it in the public interest to build plants for the manufacture of labor-saving devices such as tractors? Should the Institute limit its efforts to projects for which the environment in a developing nation is deemed entirely receptive, or is some form of social engineering a proper component of the Institute's mandate?

Another set of questions concerns equity. Technological change almost always involves economic dislocation and redistribution of wealth as one technology yields to another. In some instances new technology promotes a wider distribution of wealth, but in other instances benefits are more confined. To what extent should these issues be determining in the selection of R & D projects by the Institute?

The four papers, in addressing these and many other issues, all stress the critical importance of the role of the social scientist in the work of the Institute. Both in planning and directing the Institute's overall activity and in the management of specific programs social scientists from a wide variety of disciplines must be engaged on a continuing basis. Technical experts in the problem areas of Institute concentration, agriculture, health, education, etc., need to work in close cooperation not only with development economists but also with anthropologists, demographers, psychologists, sociologists, and public administrators.

In its broadest sense public administration is the management of change. The branch of public administration concerned with development has a similar focus on change and the building of institutional capacity to effect change. Technology is seen as a neutral force. How it is deployed and whether it works for good or ill in any society depends largely on decisions and actions by informed administrators. A number of fields of inquiry being pursued by the domestic public administration community, especially the area covered under the term "implementation", have much to contribute to understanding the process of development.

For too long the field of public administration has been relegated to a secondary status in U. S. foreign aid programs. The new approach to be pursued by the Institute represents an opportunity to restore the vital collaboration between development technicians and the public administration community.

I. A SOCIAL SCIENCE PERSPECTIVE ON THE
TRANSFER OF TECHNOLOGY

Irwin Feller

and

Warren C. Robinson

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A SOCIAL SCIENCE PERSPECTIVE ON THE
TRANSFER OF TECHNOLOGY

Summary

Social science methodology is of relevance to the design of technology transfer programs in several ways. There is a sizeable literature, drawn from the perspectives of several different social and behavioral sciences, on the characteristics (variables, relationships) which affect the likely success of R & D and/or technology transfer programs. Implicitly or explicitly, ISTC has been drawing and will continue to draw upon these findings in shaping its organizational structure, in selecting various modes of collaboration with other countries, in determining its involvement in the various stages contained within the technology transfer process, and in selecting methodologies which it promotes.

There is likewise a sizeable and growing literature not only on technology transfer programs, but also on the impacts of technological change on societies. These techniques include project selection studies, evaluations of the effectiveness of alternative technology delivery systems, cost-benefit procedures for capturing external effects, and technology assessment procedures. Beyond selection of an evaluation methodology appropriate to a specific action, ISTC must confront two issues in developing an evaluation component to its activities: First, evaluation activities tend to increase the front-end costs of projects, in terms of time, personnel requirements and financial outlays. Second,

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it raises questions concerning the criteria to be used in determining not only whether or not a technology is "appropriate" to a particular problem but also of the legitimate degree to which an external organization can intervene to introduce change into another country.

The very design of ISTC's activities, including decisions concerning the extent of its involvement in the various segments of the technology transfer process and the form of relationship it enters into with collaborating countries, requires a social science perspective. At a minimum, ISTC should take steps to include this perspective in its planning activities. The most effective means of insuring that this perspective is included is for ISTC, first, to employ personnel with the requisite social science skills, and, second, to develop internal organizational procedures which permit this perspective to be brought to bear on decisions concerning programmatic approaches.

Statement of Objective

This paper is one of a series commissioned by the National Academy of Public Administration in its consulting role to the planning group for the proposed Institute for Scientific and Technological Cooperation, (ISTC).

The focus of this paper was laid out in a planning session with NAPA and ISTC personnel and is understood to be as follows:

What can social science methodology offer to the better design of technology transfer? What can the social sciences add to evaluate the consequences? How can social sciences be built into the mechanism?

Our answer to these questions occurs in two parts. In Part I we present an overview of findings drawn from the social sciences which relate to the objectives and functions of ISTC, as described in ISTC planning documents. We present this overview because the planning documents suggest that ISTC has both a product orientation, e.g., the development of improved practices for farming on marginal lands, as well as a process orientation, e.g., capacity building in science and technology. Thus not only must the answers to the above three questions draw upon different social science disciplines, but they must also encompass different conceptual frameworks which cut across disciplines. For this reason, we have organized the first part of our answer about three specific issues: (1) the relationship of technological change to economic development (a "product" or "productivity improvement" perspective on technology, which relates to the treatment of appropriate technologies contained in E. Edwards paper); (2) the development of a

technological capability in collaborating countries (a "process" perspective which relates to specific objectives of ISTC as well as to its role as a research and development institution); and, (3) the development of evaluation or assessment mechanisms for determining the "appropriateness" of a technology (a "process" orientation, which relates to the criteria ISTC will employ in determining which projects it will support.)

In Part II we present answers to the three stated questions, principally as conclusions and recommendations drawn from the above analysis.

Part I: Overview

What is "A Technology"?

Let us begin this review with a brief review of what is meant by "technology." In popular discussions, the term is very widely used often as an adjective. Thus, "technological unemployment," or "technological bias." Technology, however, can be defined as the entire combination of how we do things, what we use to do them with, and also to some extent why we do them. It is the study of "technics," or the material basis of the civilization. It is "the social pool of knowledge of the industrial arts."^{1/} "Technology," conceived in this way is the underlying basis within a given society of how the human population interacts with its natural resource base. The technological structure of the society is the mediating force of knowledge, as filtered by institutions and customs, which affects the interaction of the

population with its natural resources endowment. Thus all knowledge can be conceived of as "technology;" technology transfer thus occurs each time one culture or society "learns" anything from another.

These definitions of technology, however, are too broad to be of much help in dealing with specifics of technological change, or more particularly with technology transfer. They fail to differentiate between the continuous historical processes by which countries exchange methods of production through trade, migration, and licensing agreements and the specific goals proposed in the establishment of a new public sector transfer organization. Given that the international transfer of technology has and will continue to occur in the absence of new institutional arrangements, the key question in examining the direction of an institution such as ISTC is whether technology transfer can be done in a selective and "controlled" way or whether once the underlying technological structure is altered radically, the whole superstructure of social economic and political institutions does not also end up changing.

Relationship of Technology to Development

Changes in technology, that is in the knowledge, art and technique applied by man to his resource base, are essential to the processes called economic development. Development, in essence, is a process of transformation, one part of which entails structural changes in the way in which resources are combined to achieve output. Growth may simply represent an increase in all inputs and consequently in output. For example, clearing new land to accommodate an increase in labor force results in an increased total product but not necessarily in a change

in the labor/land ratio or in the output per worker or yield per land unit. This kind of growth may be possible if there is a "frontier" to be cultivated, but it is inherently limited. Development, by way of contrast, implies a rise in output per worker (and consequently an increase in income per capita). At some point in the development process, this increase is possible only through increases in the efficiency with which inputs are used. Although there is considerable debate concerning the sources of these efficiency gains (e.g., learning by doing, economies of scale), it is clear that a substantial portion of it is the result of technological change, narrowly defined as the introduction of new methods of production or new products.

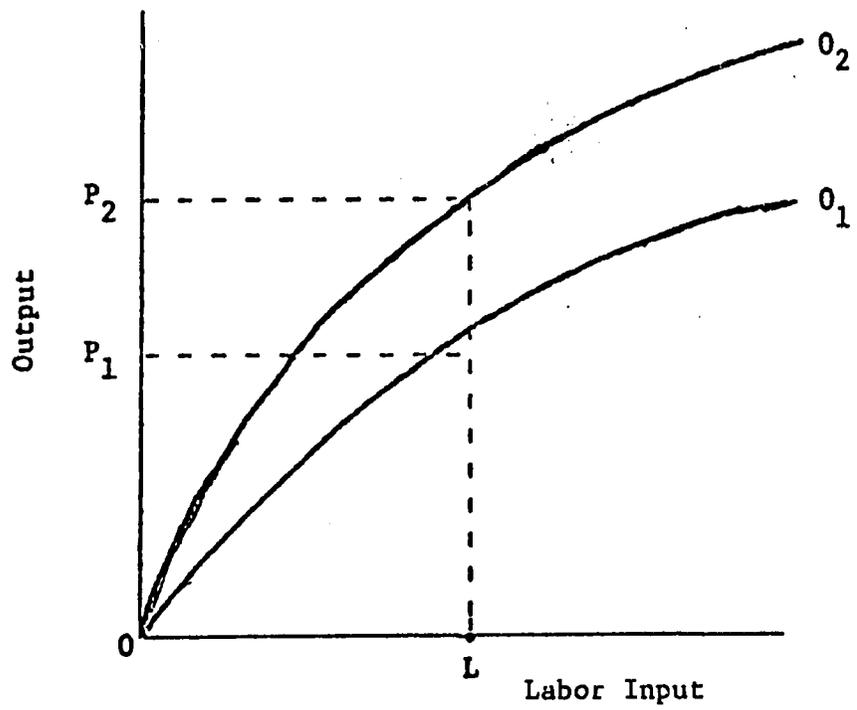
This view of technology and its impact of development is illustrated in Figure 1.

The horizontal axes measure the conventional inputs of labor (and other resources) which yield the levels of output shown on the vertical, production axis. When labor is OL , output is OP_1 . With a changed technology, we move to O_2 along which all factor inputs now yield higher levels of output, (e.g., OL now produces OP_2 .) Looked at this way, it is clear that technological change is essential to the pace of economic development. Thus, we return to where we started this introduction. Technological change and economic development are inescapable partners in the process of economic and social change. It is not really a question of whether the process will occur as much as along what lines, how and when.

The key questions then for developing nations (and the institutions and agencies which work with them) are what technologies will be

Figure 1

Effect of Technological Change on Output



O_1 = Technology A

O_2 = Technology B

available to them, either through their own internal efforts at generating new technologies or through adoption of technologies developed elsewhere; that is, indigenous research capacities and/or the transfer mechanisms. There are also questions regarding the evaluation or assessment procedures for the technologies transferred (or otherwise becoming available). Existing technology transfer mechanisms contain assessment procedures also, namely, whether from the perspective of the adopter the technology yields benefits to at least equal the cost of the acquisition. This calculus is most clearly defined in terms of the profit calculus of an individual firm. It is more difficult when the adopting unit is a government organization concerned with a broad set of national objectives (e.g., growth in output, minimum labor displacement) which may conflict with each other. The call for distinct technology assessment procedures involves the judgment that the existing assessment criteria contained within these mechanisms do not adequately capture or rank (by some normative standards) the full effects of technological change.

One final point is worth mentioning here. The "right" amount or rate of technological change is inescapably connected with one's theory of development. Leading-sector, import substitution or balanced growth approaches imply both a different "quantum" of technological change as well as a different mix of specific technological changes. To discuss the one without the other is not possible. Similarly, the "right" way of transferring technology or the "right" way to judge when the transfer has been successful also must proceed from some basic underlying view of what development means and also of how the economic system ought to be organized.

Technological Capability

A technological capability can be viewed as a set of skills, resources, attitudes and institutional arrangements which promote the development, acquisition, diffusion, and utilization of (cost-effective) new approaches. Heuristically, this capability can be subdivided into an examination of a country's capabilities in each of the several functional phases (invention-innovation diffusion; basic research-applied research-development-commercialization; problem definition and idea generation; invention, research and development, application and diffusion) which various authors have used to characterize the production and distribution of new knowledge.

A similar approach, following the stages contained in the December 1978 planning document prepared by the ISTC Planning Office, will be used in this paper. It should be noted, however, that use of these sequences, which correspond to what Havelock has termed the "rational, problem-solving approach," is mainly for purposes of exposition.^{2/} There is increasing evidence that the relationship between phases is neither linear or unidirectional. Thus, Kelley and Kranzberg note: "logically, innovation precedes diffusion; i.e., that which does not yet exist cannot be diffused. Logical priority is not the whole story, however. It is not always possible simply to adopt an innovation; often it must also be adapted to its new context of use. Such adaptation, although a form of diffusion, also involves the process of innovation, since modifications are required. Thus diffusion may precede and bring into being new innovations, as well as the other way around."^{3/}

Another example of this complexity of causation is suggested by the contrast between two different interpretations of the "stages" of technological change. Based upon their review of several hundred successful technological innovations, Marquis and Meyers posited the following stages in the innovation process:

Recognition → Idea Formula → Problem-solving →
 Solution → Utilization → Diffusion^{4/}

Based, however, on this study of the origin and commercialization of innovations in the field of scientific instruments, von Hippel has suggested a significantly altered set of stages, as outlined in Figure 2.^{5/} According to von Hippel, it is the users rather than the producers who are responsible for the creative or "problem-solving" stages of technological changes. Users also are held responsible for disseminating information concerning the characteristics of the new approach. Manufacturers, in this schema, are responsible for manufacturing and marketing (commercialization) stages.

Figure 2

Outline of User-dominated Innovation Sequences

User-dominated Stages			Manufacturers Role
Significant instrument improvement invented; built and used by users.	User diffuses results "how to do it" information via publication, symposium, visits, etc.	A few users build their own.	Instrument company introduces commercial version.

The import of these observations is to suggest the complexity of the sequences from determination of an R & D agenda to the successful implantation of a new (appropriate) technology. This conclusion holds whether the technology under study is an industrial process, an agricultural process, or a new medical product. The specific set of variables which affect the success of an R & D and technology transfer program will likely vary according to the characteristics of the technology being developed, but the general steps described below will have to be coursed in each case.

These observations also relate to the strategies followed by ISTC in determining the relative emphasis it gives in its operational activities to: (a) developing solutions where solutions do not exist; e.g., "basic research" on vaccines for tuberculosis strains not adequately controlled by existing vaccines; (b) testing new approaches for delivering existing "best-practice" solutions - a mode which most tightly fits the general usage of the term "technology transfer;" or (c) developing methodologies and institutional arrangements which provide a collaborating country with a "technology assessment" capability which can be employed both to gauge the desirability of changes generated by ISTC as well as the larger set of changes generated by other change agents (firms, government agencies) in a country.

The Generation of Technological Change

Two principal findings concerning the processes by which a nation's scientific and technological communities determine which problems they seek to solve are of relevance to ISTC's operations, particularly to

its identification of the "problems" which need to be solved. There exists a market or economic approach to the determination of R & D product selection which involves a formal interpretation of the common proposition that necessity is the mother of invention. Necessity, in an economic sense, is more properly defined as the prospective rate of return associated with the solution of different problems. Under this prospective, "problem-solvers" (e.f., scientists, engineers) channel their energies to solve those problems to which a society attaches the "highest" values as gauged by economic rates of return. The underlying assumption here is that problem-solving capabilities are scarce as with other resources, and that in a market environment their allocation is channeled by relative rates of return among competing ends.

There is considerable empirical support for this position, mainly for the developed economies, although it is not beyond criticism. More relevant to the interests of ISTC, however, is the relationship in this approach between science and technological change. Under this perspective, science as a stock and scientific discoveries as a flow are judged to be passive backdrops for the development of technological solutions. Science is seen as a passive constraint in determining what problems can be solved and the technical shape of the solution, but is not by itself seen as directly stimulating the development of new technologies. This finding is contained in a number of retrospective studies of the origins of important technologies (e.g., Technology in Retrospect And Critical Event in Science) and in Schmookler's studies of the economics of invention. At least for the period and set of inventions covered, these studies do not show any close timing between

the changes in scientific knowledge and technological change. Schmookler, for example, found that when inventions "are examined in their historical context, in most instance either the inventions contain no identifiable scientific component, or the science that they embody is at least twenty years old."^{6/} (Thus, for ISTC's purposes, a strategy of developing a scientific and technological capability in a country may involve a longer term perspective towards the solution of specific problems than if ISTC serves in effect as a project director who assembles a pool of technical experts to address the same problems).

Another branch of this economic approach to the problem identification stage of technological change emphasizes the dynamics of technological systems. The impelling element in these dynamics is that a change in one component creates an imbalance between it and other components of an existing technology. The interrelationships between spinning and weaving innovations in 19th century British textile technology or the interrelationships among plowing, cultivating, and harvesting technologies in 19th century American agricultural technology are examples of this tension. The dynamics is also described in the work of Nathan Rosenberg on focusing devices and inducement mechanisms.^{7/} Again, the dynamics of the process relate to a set of events which induce inventors to focus on specific problems. Scientific knowledge as such, affects the possibility of success and the form in which a solution occurs (i.e., whether it is likely to be a mechanical/chemical or electronic process), but does not provide an independent direction to technological opportunities.

The principal alternative perspective to these "demand-pull" approaches is that which sees the long-term technological vitality of a

society as requiring that its knowledge institutions be permitted to shape their own problem-solving agendas in terms of the internal norms by which the scientific and knowledge communities operate.^{8/} These norms serve to specify a priority ranking of the importance of different problems to be addressed. This perspective relates primarily to the criteria used to determine the level and pattern of support for R & D which are not directly or immediately related to market incentives, such as the development of public health techniques.^{8/} The traditional economic rationale for support of basic research is that such research (a) is a "public good" whose benefits cannot be captured by profit-seeking organizations, (b) provides the base for subsequent technological development, and (c) frequently yields serendipitous solutions to existing problems.

Differences in perspectives concerning the processes of problem identification coverage towards one central policy question. To what extent are the activities of the knowledge institutions (suppliers) linked to a society's demand for specific technologies? The question of the extent to which the activities (and incentives) of the supplier institutions are "optimally" integrated with the needs of the users has been raised, in most accounts of "national science policies" in the developed economies, as illustrated by several UNESCO and OECD reports.^{9/} These issues relate to the level of public support for R & D the allocation of this R & D by problem area, discipline and institution, and the system of sanctions or incentives which the government employs to channel the efforts of the knowledge institutions towards problems it wants to solve.

ISTC confronts the following issues in attempting to relate to the research and development institutions in cooperating countries: (1) the number and type of such institutions, (2) the capabilities of these institutions, (3) the intent to which these institutions share with ISTC the same set of concerns concerning the relative importance of solving specific problems in their own countries. Thus, ISTC may confront both a "capability" question and an "allocation" question. The same norms which are often held to channel scientific and technical personnel always from "applied" research may also exist in the collaborating countries.

The above analysis of the allocation of inventive activity toward market-determined goals reflects an environment in which inventive activity is conducted by profit-seeking individuals or corporations; that is, it assumes a market for knowledge. Where, however, knowledge institutions are funded through public monies, whether these be in the form of university appropriations, government foundations which channel funds to the research community, or governmentally operated research institutes, the question of the relative role of the funder and of the performer in determining the set of problems to be addressed is a point of tension between the two communities, regardless of whether the focus of inquiry be that of the OECD countries or those belonging to the U. N. Industrial Development Organization. Indeed, one of the initial activities which ISTC will likely have to undertake is an inventory, not only of social science institutions as called for in the paper by Brokensha, Horowitz and Scudder, but also research and development institutions, broadly defined to include industrial, academic and government organizations, in collaborating countries.

The point here is that the development of a capability in developing countries to generate a technology suitable to their own needs is likely to encounter the same set of problems now confronted by knowledge institutions in the developed countries. It is one thing for ISTC in its R & D mode to come to a decision, based say on input from its Advisory Board, that development of new vaccines is important to a country, and another thing for ISTC in its "capacity-building" mode to get the scientific institutions in that country to agree to work on the problem. These problems are inherent in the multiple objectives of such institutions. They relate directly to the meaning attached by ISTC to the concept of "capability." In one sense, a capability can be developed in terms of enlarging the corps of technical problem-solving personnel upon which an economy can draw. This approach involves many staple techniques: development of technical institutes; arranging for international exchange programs; subsidizing research areas. A capability, however, also requires a combination of incentives and social norms which induces this corps to work towards the development of the technologies required by the particular economy. Thus, not only must resources be made available to conduct the R & D which is necessary to develop solutions to specific problems, but the personnel engaged in this work must be assured that these activities will be rewarded within their home institutions.

The Stages in the Transfer Process

Let us look at each of the several stages outlined in our introduction above and present them in the context of alternative technology transfer process mechanisms.

a. Adaptation

There is an increasing recognition that the successful transfer of technology from a supplier to a user often involves the adaptation of the technology to meet the local needs or environment of the user.^{10/} This adaptation occurs in several ways. First, as indicated in studies of the diffusion both of industrial and of agricultural technologies in both the developed and developing countries, the early phase of the diffusion frequently involves the modification of a technology. This adaptation is often required to make an innovation applicable to a broader set of production settings and perhaps more importantly to enhance its economic attractiveness.^{11/} This adaptation can involve changes in characteristics of the technology to accommodate a different or more variable input mix than allowed for under pilot conditions, changes to account for a different range of outputs than was projected by the supplier, and changes to reduce its total input requirements. Rogers' has termed as "re-invention" this adaptation stage.^{12/} Reinvention means that the users frequently employ a technology in a different way and/or for different ends than was projected by the supplier.

The adoption of a technology thus involves not a simple one-step, dichotomous decision (adopt, not adopt) but rather a process of interaction between the user and the technology which determines whether or not a technology is used or the efficiency with which it is used, once adopted. These are elements of use which are dependent upon the skills of the users. What these skills are is less clear. At a minimum, it implies a technical capability in terms of skilled manpower who can operate a technology in a way that approximates the productive potential

projected by the supplier. It also may involve sufficient skills to adapt the technology where it is inappropriate to an existing situation, and skills to modify a technology to exploit potential gains within a given set of technological and economic parameters. More ambitiously, it involves the capability to perceive how the introduction of a single innovation creates opportunities for a recasting of other components in an interrelated technological system.

b. Utilization

Another finding in the recent adoption/diffusion literature that relates to ISTC program planning is that adoption and utilization are not synonymous terms or activities. This adoption/diffusion literature that relates to ISTC program planning is that adoption and utilization are not synonymous terms or activities. This adoption/utilization dichotomy means that several different outcomes may occur after adoption. Some of these differences relate to the efficiency with which the technology is used, others to the processes by which technologies become incorporated into the standard operating procedures of organizations. The first set relates to the extent to which the potential capacity of a technology is fully realized by the adopter. Physical possession (installation) as such is not necessarily synonymous with a contribution to productive use. The productivity of the technology will depend upon the extent to which the user has the supplemental skills necessary to reach the gains latent within it. Utilization also relates to the earlier topic of adaptation, namely, the extent to which a user can employ a technology in changing ways as input or output.

Utilization also has a second meaning which relates to the adoption of a technology within an organization. Unlike the case of the "individual" adopter (a household or a farm), where adoption and use are almost synonymous concepts, is the case of organizations. Two sets of decision makers (and decision criteria) may be involved. One group may be responsible for the decision to adopt a technology; another group may be responsible for implementing the technology. In a hierarchial structure, a decision may be made by managers to adopt a piece of equipment, but a decision may be made at the plant level not to use the technology or to use it in a manner which limits its impact. The intra-organizational steps by which a new technology becomes "standard operating procedures" have been termed "routinization" by Robert Yin.^{13/} Routinization is a multisequence process involving the redirection of operating procedures so that it is built around a technology. In terms of the development of technologies for other countries the key importance of this sequence is that the steps between adoption and utilization are usually intraplant activities. It includes activities built into the entire management and support structure of an organization. To achieve routinization generally requires that the promoter of a particular technology become more extensively involved in the activities of the users than is typically provided in a technology transfer program.

c. Diffusion

Diffusion research constitutes an embarrassment of riches. It is a subject which has been explored from many disciplinary perspectives. Rogers and Shoemaker, for example, identified seven "major" and six

"minor" traditions, and even their (1971) survey is dated.^{14/} From this research have flowed a large number of propositions concerning the characteristics of the elements in the diffusion process. Part of this research is organized along disciplinary lines, as noted by Rogers and Shoemaker, part along functional areas (health, education, agriculture). The difficulty in providing a summary statement is that a number of recent critiques of this literature have contended that there is an instability to findings emanating from these overlapping traditions. Instability means that variables found significant in one study have been found not to be significant in other studies, or, in different studies have been found to be significant in opposite directions. These differences at time reflect different disciplinary perspectives in terms of whether or not a particular variable is included or the form in which a variable is operationalized. At yet other times they relate to the extent to which findings say on "significant" variables in the diffusion of educational practices are generalizable to the diffusion of medical innovations.

This ferment within the field raises questions as to which of the number of readily available propositions (e.g., role of "opinion leaders") can with confidence be put to use in program design. Moreover, much of the recent literature focuses on the interaction of variables and the larger setting within which decisions to adopt innovations are made rather than on specific variables (or "levers"). While this orientation is compatible with and indeed supports the position taken by ISTC of the need to strengthen the capabilities of the collaborating countries, it also complicates the formulation of specific programmatic approaches. Thus, within diffusion research today greater attention is now paid to

the processes by which an adopter determines whether or not an innovation is suitable to his needs than on the characteristics of the adopter (i.e., education, social class) or on the channels through which this information is provided. The concepts of "selection environments"^{15/} or "diffusion milieus"^{16/} have begun to displace the narrower if more readily tested concepts of adopter characteristics or information channels. Moreover, a contrast is increasingly being made in the diffusion literature between those findings which apply to the behavior of individuals and those which apply to the behavior of organizations. The further contention is then made that the transfer of findings which apply to the behavior of individuals, the "classical diffusion paradigm, as it has been termed," to the behavior of organizations is inappropriate in many cases.

There is, of course, an extensive body of literature on the characteristics of innovativeness and diffusion among organizations. For much the type of reasons cited above, this body of research is also held to be of limited validity. In general, there is a lack of consensus concerning the validity and salience of diffusion research as a guide to specific technology transfer strategies. In part, this ferment reflects the fact that diffusion today is seen in a much broader context than in traditional studies. As noted in a 1978 conference held to assess the state of this field, diffusion research in practice now encompasses a longer section of the continuum from invention to impact than was true in its paradigmatic days. What was formerly viewed primarily as a question of adoption of exogenously generated innovation, first, by an individual

and then by some larger population has now been broadened to include (a) the influence that adopters exercise on suppliers to shape the characteristics of the innovation which will subsequently be diffused among them; (b) the impact that the strategies and activities of suppliers of innovations have upon patterns both of earlier adoption and subsequent diffusion; (c) the processes by which an innovation is routinized within an organization; and finally (d) the impact of the innovation upon the activities of the adopting organization."^{17/}

There is then both an array of findings readily available and disarray within the research community concerning the validity of specific findings in given settings. The following is a summary of those findings which seem to be most applicable to ISTC's planning activities rather than as a manual of prescribed diffusion techniques.

(1) Diffusion takes time. Adoption is rarely instantaneous or complete. A historical perspective is necessary in formulating programs or in evaluating the impact that any specific approach may have on accelerating a process of diffusion.

(2) An innovation frequently undergoes modification during the diffusion process. This point relates back to the earlier discussion of adaptation and reinvention and ties in quite closely to the concept of capacity-building. The issue here is that efforts to promote the incorporation of an innovation may also require prior assistance to the user so that it possesses an ability to adjust or to alter the innovation to the specific environment within which it will be used. Capacity-building is thus an integral part of the process of technology transfer.

There is a subsidiary problem here in evaluating the effectiveness of any technology transfer program. The adaptation or reinvention process often involves a sufficient modification of the item being diffused. It thus is not always a simple matter to operationalize the meaning of "adoption." This problem will likely occur at the evaluation stage of a program, but it does suggest that throughout the program planning process there is a danger in a misplaced concreteness, of considering innovations as unitary or unchanging entities.

(3) Consideration must be given to the institutional characteristics of potential adopters in determining which of the set of variables or relationships are likely to effect the diffusion process. In particular, attention should be given to whether or not the intended user is an individual (i.e., a farmer or a household), or an organization. There has been an uncritical transfer of concepts relating to the diffusion of innovations among individuals to that of organizations.

(4) A decision to adopt an innovation may occur at one level, but decisions affecting how that innovation is used may occur at other levels within the organization. This disparity can create major problems in the effective utilization of the innovation. Moreover, strands in the literature on organizational behavior differentiate between those attributes of an organization which affect its ability to search out and adopt new practices and those which affect its ability to reshape an organization to accommodate these new practices. The implementation/routinization stage often involves the development of a broad coalition of actors within an organization and attention to a different set of incentives or behavioral pattern than those which led to adoption.

(5) There are major differences in the emphasis given to various variables or relationships and the diffusion process depending on disciplinary perspectives. For example, a major strand in the sociological or organizational behavior literature is that communication flows between suppliers and adopters and then between adopters and non-adopters are significant determinants of the rate and extent of diffusion. This approach is most frequently couched in terms of the two-step diffusion processes in which earlier adopters or cosmopolites are more likely to search out new approaches and to be more ready to adopt them than the majority of the potential adopters. The second part of the diffusion process occurs when nonadopters cue off the behavior of the adopters and become adoptions. Diffusion thus is seen as a process of emulation and imitation. An alternative approach emphasized, more by economists than by other disciplines, is that the relevant information for certain types of innovations, for example agricultural technologies, is, in effect, transmitted via market signals. The diffusion dynamics here begins when certain firms respond more readily than others to the profit potential of new innovations. It is then reinforced as the behavior of these firms affects prices and costs in such a way as to require that other firms within the economy adapt to these changes.

The extent to which these diffusion relationships (e.g., communications flows, market forces) are couched in either/or terms, a characteristic of the early debate among disciplines, has been muted, but there is nevertheless a clear difference in emphasis among disciplines. Economists, for example, tend to focus more on the set of incentives for adoption or non-adoption behavior than on other variables. They tend to suggest promotion of the diffusion of technologies can be more effectively stimulated by

insuring that the economic conditions associated with new innovations can in effect be transmitted through a market environment rather than on developing information dissemination systems. In effect, this emphasis involves reducing or eliminating legal or other social restrictions on the flexibility in prices and wages. Sociologists have tended more to emphasize the "characteristics" of the individuals who are the "early adopters" of an innovation, and the spread of influence from the actions of these individuals to "followers" within a social network. The "programmatic" thrust of this orientation would thus be directed at identifying "leaders" within a community and on programs which foster the exchange of information.

(5) The institutional context within which diffusion is to occur must be specified. There is a general absence in the planning documents produced by ISTC of references to the characteristics of the technology delivery systems into which its operations will be melded. One assumption is that, as a government body, ISTC will relate to government bodies in other countries, who will then develop their own diffusion networks. The extent to which ISTC will be able to influence or to relate to non-governmental diffusion channels is not clear. To what extent will ISTC seek to foster the transmission of appropriate technologies from firms within the United States to firms within the countries with whom it enters into relationships? To what extent will ISTC be organized so as to capitalize or even to develop the transmission mechanisms for new technologies which are often associated with the performance of market oriented economies? It must not be forgotten that transmission mechanisms likely already exist within a country most probably related to market

conditions. The operation of any new capacity-building organization is not neutral with respect to its impact on the viability of technology delivery systems in a given country. Conceivably one could use the activities of ISTC to strengthen the public vs. the private roles or the reverse without any clear guidance from the research literature.

Institutional and Organizational Aspects

The framework within which ISTC proposes to operate is consistent with the body of recent research findings on the processes of technological change, especially in the emphasis on process rather than comparative statistics and in the recognition that adopters are not passive recipients of externally generated solutions. The stated philosophy of ISTC represents a much needed alternation in the conventional framework and design of technology assistance programs, whether these be between levels of government within a country or between different countries. The proposed guiding principles for ISTC, however, do run counter to the mainstream of government programs and as such cannot help but be vulnerable to the systems of accountability, evaluation, and budget review increasingly required for publicly funded programs. The emphasis in the above analysis on the length of time necessary for change to occur and the likely heterogeneity of final outputs that ensue from a capacity-building program run counter to bureaucratic needs for immediate and discrete measures of output, such as the number of farms or organizations in a cooperating country which have adopted a specific solution. The potential effective strategies contained within the ISTC planning documents may quickly run up against political and bureaucratic realities

of defending program plans and budget submissions. The key to the success of ISTC may be less its adherence to specific theories which flow from the literature on technological change than to its ability in the face of the internal pressures of government organization to remain on a path, however roughly hewn, consistent with recent social science findings on the processes of technological change.

In discussing possible solutions to problems these days it is common to stress the importance of organizational and institutional forms. Thus, a separate agency is frequently created in the public sector to undertake (or at least encourage) research and development; another agency to deal with the transfer itself; and yet another to assess and evaluate the outcome. As perhaps is clear by now, we regard this arrangement as wrong. Such organizational segmentation arbitrarily divides what is (and should be viewed as) an integrated process from initial development to final assessment. ISTC, or any other problem-solving group, must deal with the entire process. To do this almost certainly means dealing with and interacting with the other integrated transfer mechanism, the market.

Evaluation and Assessment

The process of effecting the "transfer" of a new technology does not end with the adoption. In fact, the process must always be a trial and error one, with some of the new technologies proving successful and continuing in use, while others are dropped after proving unsuccessful. Measures of "success" lead back to the question of what is the basic objective of a technology cooperation program. We have already suggested that new technologies contribute to economic development mainly through

increasing the total productivity of factor inputs. This framework most clearly applies to those technologies which are directly related to the production of goods and services. Indeed, we would suggest that the concern for appropriate technologies rests upon the judgment that earlier "received" technologies, regardless of whether they were installed for agricultural or industrial uses, did not, in fact produce sustainable increases in production efficiency.

This criterion of productivity improvement has, in recent years, been subjected to criticism for many reasons. Two main lines of attack warrant attention here. First, the full, social, "spillover" costs of the technology are not likely to be taken into account by the private decision. A change in the technology of the automobile industry may have a profound environmental or ecological effect, profit-seeking firms have little incentive to take these effects into account when they make decisions. The evolution of the technology in strip mining of coal is an even better example. Gigantic draglines now make it economically profitable to exploit low quality, thin surface deposits of coal. They also have a devastating environmental effect. When these external effects are fully internalized into a firm's decision (through taxes or charges) the operation may not be profitable after all. But, note that even allowing for such effects, some type of economic test of the desirability of the technology is useful and appropriate.

It is sometimes argued also that the market is too short-sighted and insists on a quick pay-out of its investment, thus tending to undervalue longer-run social needs and benefits. This may well be so

(although some private firms have shown remarkably long-run planning horizons) but, even if so, the issue is simply one of which discount rate to use on future profits.

In sum, even at a zero discount rate of future profits and with a full internalization of all costs, an "efficiency test" (social, private or otherwise) may remain the best evaluation or assessment procedure.

A second theme in some recent criticisms of the market-oriented evaluation and assessment procedures has been associated with the phrase "appropriate technologies" coined by the late E. F. Schumacher.^{18/}

In his original version of this concept, Schumacher argued that modern, capital-intensive technologies were frequently "transferred" to developing nations when they were not "appropriate," given local factor endowment, relative costs and also consumer tastes and needs. In the main, this argument has become a celebrated vehicle for advocating labor-intensive, small-scale handicraft type technologies and industries. But, many of those making the greatest use of the concept and the phrase have not read Schumacher carefully or fully thought out the situation he describes. For the roots of the problem of using "inappropriate" technologies lie in the use of inappropriate criteria in selecting technologies. If a firm chooses capital-intensive techniques solely to gain prestige or to boost the ego of the manager, this will almost certainly not be economically optimal either. Or, if misguided government policy underprices capital, thus encouraging "excess" use of capital, the "inappropriate" decision is not that a "market" test was inappropriately applied but that the "signals" generated by the market did not accurately reflect opportunity costs. In short, "appropriate technologies" are very likely to be efficient as well. Schumacher himself frequently

referred to the fact that government officials and university professors were far harder to convince regarding his ideas than ordinary businessmen. For businessmen owe allegiance to economic accounting and profits, where the others gain from the prestige and large budgets deriving from large-scale long-term research, development and capitalization projects.

To sum up, assessment should mean assessment of all consequences, those external and those internal to the unit using the technology.

Part II: Answers to Specific Questions

1. What can social science methodology offer to the better design of technology transfer?

Social science methodology enters in the design of technology transfer program in several ways. There is a sizeable literature, written from the perspectives of several different social and behavioral sciences, on the characteristics (variables, relationships) which affect the likely success of R & D and/or technology transfer programs. Implicitly or explicitly ISTC has been and will draw upon this literature in shaping its organizational structure (e.g., an Advisory Board to generate "user needs"), in selecting various modes of collaboration, and in determining its involvement in the various stages in the sequence from R&D to routinization.

Second, of interest to ISTC, is the emerging theme in this literature that development of technological capacity on the part of the user is a needed element in the operation of a technology transfer program.

Third, it is important for ISTC to be aware that the field of technology transfer is in a state of disarray. Moreover, there are few widely accepted action principles directly derivable from this literature. Although there is growing recognition that "technology-push" as such is an inherently limited approach, there is considerable disagreement concerning not only the efficiency of existing transfer approaches but also the potential effectiveness of proposed alternatives.

The social science literature which bears upon the multiple objectives established by ISTC embodies a collection of findings concerning the importance of different variables and different relationships from almost every social and behavioral science discipline. The difficulty here is that not only are the findings at points so extensive as to be unmanageable in program design, but that the significance of different variables varies depending on the disciplinary perspectives that one takes.

Beyond, however, these cautionary comments about its immediate utilization value in formulating programmatic approaches, social science methodology is of considerable relevance to ISTC, if only because it demonstrates that the development and transfer of technology is a process rather than a static target definable in terms of a single measure or objective. Many past technology assistance programs have been built on the assumption that building (or offering) a better mousetrap automatically attracted adopters. Such programs have also tended to focus on speciously concrete output measures of success--such as a given figure or percent increase in research and development expenditures, or similar targets for the degree and extent of adoption of a technology among a set of adopters.

The focus in the ISTC planning documents on the process of technology transfer is strikingly close to that used in the developed countries to

describe the need for approaches which integrate the needs of a nation with the type of research and development which is supported by public funds, and the need for methodological and institutional procedures for assessing the impacts of technologies. The analytical perspective needed for determining the programmatic content of many of ISTC's objectives, such as developing a technological capability in collaborating countries, is not solely a function of a comparison of levels of economic development among nations. Rather it requires a consideration of the technological problems to be addressed (which relates to assumptions about national development strategies) and the set of assumptions one makes about the existing capabilities of the knowledge institutions within the recipient countries.

Another contribution social science can make to any aspect of the operations of ISTC is to insist that a simple, rational framework be employed in decision making; resources (including time and administrative capacity) are scarce; needs and aspirations limitless; and conscious, purposeful decisions necessary. A holistic approach which incorporates an understanding of several stages contained in the process of the technology transfer, with a strong dose of pragmatism is required.

2. What can the social sciences add to evaluate the consequences?

Again, there is a sizeable and growing literature on the evaluation not only of technology transfer programs but of techniques to be used in gauging the impacts of technological change on societies. These include project selection studies, evaluations of the cost-effectiveness of alternative technology transfer techniques, cost-benefit procedures, and

technology assessments. As we have noted throughout our paper, the immediate issue for ISTC is less the availability of a body of social science knowledge upon which to draw than the determination of which of this literature is most appropriate in a given setting.

There are, however, two additional issues which are raised in Warwick's paper concerning the evaluation of consequences which are of relevance to ISTC's activities. Prospective evaluation of the consequences of a technology is a complex matter, often requiring considerable time, expertise and resources. To the extent that ISTC requires the equivalent of "technology assessments" before it undertakes an R&D or technology transfer program, it will tend to increase the front-end costs of such projects. It will lengthen, perhaps significantly, the period of time between a decision to commence a program and the date at which actual operations begin. It may also serve to compel either ISTC or the collaborating countries to include as part of their planning staffs individuals with the skills and training necessary to conduct such assessments.

Questions of appropriate assessment techniques and requisite personnel aside, the issue of evaluation raises a set of questions related to criteria by which a technology will be deemed to be "appropriate" or not.

As we note in Part I, market tests of profitability do not always provide either for the full range of effects of a technology upon a society (e.g., the case of externalities) or for a socially optimal level of investment in research and development in certain areas (public health practices). The economic test of usefulness can be modified to include social, ecological and environmental considerations and still provide a useful

framework for assessment and evaluation. There is a danger (and a misinterpretation of the concept) of employing the concept of "appropriate technology" to justify the development and promotion of technologies which fail to meet economic tests, as modified above.

Finally, in formulating evaluation criteria, ISTC will inevitably confront the issue raised in Warwick's paper, namely the extent to which any external organization is justified in introducing disruptive changes into society. This issue is too complex to be answered in the context of this paper. We would suggest, however, that, for many purposes, change and disruption are synonymous terms, and that, indeed, from the perspective of some groups within the collaborating countries a major objective in introducing change (whether these be in agricultural practices or communication systems, two fields in which ISTC proposes to operate) is to alter (e.g., disrupt) existing social arrangements. Distinctions between change, alteration, and disruption are normative concepts. We doubt very much if there are any actions that can be undertaken by ISTC (except possibly frequent meetings with its advisory board) that cannot be charged with seeking to alter (with the associated negative connotations) the existing situation in the collaborating countries.

3. How can social sciences be built into the mechanism?

The very design of ISTC's activities, including decisions concerning the extent of its involvement in the various segments of the technology transfer process, the form of relationships it enters into with collaborating countries, and the characteristics of the evaluation and assessment procedures it employs require a social science perspective. At a minimum,

to the extent to which it is not already present, ISTC should take steps to include this perspective in its planning operations. The most effective means for insuring that the perspectives described in Part I of this paper are incorporated into the ongoing operations of ISTC are to first employ personnel with the requisite social science skills, and to then develop the internal organizational procedures required to have this perspective represented in decisions concerning programmatic approaches.

ISTC should also draw the assistance of social scientists in setting forth the evaluation methodologies and data requirements to be used in evaluating the impacts of its operations. Evaluation of government programs all too frequently has been a post hoc endeavor, in which outside evaluators are brought in after a project has been completed to determine its impacts. A common problem of such an approach is that little attention is paid to the development of base line points of reference or to the documentation of project activities. The quality of an evaluation effort, holding other basic conceptual problems of measurement of outcomes, is likely to be enhanced if attention is paid in the planning stage of an activity to the type of information needed to a subsequent assessment. Again, this is a perspective and a set of skills which is likely to flow from having within ISTC personnel trained in evaluation. But, the assessment procedure must still use a framework which looks at costs, benefits and distributional impacts through time. Any other assessment procedure runs the risk of substituting totally arbitrary criteria for project and/or technology selection which in the end becomes simply "planners preferences." Evaluation should mean simply a continued, ongoing assessment which is also built into the mechanism of transferring and using the technology.

Footnotes

1. Schmookler, Jacob. Invention and Economic Growth, (Cambridge, Mass.: Harvard University Press, 1966) p. 1. See also: W. F. Ogburn, "The Meaning of Technology" in: F. R. Allen et al., Technology and Social Change, Appleton, Century-Craft, 1957.
2. Havelock, Ronald. Planning for Innovation, (Ann Arbor, Michigan: Center for Research Utilization of Scientific Knowledge, 1971).
3. Kelly, P. and M. Kranzberg, editors. Technological Innovation: A Critical Review of Current Knowledge, (San Francisco: San Francisco Press, Inc., 1978, p. 11)
4. Myers, Sumner and D. Marquis. Successful Industrial Innovations, (Washington, D.C.: National Science Foundation, 1969).
5. Von Hippel, E. "The Dominant Role of Users in the Scientific Instrument Innovation Process," Research Policy, (July, 1976) 221-239.
6. Schmookler, Jacob. op. cit., p. 67.
7. Rosenberg, Nathan. "The Direction of Technological Change: Inducement Mechanisms and Focusing Devices," Economic Development and Cultural Change, (1969).
8. See Shils, E., editor. Criteria for Scientific Development, Public Policy and National Goals, (Cambridge, Mass.: M.I.T. Press, 1968).

9. Spaey, J. Science for Development, (Paris, France: UNESCO, 1971).
10. Radnor, M., I. Feller and E. Rogers. "Research on the Diffusion of Innovations by Organizations: A Reappraisal," in The Diffusion of Innovations: An Assessment, edited by Radnor, Feller and Rogers (Evanston, Ill.: Northwestern University, 1978).
11. Nasbeth, L. and G. Ray, editors. The Diffusion of New Industrial Processes (Cambridge: Cambridge University Press, 1974). Hayami, Y. and V. Ruttan. Agricultural Development: An International Perspective (Baltimore, MD: Johns Hopkins Press, 1971).
12. Rogers, E. "Re-Invention During the Innovation Process," in Radnor, et al., op. cit.
13. Yin, Robert. Changing Urban Bureaucracies: How New Practices Become Routinized, (Santa Monica, Calif: Rand, 1978).
14. Rogers, E. with F. F. Shoemaker. Communication of Innovations: A Cross-Cultural Approach, (New York: Free Press, 1971).
15. Nelson R. and Winter, S. "Neoclassical vs. Evolutionary Theories of Economic Growth: Critique and Prospects," Economic Journal 84(1974), 886-905.
16. Feller, I. and D. Menzel,. "Diffusion Milieus as a Focus of Research on Innovations in the Public Sector," Policy Sciences, 8(1977), 49-68.
17. Radnor, M. op. cit.
18. Schumacher, E. F. Small is Beautiful, (New York, 1971). See also: Charles Weiss, "Mobilizing Technology for Developing Countries," Science, Vol. 23 (March 16, 1979), 1083-1089.

II. ORGANIZATION AND MANAGEMENT
IN THE
INSTITUTE FOR SCIENTIFIC AND TECHNOLOGICAL COOPERATION:
SOME KEY ISSUES

Donald P. Warwick

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ABSTRACT

This paper examines four questions relating to the organization and management of the Institute for Scientific and Technological Cooperation. The first concerns the institute's central administration and staffing. Recommendations include considerable autonomy vis-a-vis Congress, an attractive career track for Foreign Service personnel, incentives for recruiting top-flight short-term staff, and the development of an institutional memory. The second question deals with relations between ISTC's central and field offices, and especially the latter's autonomy. The paper suggests that steps be taken to avoid long delays in project reviews and that limits be set on "selling" projects overseas. The third topic is ISTC's relationships with its collaborators in the developing countries. The author recommends genuine collaboration in project initiation and execution, experimentation with projects in two or more developing countries, arrangements for equalizing the resource contributions of the collaborators, and regular evaluations of the effectiveness of collaboration. Most of the paper is devoted to the fourth topic, the issues arising in field testing. Several specific recommendations are made in this area, including the effective integration of planning and implementation; careful assessment of the contexts for trials; attention to the dynamics of implementation, and improved methodologies for evaluation. The author strongly emphasizes the need for continuing evaluation as a key ingredient in ISTC's success. He also urges attention to the ethical dimensions of ISTC's work, particularly the protection of human subjects in field tests.

INTRODUCTION

This paper addresses the following questions concerning the organization and management of the Institute for Scientific and Technological Cooperation (ISTC):

In general, what is the role of management systems in understanding development technologies? How will the internal organization of the institute affect its possibilities for action? What management issues arise in the relationships between ISTC and its collaborators in the developing countries? How can an organizational and management perspective improve the testing of development technologies in field settings?

The organizational and management questions facing the ISTC revolve around four critical issues: (1) the design, operating style, and de facto autonomy of the central office, including its relationships with Congress and other executive agencies; (2) the relationships between the central and field offices; (3) the relationships between the previous two and cooperating institutions in the developing countries; and (4) field testing. These issues are obviously interrelated. If, for example, Congress chooses to hold a tight rein on the central office, the field offices may not have the flexibility necessary to adapt field testing to diverse economic, cultural, and bureaucratic conditions across countries in the region. Similarly, if the central and field offices basically retain the power to make the key decisions about priorities, institutions in the developing countries may reject the terms of cooperation as imperialistic or paternalistic. Field testing could also be severely constrained if the central office demands clear and tangible "results" in such areas as population control as a condition for continued appropriations. Such pressures could undercut the entire set of relationships, and place ISTC initiatives in roughly the same position as some development programs financed by AID.

Discussion of these four issues should be prefaced with a broad observation and an overarching recommendation.

The observation is that the state of knowledge in organization theory, management studies, and implementation research is exceedingly limited with respect to an innovative agency such as ISTC. While there are dozens of studies bearing upon one or the other aspects of its intended structure and operation, there is simply no firm basis for generalizing about, much less prescribing for, this new entity. There are analogues in the U. S. federal government, including the National Science Foundation and the National Research Council, but none of these agencies faces the same complexities in relationships with the developing countries. The International Development Research Centre of Canada, on the other hand, is partly similar in mission to the ISTC, but comes out of and operates within a distinct governmental setting. The Canadian legislature is much less prone to intervene in the operations of executive agencies than its U. S. counterpart. Thus the relevant literature and the experience of organizations such as the IDRC will be helpful in pointing to problems, likely issues, and organizational possibilities, but there is now no valid basis for prescribing in any detailed way how the ISTC should be organized and managed.

The recommendation flows directly from this admission of limited knowledge:

During at least its first five years of existence, ISTC should, within reasonable limits, regard its own structure, management style, internal relations, and interactions with organizations in the developing countries as a continuing experiment, subject to evaluation and change at regular intervals.

Rather than wedding itself to a bureaucratic structure and management system which may prove inappropriate but then difficult to dislodge, ISTC should give itself a period of at least five years to try out alternative ways of organizing, and self-consciously seek to evaluate them once a year. Such a move would be virtually unprecedented in the U. S. federal bureaucracy, and would face strong obstacles from those who like neat structures of accountability. But if there are no readily applicable models, and no comparable cases from which to generalize, would the temporary confusion of tentativeness not be better than the permanent constrictions of closure? And would it not be uniquely appropriate to ISTC, whose mission is to encourage flexibility and experimentation, to apply those same principles to its own organizational evolution? There would, of course, have to be limits to such reflection and change, for concrete work must be done if the institute is to have some experience to evaluate. But it would not

be unreasonable to have a detailed annual evaluation not only of programs and projects, but of the organization's internal structure, relationships with the field, and other aspects of management. To have this flexibility the senior officials of ISTC, ideally with the backing of Congress, would have to ward off pressures to have this fledgling organization take on the familiar trappings of a federal agency. Hierarchy could not be cast in concrete and rules chiseled in stone if the institute is to retain the potential for adaptation to its own unique circumstances.

In seeking appropriate models for organization and management, ISTC might profit from a careful examination of other governmental organizations with a proven record of flexibility and innovation. Two obvious examples would be the National Aeronautics and Space Agency in its early history, and the Peace Corps under Sargent Shriver. NASA would be a particularly relevant example because of its heavy involvement with science and technology. It would be useful to determine how this agency succeeded in negotiating considerable scope for initiative within the confines of the federal system, how it was able to attract outstanding talent to the government service and how, in general, it was able to remain innovative in the face of all the usual pressures for bureaucratic conformity.

CENTRAL OFFICE

A set of decisions with crucial implications for the future of ISTC are those concerning its central administration. Unfortunately, much of this planning must be done in a vacuum, for no one has, nor can have, a precise idea of what this institute will do, of the problems it will meet, and thus of the organizational forms most appropriate to its mission. Under such conditions of uncertainty ISTC will do well to avoid the conventional departmentalized bureaucracy, with its known propensities to rigidity. At the same time someone must be in charge, staff must be hired, expectations will be created, and patterns will be set that may be difficult to reverse unless self-correcting mechanisms are built in from the outset. The following are some fundamental administrative and management questions which have not been adequately addressed in the existing planning documents.

First, how much autonomy should and will ISTC have in its relations with Congress, including the Congressional staff? Flexibility in the current foreign assistance program is greatly constrained by tight legislative control over aid programs. Given the ambitious and yet rather general mission of ISTC, the organization would be hobbled at the starting gate if it had to follow the de facto clearance procedures now seen in AID. These are not only

time-consuming, but lead to an exaggerated specificity that is totally at variance with the flexibility and collaborative style sought by ISTC. Perhaps this question could be openly discussed with the key legislative sponsors and overseers so that the necessary autonomy can be negotiated. If the institute is to achieve its goals, legislators and legislative staff members will have to refrain from interventions in the implementation of specific field projects.

Second, what will be the career implications of service in IFTC for Foreign Service Reserve Officers (FSR's)? The planning documents indicate that the career service will be the same as that of the bilateral aid program, with special provisions for obtaining needed talent in given areas of specialization. If the career service is to be the same, the problems now seen in AID will also carry over to ISTC, and may be aggravated by certain features of this new organization. For example, will ISTC try to develop its own career tracks, or will FSR's on assignment there eventually move back to AID or its successor? It is no secret that the pinnacle of service for many AID staff members is the post of mission director. It is also no secret that some kinds of assignments in AID (e.g., program officer) are more likely to lead in that direction than others (e.g., training officer or education advisor). Where will ISTC fall in the

perceived reward structure? Will it try to develop its own "plums" equivalent to the mission director appointment, or will it assume that service here is temporary and the pinnacle will be attained elsewhere? If the latter, how will the FSR's regard the career implications of service with ISTC -- as an interesting diversion that will neither help nor harm advancement in the "mainstream?" as a potential dead end that will be harmful if not fatal to long-term career ambitions? And what will these perceptions do to the recruiting possibilities for ISTC? Will it be an assignment that is avidly sought for its intrinsic interest, and which thus attracts the best FSR's, or will it be seen as a cocoon for the incompetent or a diversion for the dilettantes? Anyone familiar with the assignment and promotion process in AID knows perfectly well that these perceptual factors make an enormous difference for who goes where in the organization. The institute would be wise to give these questions some very tough thought before recruiting its initial staff. Moreover, once this group is on board it will create a certain image which will further affect ISTC's ability to attract and retain the quality of personnel it desires. An institute perceived as a hub for the talented will have quite a different effect than one dismissed as a haven for the unwanted.

Third, what will be the incentives for and the expectations of non-career specialists? Present plans envisage a corps of term specialists from other agencies, inter-governmental personnel agreements, universities, private industry, and the developing countries. The assumption is that this group would see its work with ISTC as temporary. One issue raised by this policy concerns the caliber of individuals who will be willing to take leave from their usual posts. At first blush it does not appear that the incentives would be sufficient to attract really top-flight personnel, although much would depend on the specific arrangements made. A second potential problem arises from the personnel mix produced by this unusual combination of foreign service personnel and temporary specialists. Unless ISTC develops a new career track in the foreign service, in all likelihood the FSR's appointed to this organization will be individuals whose capacities are stronger in the bureaucratic side of foreign assistance than in applied research. AID does not have a cadre of researchers, such as is found in the National Institutes of Health, who could be transferred to ISTC. The term specialists, on the other hand, will usually be professionals whose interests and experience are in either basic research or in R & D. The difficult questions, then, are (a) whether these two groups will mix well to form an effective headquarters and field staff;

and(b) whether the experience gained from the term specialists will be in any real sense cumulative -- will there be a genuine organizational memory? If, for example, ISTC gains valuable insights from a series of field trials on agricultural technologies, and the specialist in charge of evaluation leaves the agency after three years, who will ensure that the lessons learned are not only written up but incorporated into the Institute's operating wisdom? The foreign service personnel are not likely to have the technical knowledge to carry out this task effectively, while successors to the original specialists will lack the experience and broad understanding of what happened.

This discussion suggests three recommendations concerning the personnel structure of ISTC:

1. ISTC should take steps to develop a new and attractive career track for highly capable Foreign Service personnel. Specific consideration should be given to creating a professional career for a small number of Foreign Service officers who would remain in the institute as continuing specialists on development technology.
2. ISTC should consider ways of creating incentives for the recruitment of highly talented short-term specialists. Specific attention should be given

to the possibility of strong scientific and professional incentives, such as those flowing from the opportunity to conduct innovative research in new settings. From all indications the proposed personnel arrangements for short-term specialists are unlikely to attract truly top-flight talent to the institute.

3. ISTC should establish a permanent evaluation unit or some other appropriate organizational mechanism to serve as an institutional memory. While the principle of continuous staff turnover is sound, there should be at least one part of the institute which knows in some detail what has been learned from experiments to date, and which can feed that information back into the planning process. One possibility is an evaluation unit with a core staff of perhaps 10 professionals, including Foreign Service and Civil Service appointees.

While the institute does plan to rely on networks of outside collaborators who will stay with the same problem over a period of several years, there is no substitute for an internal staff that is thoroughly familiar with, and has full access to, work carried out in a given area. Also, there would be a great advantage in having a single group

to inform a task force working on, say, agriculture about relevant information and field experiences in other areas, such as health. The "memory" being suggested here is not a computer with a sophisticated retrieval system, but a set of highly qualified individuals who can relate directly to the various task forces and individual scholars involved.

HEADQUARTERS--FIELD RELATIONS

A second area raising significant questions of organization and management is that of relationships between the central and field offices. The comments on this topic can be fairly brief, for the issues here are roughly the same as those encountered in the dealings between AID/Washington and the overseas missions. Nevertheless, a few questions should be carefully examined in the specific context of ISTC.

The first and most basic concerns the degree of financial and professional autonomy to be granted to field offices. While current planning documents do seem to allow for some autonomy, they are silent on the most difficult questions. For example, will the central office accept the judgment of field representatives that a given project meets reasonable standards of quality, or will it have a detailed reviewing system in Washington? If the latter, what standards of project appraisal will be instituted, and what will be their implications for the timing

of field activities? One of the major difficulties in the present arrangements for AID grants and loans is that the reviewing system, with multiple and overlapping clearances, creates delays averaging more than two years between the initiation and execution of a project. In the interim key personnel in the AID mission and the local government may have changed, so that the interest and momentum seen at the time of submission have substantially waned. But here ISTC is in something of a bind, for if its overseas staff are basically foreign service officers without the technical expertise to evaluate projects, the organization will have to rely on central office review, while if it is to have technical specialists overseas, it may have to shift more of its projected short-term staff to the regional offices. This arrangement might work out if the specialists are given specific responsibility for reviewing proposals, but much time would be lost if their reviews were repeated in the same detail in Washington. At the moment it is unclear exactly what the field offices will do, who will staff them, and how they will relate to Washington. Whatever the decisions made,

ISTC should adopt a system in which project review takes no more than a year at the outside, and for most projects takes no more than six months.

Longer delays will be demoralizing to all concerned, and will seriously undercut the commitment necessary for implementation.

Another issue which must be faced is the extent to which the central office will be permitted to "sell" projects to the field posts, or even directly to interested collaborators in the developing countries. Much can be learned in this respect from a careful analysis of the behavior of the Office of Population in AID. Over the past 12 years, and especially in the late 1960's, the population unit vigorously pushed its particular line of activities and technology, sometimes in full collaboration with USAID missions, sometimes without. In more than one country population officers, with strong encouragement from their superiors in Washington, worked diligently to sell family planning at a faster pace than senior mission staff thought advisable. In other cases the Washington office took advantage of its relationships with intermediary organizations, such as the International Planned Parenthood Federation, to finance family planning activities that were not expressly approved by the local missions. This question will undoubtedly arise anew for ISTC, especially in fields, such as population, that are often of greater interest to the U. S. government than to the developing countries. ISTC would be well-advised to avoid any pressure tactics in selling programs to its own field

offices and to potential collaborators. The costs of even slight deviousness or high-handedness for an organization with ISTC's ambitions will be enormous, for broken trust is difficult to repair.

ISTC RELATIONS WITH COLLABORATORS

As elaborated to date the concept of ISTC places strong emphasis on cooperation and collaboration with scholars and institutions in the developing countries. A report from the Planning Office states: "The [institute] will consequently place high priority on working directly with institutions in developing countries and supporting co-operative relationships between these and U. S. institutions for the purpose of enhancing the capabilities of developing countries."¹ From the standpoint of management and organization this emphasis raises fundamental questions about the style of cooperation and collaboration to be promoted, and about the most effective means of building local capabilities.

The Meaning of Collaboration

Anyone who has ever undertaken or closely observed a cross-national collaborative project will immediately perceive a core dilemma facing ISTC's quest for collaboration. This arises from the fact that in many cases the work will

be defined as an endeavor of equals but the sole source of funding and the primary locus of accountability will be the U. S. government. Thus one must ask if it is really possible to have genuine collaboration if one partner to a relationship controls the bulk of the resources.

Experience with cross-national collaboration suggests a variety of models, some of which are closer than others to the institute's stated objectives. One type, seen in several social science research projects in the 1950's and 1960's, could be termed hired hand research. In this arrangement the problem to be studied, the methodology, and sometimes even the most specific questions to be asked were determined by the North American party, who then hired local scientists to execute the study. Such relationships have been roundly condemned by Third World critics as paternalistic, demeaning and also bad science. ISTC should avoid projects even approximating the hired hand model. A second type of relationship might be termed limited participation. ISTC might, for instance, itself decide that a certain line of research should be carried out cross-nationally, set down the basic methodology, but then leave the precise applications to local experts. Participation thus comes in only at the third stage of research design, rather than at the level of problem-definition and choice of strategies. While clearly better than hired-hand studies, this model remains essentially paternalistic

and asymmetrical. An ideal often difficult to attain is genuine collaboration in which all major parties, whatever their contribution to funding, have an equal voice in deciding all crucial aspects of the work to be done. One reason why this model is sometimes beyond reach is that the potential collaborators do not have equal levels of training, experience, and general sophistication. In institutions where the research staff has the equivalent of an M. A. degree from a national university lacking in modern training facilities, it will be difficult to expect the local scientist to participate as an equal with a Ph.D. from a major U. S. university who has worked for years on the problem in question. Nevertheless, there are situations where true collaboration can take place, and others where training efforts could make this possibility realistic within a period of years. I would thus offer five recommendations about collaboration:

1. To the extent possible, ISTC should work toward genuine collaboration in all relevant aspects of its research and development activities in the developing countries. Institutions and individual scholars in the developing countries should be actively encouraged to submit proposals reflecting their own notions of useful projects. Ideally at least half the initiatives for new

projects should be generated in this fashion.

A distinction should be drawn between projects whose initial idea and broad formulation originate in the United States, and those tracing their origins to the developing countries. While it is quite possible to have genuine collaboration in the first case, it would be unfortunate if most of the projects undertaken by ISTC were of this kind. To avoid or reduce the intellectual dependency commonly seen in cross-national research projects, the institute should actively encourage local scholars and institutions to submit proposals embodying their own notions of how science and technology can best be applied to their national situation. To the extent that ISTC engages in international entrepreneurship, its activities should be more oriented to stimulating ideas on the part of local scholars than to selling those pre-formulated in the United States.

2. To the extent possible, ISTC should work toward genuine collaboration in the execution of all research and development activities in the developing nations.

The previous recommendation urges collaboration in the very initiation of projects to be undertaken; this advocates the same for all subsequent stages. Specifically, a collaborative approach should characterize decisions about

(a) the broad approach toward studying a given problem; (b) the methodologies and concrete research strategies to be followed; (c) the organization and management of the research undertaking; (d) the analysis of the data to be collected; and (e) the publication and utilization of the data. While it is perfectly reasonable for ISTC to indicate that it has priority areas for funding, such as health and agriculture, its staff should encourage full collaboration in all other aspects of the research process.

3. ISTC should experiment with collaborative projects involving scholars and institutions from two or more of the developing countries.

From the standpoint of both theory and application there are great advantages to projects which test the same equivalent methods in several national settings. At the simplest level this comparative approach allows for a broader exploration of relevant contextual features, such as the impact of varying systems of political and bureaucratic organization. While there is a risk of trying to test too many hypotheses in too many situations, the drawbacks can be kept within bounds by concentrating on no more than four or five different national settings. Another advantage, seen in my own work with the UN-sponsored Project on Cultural Values and Population Policies, is the mutual learning that takes place. In this project, which

included major country studies in four national settings, some of the most significant learning was fostered by discussions and disagreements among the project directors. National and regional differences in theoretical orientations, methodological predilections, and other intellectual matters can shed important light on the issues at stake in ways that are not likely to materialize in studies confined to a single national setting.

4. To provide the basis for true collaboration, arrangements should be sought for equalizing the overall contributions made by the several participants.

While it is unrealistic to expect collaborating scholars and institutions to match the research funds provided by ISTC, there are other ways of reducing the asymmetry in contributions. If "contributions" are defined to include all of the resources necessary for the execution of the project, the following possibilities are open. First, the collaborating institution might be asked to contribute some support services, such as secretarial and clerical assistance, vehicles, and administrative backstopping, on its own budget. Second, the institution could assist the project by organizing a local advisory council or some other means for obtaining local views and counsel on the project's design and implementation. While such arrangements are not without

political risks, particularly when the setting for the project is laden with conflict, they could have both tangible and symbolic value in promoting more equal contributions. Whatever the specific actions taken, ISTC should actively seek ways of having collaboration extend to resource contributions as well as decision-making. Total or near-total dependence on the institute would clearly militate against the other forms of collaboration recommended here. The case of the Latin American Scholarship Program of American Universities, to be cited shortly, suggests another possibility.

5. During the first five years of its existence, ISTC should conduct annual evaluations of the styles of collaboration actually being followed, the problems arising, and the most fruitful kinds of relationships emerging.

This should be one aspect of the continuing review suggested earlier, and to make it worthwhile ISTC should be prepared to change its behavior where necessary. Recognizing that full collaboration will often be difficult to achieve, the institute should experiment with different modes of relations and make a systematic effort to learn from its experiences.

Building Local Capabilities

The question of developing local capacity to conduct research and field testing is one that has long been the subject of action by U. S. institutions, including ATD. This is not the place to review the extensive literature on training strategies and institution building approaches. It may be helpful nonetheless to underscore two points bearing directly on the mission of ISTC.

The first is that the development of research capacity is best done on a collaborative basis. The broad principle cited earlier can be applied as well to institutional development as to specific research projects. ISTC will make the most effective use of its training resources if it chooses to work with rather than decide for local institutions. ISTC officials might take a careful look at the experience of the Latin American Scholarship Program of American Universities, probably the most effective program of its kind. In its early days LASPAU sought to develop teaching capacity in Latin American universities largely by itself selecting individuals who looked promising, many of them undergraduates. As time went on it became clear that this strategy faced a critical drawback: the candidates trained were not being incorporated into the teaching faculties of the universities which had nominated them. In effect, LASPAU was regarded by

university administrators as just another scholarship program intended primarily for individual education. They dutifully signed the nomination forms, but had no intention of hiring these individuals when they returned or, when they did, were often not there to honor that intention. With this realization LASPAU shifted its strategy to one involving more direct collaboration with universities. Many of these officials felt, first of all, that it would be better to train existing faculty members at the M. A. level than to select undergraduates with no real connection to the university. They and LASPAU also agreed that it would make a great deal of sense to train faculty members within the framework of a program for university and faculty development. Thus over a period of several years LASPAU and university administrators together tried to set training goals and to encourage a kind of institutional planning that was rare in Latin America. Sometimes the resulting plans were hollow exercises lacking in real meaning, but in many cases they had their intended effect. ISTC might learn from this example in its own efforts at capacity building, though again with the experimental attitude recommended earlier. One reason, incidentally, why LASPAU has been unusually well-attuned to the realities of Latin American higher education is that its own board is genuinely bi-cultural. The Latin American members, who have included some of the most prominent educators in the

region, have not served as window-dressing for decisions made in Washington and Cambridge. Rather, they participated fully and freely in the board's deliberations (I speak here as a former board member and a board chairman who succeeded a Salvadorean in that position). A highly significant factor in this participation pattern is that the Latin American universities make a tangible contribution to the program's resources, mainly through continuing faculty salaries and backing loans for language training and transportation. There may be several important lessons here for ISTC's future efforts.

A second point that deserves particular emphasis in the context of the institute's mission is the training potential of genuine collaborative research. The best way to train local scientists in the methods and techniques of research is to involve them in all aspects of its design and implementation. The work that ISTC envisages provides an exceptionally fertile area for new approaches devised and carried out in local settings. By encouraging local scholars and institutions to try approaches which respond well to local abilities, traditions, and conditions and by providing the training necessary to implement these ambitions, ISTC can promote the most effective learning process of all, which is learning by doing. This is not to say that fellowships, special training courses, and other familiar ingredients of institution-building are

unnecessary, but that they may have the greatest impact when combined with and integrated into ongoing research. My own experience in advising a research organization in Peru underscores the wisdom of combining formal training (such as courses on the theory and methods of research in a given area) with direct experience in the local setting. We found that training in sample survey methodologies was immensely more effective when conventional courses were linked up to actual surveys than when they stood alone. But here, too, ISTC should follow the overarching precept of trying various strategies and then evaluating them, not in the spirit of finding "success" and "failure," but of determining which of several reasonable approaches bore the greatest fruit under specific conditions. This cycle of openness, experimentation, honest evaluation, and organizational change may well be the single most important "management" challenge facing ISTC.

FIELD TESTING

At the heart of ISTC's work is the testing of science-based solutions to development problems in a variety of national settings. In the final analysis the success or failure of this institution will depend on the degree to which it is able, in collaboration with the developing countries, to try out new ideas in field conditions

representative of those found more generally in the participating nations. If ISTC is to avoid the mistakes and false hopes of the past, it will have to move beyond "demonstration projects" where the odds are stacked in favor of success to "generalizability projects" where the conditions prevailing are closer to normal. The developing countries do not need yet another set of projects showing that under optimal conditions of resources, organization, and leadership commitment a given technological innovation will work. What is desperately needed is a set of procedures for testing technologies in settings where these conditions may be less than ideal but within the range likely to be found in 90% of the anticipated situations. Developing such procedures and then carrying them out on a collaborative basis will be a continuing management challenge for ISTC.

One point that merits particular attention is the relationship between technological innovations and the government bureaucracy. A great failing of demonstration projects in many fields, including agriculture, health, and population, is that they are conducted in conditions which can almost never be duplicated in the public sector. The pattern of these projects is very familiar. A donor agency, such as the Rockefeller Foundation, provides generous financing for a pilot project. The national directors chosen are among the most capable people in the country,

and are well paid for their work. Sometimes in collaboration with the government but often outside the bureaucracy the program is launched, typically in a limited geographic area. Able foreign advisors are present to provide counsel when needed, and to expedite problem-solving when difficulties arise. Organization and management are marked by reasonable flexibility and close attention to the project's working details. In the end many of these projects are hailed as successes, and recommended for broader application.

Then comes the rub. As the pilot project is taken over by the government, problems begin to multiply. A common obstacle is that the public officials responsible for implementation are of a lower caliber than their predecessors from the private sector, and must work within a host of bureaucratic constraints. Where, for example, the private group could work out its own arrangements for land on which to conduct an agricultural experiment, when the government tries the same strategy the intervention suddenly becomes a political issue. Where the outside donor could supply the necessary financial and technical resources, the government finds that there are other priorities, other claims on an official's time, and innumerable delays in getting any kind of action. Unless the project has a guardian angel well-placed in the government, the innovation may languish for months as papers move up, down and

across the layers of bureaucracy. Then, too, there are often problems of scale as the government tries to carry out in two or three different places what the demonstration project did in one. Incomparable conditions and the usual logjams of coordination will further decelerate broader testing of the innovation. Finally, in all too many cases, the government will write off the effort as unrealistic within its constraints and return to business as usual.

The point of this example is not to show that governments in the developing countries are hopelessly incapable of carrying out technological innovations under their own aegis, but to argue for testing under conditions that are genuinely representative of the realities to be faced in final applications. In the language of sampling theory ISTC should select a set of testing sites that will be generalizable to the full population in which it is ultimately interested. But to carry out such sampling the designers themselves will have to have a fairly clear idea of the relevant variables (such as the quality of the civil service, the state of logistics, regional variations in openness to innovations of various kinds, etc.) and a strategy for factoring these considerations into the testing process. To get to that position the institutions involved will have to prepare a fairly accurate picture of the relevant situation in different parts of the country, a task which itself may require more than a little

preparatory research.

In addition, and related to the question of generalizable field testing, ISTC and its collaborators should consider four other questions of management and organization: integrating planning and implementation; assessment of contexts; the dynamics of implementation; and program evaluation.

Integrating Planning and Implementation

ISTC should make every effort to avoid a trap seen time and again in development programs: an unnecessary disjunction between planning and implementation. Someone has called the separation of these processes the original sin of development programs, and so it is. The root cause of the difficulty is the rationalistic view that the critical elements of a program can be adequately planned in advance, and that implementation is basically a matter of executing the program components thus set forth. In this view planners and program designers become a cerebrum responsible for the most significant elements of a program, while implementers become the hands for accomplishing action. Despite the many criticisms leveled at this kind of rationalism donor agencies persist in designing projects in this way. The heavy emphasis on the front end of project design, the extensive use of outside

consultants and review missions to design the perfect project, the failure to involve the actual implementers and other key actors in the formulation process -- all betoken a continuing belief in the separation of head and hands in development programs.

As a corrective to this exaggerated rationalism ISTC might consider the following means of bringing about a better integration of planning and implementation:²

1. Careful attention to levels of demand for the innovation in question. Development planners quite regularly assume that people in a certain area "need" or "want" an innovation because in an objective sense it will be good for them. The classic case is the demand for contraceptive services imputed to rural populations across the world. On the basis of a priori assumptions, wishful thinking, and a highly flawed measuring instrument (the Knowledge-Attitude-Practice Survey) population planners have assumed a "widespread latent demand" for family planning and mounted service programs accordingly. Yet in country after country after the "early acceptors" have their needs met the level of effective demand proves to be very low. The foremost problem in most cases is not poor technology nor even poor management, but simply a lack of interest. For many rural people the idea of using contraceptives, much less sterilization, to limit fertility makes no sense in their current social and economic circumstances. Thus one

practical way of integrating planning and implementation is to determine in advance where interest in a given innovation is likely to be above a critical threshold, and to conduct field trials there. This approach would not preclude the use of information campaigns or even persuasion as an integral part of the experiment provided that the changes sought are within reasonable social and psychological bounds. There is a difference, for example, between trying to convince rural people to try a new variety of fertilizer which they do not understand and attempting to promote a massive campaign of voluntary sterilization where the entire culture is against that concept.

The point, then, is not that the social environment should be treated as immutable, but that some kinds of changes represent such a radical departure from existing practice and are so far removed from the perceived needs of the people that they should not even be attempted. Moreover, in some cases, such as sterilization, the proposed intervention may not really be in the interest of the clients, so that attempts to use persuasion or manipulation (as with financial incentives) will raise serious questions of ethics. The challenge for planning is to determine the range of change that will be both feasible and ethically acceptable in a given area at a given time.

2. Active involvement of opinion leaders and other gatekeepers. In the common case development programs are

designed by experts in donor agencies and capital cities without the significant involvement of opinion leaders and other gatekeepers in the areas to be affected by them. When the program is sent to the provinces for execution, it often meets with indifference or outright hostility from persons whose views count locally and who feel that their interests are not being served by the intervention. With family planning programs local religious leaders, such as the rural imams in Egypt or parish priests in Latin America, may charge that the technology being introduced is prohibited by religious teachings or will corrupt the morals of the community's women. While in some cases no amount of involvement will remove these objections, in others consultation can have two beneficial effects. First, it may reveal elements of the program itself or of its public presentation which can be changed to make it more acceptable to local communities and their leaders. In Malaysia, for instance, leaders of rural Malay communities may have no intrinsic objections to the testing of a new fertilizer, but they may indeed take issue with the fact that all of the Malaysian professionals involved in the trials are of Chinese or Indian origins. There is a growing literature on the nature and consequences of participation in development programs, most of which is being synthesized by the Cornell University/AID program on participation. This literature should be consulted

and relevant inferences drawn before ISTC moves very far ahead in its work.

3. Significant involvement of potential implementers.

A group that is regularly ignored in program design is the field implementers who will be directly involved in testing the innovation. There are the people, such as school teachers, nurses, social workers, midwives, and extension workers, who enter into direct contact with local communities. In the usual paradigm of implementation they are regarded as irrelevant, as bureaucrats who should act when they are given instructions and whose opinions are not worth considering in advance. They may be given special training courses to improve their performance, but even then the objective is often to turn them into passive, compliant instruments of implementation rather than active participants in shaping that process. Yet careful research shows that these implementers often have insights into the likely impact of an intervention that are both shrewd and not available to their superiors. They may point out, on the basis of ground-level experience, that a given technology will evoke strong opposition, play into class or ethnic conflicts in certain areas, or otherwise touch off unanticipated consequences. The fact that they are consulted rather than simply told what to do may also increase their own motivation to take the proposed innovation seriously. But to benefit from this kind of consultation

national administrators will have to change their views of themselves as the only valid source of knowledge. ISTC could perform a valuable service for the entire development community if it encouraged and evaluated experimentation along these lines.

Assessment of Contexts

A critical element in field testing is the fit between a given innovation and specific socio-cultural and political contexts. Of foremost importance, though not the subject of this paper, is the consonance between the element being tested and the attitudes, values, beliefs, and expectations of the surrounding community. For each of the major areas of science and technology to be tested, ISTC should enlist the aid of sociologists and anthropologists to make preliminary assessments and continuing appraisals of socio-cultural influences and consequences. Also crucial for field tests is the political environment affecting a given type of intervention. The following discussion provides some leads toward assessing this environment.

It will usually be advantageous to analyze the political context at three levels: the national government, including its relations with ISTC and other donor agencies; the regional level (where relevant), such as the states in

India; and the local level, which may comprise several steps in the administrative hierarchy. Research on implementation suggests that the context for field trials may, in fact, be quite different at these three levels, and that there may be sharp differences in perspective across levels. With population programs, for example, national planners, the heads of the ministries involved (health, social services, etc.), and the country's principal religious leaders may be in agreement on the desirability and moral acceptability of family planning services. But when the resulting program reaches the local community, resistance may arise from several quarters. Local religious leaders, who were trained years before and are either not informed about or do not believe in current thought about family planning, may attack the entire endeavor as immoral. Midwives, who have been ignored or ostracized by the official health program, may sow rumors about the detrimental effects of contraceptives on the health of the mother and her children. Sensitive to the currents of opinion of the communities in which they live, doctors and nurses employed at local health clinics may de-emphasize family planning and spend their time on more "respectable" activities, such as prenatal care and anti-malaria campaigns. These reactions, which have been seen in several countries, underscore the need for careful attention to the salient contexts for field trials. The

following questions could be raised in the case of the political environment:

1. What is the power setting at this level? Who are the actors, individual and organizational, who count most for this particular intervention? At the national level the critical actors usually include the chief executive, the responsible minister(s), donor agencies, and various interest groups. At the local level the power setting may include the village religious leader, leaders of ethnic groups, traditional practitioners of medicine, landlords, moneylenders, and others.

2. What is the issue context? What are the most sensitive points of debate, discussion, or controversy in this general area of activity? How will this field trial play into this set of issues? What issues can help to energize the program? What issues can cripple it? Key actors in the power setting will often make strenuous efforts to link the program intervention with sensitive or controverted questions if they wish to kill it, or to positive issues if they wish to support it. And once again the issue context may be quite different at different levels of government. With population programs in the capital city the critical questions may be Church-State relations, ethnic group balances or, among university students, American imperialism; in the villages they may be rumors about cancer caused by IUD's or other questions

related to anxieties about health and illness.

3. What are the key conditions affecting implementation? Beyond actors and issues the political environment also includes certain conditions which bear upon the prospects for implementing a set of field trials. Among these are uncertainty, such as that produced by a rapid succession of military governments, and threat, such as that arising from an impending war. Both of these conditions may make the testing of a controversial innovation untimely, if only because the officials involved will be less willing than usual to associate themselves with any risky endeavor.

Information about political contexts can be used to design field trials which capitalize upon the supporting and avoid the debilitating forces in the environment. The aim, however, should not be to use contextual information to slip in innovations which are offensive, but to design interventions which genuinely respond to local needs and interests. Clever manipulation may succeed in the short run, but it will almost invariably boomerang as leaders and the people themselves discover that they have been misled.

The Dynamics of Implementation

There is now a stimulating, if fragmentary, literature on the dynamics of implementing development programs.³

Studies in several countries, including the United States, have brought out hypotheses and conclusions such as the following:

1. Too much planning can hinder implementation. An excessive attention to technical detail in the planning stage can undercut the political, motivational, and other conditions necessary for effective implementation. One reason is simply delay. Several studies, most notably that of Pressman and Wildavsky on a poverty program in Oakland, California, suggest that the forces working in favor of implementation will decay with the passage of time. A two year gap between project initiation and approval, for example, may be accompanied by a change in political leadership or a rotation of those officials who were the program's strongest backers. Lengthy reviews, moreover, often mean that a program is modified to conform to the bureaucratic routines and current predilections of the funding agency. The changes made in this process, while facilitating final approval, may not only cause delay but create an organizational apparatus or management system that is not conducive to implementation.

2. Too many clearance points can bring implementation to a halt. One of the greatest obstacles to program execution is an implementation path with several dozen gates and toll houses. As a crude generalization we might say that the more numerous the clearances, concurrences,

approvals, or nods of agreement required in a program, the smaller its chances of success. First of all, more actors mean more demands for communication and thus greater chances for delay. Second, the complexities of communication may be aggravated by differences in perspective and divergencies in goals among the actors involved. For example, to introduce a technological innovation into an integrated rural development program the sponsors will often need the approval, and perhaps the active cooperation, of the ministries of agriculture, health, public works, education, and sometimes planning. If the relationships among these agencies are less than ideal, any request, however benign in intent, can be used to settle scores, establish jurisdiction, or flex bureaucratic muscles. Unfortunately, while some of these clearance points can be clearly identified at the planning stage, others will arise as a result of the implementation process itself, and thus cannot be predicted. As a practical matter, designers of field trials can ask what the implementation path is likely to be, who will have to be consulted, and what the implications will be for both the timing and the ultimate success of the planned intervention. But to be useful such calculations will have to depart from the officially determined routes for travel to the often uncharted paths of informal power.

3. Implementation requires "fixing" at many points.

Eugene Bardach concludes his book The Implementation Game with a chapter titled "Fixing the Game."⁴ While many will find the language of games inappropriate to such serious undertakings as eliminating hunger, the book does make a very important point, and one that is reinforced by other studies. This is that implementation requires the same kind of political and bargaining skills seen in formulating a complex policy, and often more. With many programs, opponents and critics are willing to see a formal policy approved because they know they will have another crack at it later, when their particular skills may be more efficacious. Bardach argues that successful implementation requires a process whereby political, organization, and other resources can be brought to bear to (1) keep a program moving on its intended track if the course proves right; and (2) work out a change in course if subsequent developments show that a shift is needed to accomplish the original objectives.

This message is of the utmost importance for the projected work of ISTC, for one of the great problems with testing technological innovations is that of fade-out. Stanley Heginbotham's study of agricultural technology provides a beautiful illustration of this problem. It shows the complex interplay of technology, culture, and bureaucracy in shaping local responses to innovation.⁵

Three years after his initial observations he found that the seeming success of the new varieties of seed had dissipated.

In Marusoor, I found that disillusionment had become widespread. In the wake of numerous problems with new varieties, many farmers had gone back to planting the seeds that they had been using before ADT-27 made its spectacular appearance. They had become involved in a pattern of ecological change that they did not understand or know how to manage. Unable to get trustworthy technical advice, it was perhaps inevitable that they would turn back to agricultural patterns that were more familiar and reliable.⁶

One of the main reasons for this failure, and the central theme of the book, was the control system laid on the field workers and agricultural extension officers by the central bureaucracy. Themselves under pressure to show results to their own superiors, senior administrators unilaterally established quantitative targets for their subordinates in the field and a reporting system emphasizing numerical attainment. In the resulting ethos of "preprogrammed compliance" the subordinates lost not only self-esteem but the intrinsic motivation to carry out the substantive goals of the program. Consequently ". . .they were increasingly inclined to work at the lowest level of output and effectiveness that could be maintained without antagonizing their superiors."⁷ The net effect was the near-total destruction of the backstopping arrangements

necessary to help the farmers testing ADT-27. Heginbotham's research should be required reading for those organizing field trials of new technologies.

Much more could be said about the dynamics of implementation, but I will conclude with a simple recommendation:

ISTC should commission a thorough review of all existing literature on program implementation, with particular emphasis on programs in the developing countries and those concerned with technological innovations.

More generally, ISTC should treat the matter of implementation as a question for scientific study rather than just a matter of organizational expedience. In the vast majority of development programs conducted thus far the implementation process was never subjected to careful analysis, partly because the conceptual and analytic tools for such work are not well-developed, but mainly because the subject was considered irrelevant. After all, if implementation is just a matter of executing, in semi-mechanical fashion, the directions and directives established in the original policy, there is little to study. My argument, which is now amply supported by the growing literature in the field, is that the process of implementation should be analyzed just as carefully as the technical dimensions of the innovations being tested. From what we can see at this

junction, in fields ranging from agriculture to health and family planning, the dynamics of implementation will be every bit as important to the work of ISTC and its collaborators as science and technology more narrowly defined.

Evaluation

If I had to select just one area for particular attention by ISTC, it would be systematic evaluation of all aspects of the institute's work, from its own internal organization to the impact of the innovations which it helps to test. If this new organization is to break out of the bureaucratic (and sometimes mental) straightjackets that have bedeviled the U. S. aid program, its management will have to adopt a relentlessly open attitude toward evaluation. But to do that ISTC will have to overcome two obstacles that have hindered evaluation in AID.

The first is the reluctance to conduct honest evaluations. While all AID projects are theoretically required to be evaluated, and the organization has a unit devoted to this purpose, few would deny that the quality of the evaluations done is often very low. The overriding reason, mentioned frequently by AID officials, is an organizational culture in which negative comments on a program are interpreted as a "failure" for its sponsors. The result in all too many cases is the selection of evaluators who are known to be favorable, or at least not negative, toward

the program, and reports whose dominant feature is blandness. There have been exceptions, but these have been few, and the entire subject of evaluation is widely regarded as a sham in AID. ISTC will have to face the same question, and a test of its mettle will be the extent to which it can create a different culture. There are several possibilities for breaking out of the blandness trap:

1. The senior leadership of ISTC can insist, in word and deed, that it wants absolutely honest evaluations, and create a culture in which these can be encouraged. The director, for instance, can make it known that he or she will personally read selected evaluations, and will be highly critical of those which appear to be "fudged." More basically, ISTC should work toward an internal culture which goes beyond the simple "success -- failure" dichotomy to an atmosphere in which learning from mistakes is considered a success. If the organization wishes to encourage experimentation, and wants to learn its full lessons, the senior leaders will have to create specific incentives for honesty and disincentives for less-than-honest evaluations.

2. ISTC could rely on outside institutions respected for their independence of judgment, and provide them with long-term contracts, such as five years. A major drawback in the evaluation system used by AID is that it makes extensive use of the freelance consultants or small

organizations whose livelihood depends heavily on evaluation contracts. The contracts, moreover, are for a specific evaluation rather than for a long-term set of services. As a result the evaluators and their organizations are under considerable pressure to come up with positive results, and there is little incentive, aside from personal integrity, for candor. Not all contractors, of course, succumb to the pressures for positive results, but not many produce a hard-hitting evaluation when it is in order. To break out of this cycle ISTC might enter into five-year evaluation contracts with a few institutions that are in a position to exercise independent judgment.

3. ISTC could introduce a system in which all major evaluations are reviewed by an independent committee charged specifically with judging its objectivity, the quality of the information used, and other technical features. Even the knowledge that such a review might be carried out, and that the evaluators themselves might be criticized for bias or careless work, may be a powerful incentive for honesty and quality.

A second problem, and one which ISTC must address in its work, is the lack of a well-developed methodology for evaluating development programs. Nothing will be more essential to effective management judgments about future directions than sound and comprehensive information about the processes and impacts of technological innovation.

At present there is a burgeoning field of program evaluation, complete with its own handbook and journal, but its central focus has been on U. S. programs. Moreover it is limited by an excessive emphasis on quantitative measurement and on conditions of design, such as randomization, which are difficult to meet in the typical development program. To date it has not made effective use of the tools of anthropology, which are indispensable for analyzing the contextual and process dimensions of development programs. At this time there is some movement in American universities toward integrating quantitative and qualitative methods in the evaluation of development programs, but progress has been slight. My recommendation is that

ISTC should sponsor basic conceptual and methodological work aimed at developing appropriate strategies for evaluating the processes, contents, and outcomes of development programs involving scientific and technological innovations.

Specifically, the organization should stimulate work which attempts to merge in appropriate ways (1) the basic logic and relevant features of current work on program implementation; (2) strategies for the collection and analysis of quantitative data on development programs, including those used by economists; and (3) the qualitative methods

used by social anthropologists and others, including participant observation. During its first five years ISTC should be able to stimulate some creative thinking along these lines and incorporate the first fruits into its own efforts.

A NOTE ON ETHICS

The areas in which ISTC intends to work raise a host of ethical issues, many of which have received careful and extensive attention on the domestic scene. Recent years have seen an upsurge of interest in the ethical questions posed by science and technology, with the new sub-discipline of bioethics emerging in response to these concerns. Among the specific ethical issues raised by the proposed work of ISTC are: (a) the protection of human subjects in the testing of scientific and technological innovations, such as experimental contraceptives, tuberculosis vaccines, and other health technologies; (b) the ethics of social intervention, including the problems arising from differential impacts on social classes or minority and ethnic groups; (c) problems arising from the use of control groups where the net effect is to deny some segment of society a vital service, such as improved health or nutrition; and (d) the issue of informed consent, particularly in the case of individuals or groups lacking the general education and specific scientific knowledge to

understand the implications of a field trial.⁸

Many of these questions have been dealt with in some depth as they apply to science and technology in the United States, but work dealing with the unique features of testing in the developing countries has been limited. ISTC should, and perhaps under existing federal regulations must, develop ethical guidelines covering its own work, particularly as it involves the testing of human subjects. It could receive valuable assistance in this effort from the leading organizations specializing in bioethics, particularly the Hastings Center of Hastings-on-Hudson, New York, and the Kennedy Institute of Bioethics at Georgetown University. Early consultation with these or similar groups, as well as federal officials charged with monitoring human subjects regulations, may save costly delays and embarrassment later. I would specifically recommend that

As a first order of business ISTC should establish a task force to address the key ethical questions raised by the testing of scientific and technological innovations in the developing countries.

One specific and tangled issue which will have to be negotiated with the Department of Health, Education, and

Welfare is the extent to which ISTC itself and the institutions with which it collaborates are to be bound by the existing federal regulations on the protection of human subjects. While some may favor skirting this issue because of its complexity, ISTC as a federal agency would be ill-advised to let the matter drift. Suffice it to say that there are federal officials who will bring the matter to the institute's attention sooner or later, and that neglect of this question could be very damaging to the institute's image of professional responsibility.

CONCLUSIONS

This paper raises a variety of issues concerning the organization and management of ISTC. My hope in presenting this larger view, rather than concentrating on any single issue, is to show the vital connections between management decisions made at one level and the possibility for action at others. It is clear, for example, that initial decisions about personnel will affect the caliber of staff drawn to the institute; this, in turn, will influence ISTC's image in the relevant scientific communities as well as the possibilities for collaboration in the developing countries. Similarly, relationships between the ISTC headquarters and its field offices will have an effect on the interactions between field offices and local collaborators which will, for their part, have a bearing on the quality of projects undertaken in the developing countries. I have thus tried to show that the ultimate success of ISTC will depend not only on sound science and technology, but on careful attention to internal organization, to the relationships with collaborators in the developing countries, to the total context of field trials, and to the ethical issues at stake in its work.

Two issues which merit special attention in ISTC's first years are the related phenomena of implementation and evaluation. While careful consideration should obviously

be given to the design of field tests for new technologies, ISTC should avoid the common tendency to assume that implementation will somehow take care of itself. The entire question of how and when planned projects are actually carried out should be subjected to the most careful scientific analysis. The issue of evaluation is closely related to implementation, for a critical point in determining what effects were or were not produced in a given trial is the dynamics of execution. One of the greatest management challenges for ISTC is to design a set of evaluation systems that will allow the international scientific community to understand in full detail how and why scientific knowledge and technological innovations did (or did not) affect key areas of development.

FOOTNOTES

1. Planning Office, Institute for Technological Cooperation, "Summary Report," March 1, 1979.
2. These and related points are developed more fully in D. Warwick, "Integrating Planning and Implementation: A Transactional Approach." Center for Studies of Education and Development, Harvard Graduate School of Education, 1978. The intellectual perspectives guiding this discussion are laid out more fully in D. Warwick, in collaboration with M. Meade and T. Reed, A Theory

of Public Bureaucracy: Politics, Personality, and Organization in the State Department. Cambridge, Mass.: Harvard University Press, 1975.

3. See, for example, J. Pressman and A. Wildavsky, Implementation (Berkeley: University of California Press, 1973); E. Bardach, The Implementation Game (Cambridge, Mass.: The MIT Press, 1977); G. U. Iglesias, Ed., Implementation: The Problem of Achieving Results. A Casebook on Asian Experiences (Manila: Eastern Regional Organization for Public Administration, 1976); S. Heginbotham, Cultures in Conflict: The Four Faces of Indian Bureaucracy (New York: Columbia University Press, 1975); M. Grindle, Bureaucrats, Politicians, and Peasants in Mexico: A Case Study in Public Policy (Berkeley: University of California Press, 1977) W. Williams and R. Elmore, Eds., Social Program Implementation (New York: Academic Press, Inc., 1976); and M. Derthick, New Towns In-Town: Why a Federal Program Failed (Washington, D.C.: The Urban Institute, 1972). There are also numerous articles on specific programs in the developing countries, though few which lay out all relevant aspects of the implementation process.

4. Bardach, op. cit.
5. Heginbotham, op. cit.
6. Ibid., p. 186.

7. Ibid., p. 171.
8. The most comprehensive guide to literature in this field is the Encyclopedia of Bioethics, New York: Macmillan and the Free Press, 1978, 4 Volumes. The other major forum for discussions of issues in bioethics is the Hastings Center Report, which appears bi-monthly. The ethics of intervention are addressed in G. Bermant, H. Kelman, and D. Warwick (Eds.), The Ethics of Social Intervention. Washington, D.C.: Hemisphere Publishing Company, 1978.

III. POLICY ISSUES IN THE PROMOTION OF
APPROPRIATE TECHNOLOGICAL CHANGE

Edgar O. Edwards

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Abstract

Technological change should serve the objectives of development and public policies are the principal means of attaining this compatibility at community, national and global levels. Policy studies should have the objective of improving the quality and effectiveness of such policy decisions by advancing knowledge and understanding of (1) the hierarchy of relevant decision and control centers, (2) the variables which affect behavior in different settings, (3) the benefits, costs and risks associated with different policy options, and (4) the means of communicating new knowledge to the public and those in positions of social responsibility.

Because decisions and policies on technological change and development are taken at many levels with different objectives and complex interactions, the general thrust of these substantive decisions cannot be comprehensively evaluated by considering each in isolation. The specification of the present management system for promulgating technological change at global, national and local levels, and the evaluation of its potential and its weaknesses should be the subject of early policy study. Indeed, the major long run objective of policy studies could be conceived in terms of improving this global management system by identifying better means of coordination and by considering and evaluating allocations of responsibilities and powers of implementation among management centers.

Among the forces that shape technological change are those that determine the supply of technology and its availability through transfer and modification to those settings in which it can be effectively employed. Understanding the global configuration of those forces and the variables to which they respond is essential to the definition of policies (at all levels) which may modify technological change in ways perceived to be beneficial. Policy studies directed to this task will inevitably confront the problem of reconciling different perceptions of beneficial change.

Some studies of appropriate technology proceed as though the settings which must absorb the technologies are themselves fixed. Yet if technological change is introduced successfully, the settings as well as the welfare of their inhabitants will certainly undergo change. Policy studies are needed not only to promote more appropriate technology but also to engender more appropriate settings for its absorption.

Social considerations may be introduced through the imposition of government regulations and standards which constrain decisions that are otherwise private in character. The establishment of standards, and means of implementing and monitoring them, is clearly a policy matter in need of continuing study.

Decisions affecting technological change taken at any management center may affect, favorably or unfavorably, constituencies other than the one served directly by the center. The problem is to identify these external effects, to internalize them insofar as possible so that each center takes fuller account of external effects in making decisions, and to inhibit unfavorable effects when all else fails. The objective is to induce socially responsible behavior at all decision centers. Means for achieving this end are an important focus for policy studies.

Policy Issues in the Promotion of
Appropriate Technological Change

This paper addresses the following questions posed by the National Academy of Public Administrators on behalf of the planning group for the Institute for Scientific and Technological Cooperation:

What should be the nature of policy studies undertaken by the Institute for Scientific and Technological Cooperation? What major policy issues affect the selection, development and adaptation of technologies?

Technological change is an essential part of the development process, but the nature of technological change as well as its effectiveness in promoting development depends on the confluence of a wide array of private decisions and public policies. Neither the conception of technologies, the manner of their employment, nor their effect on development is independent of the development process itself, for it is that process which defines the opportunities, incentives and constraints governing the course of technological change. Similarly, the nature of development is conditioned by the technological options available for choice. This mutual interdependence is now widely recognized though not yet well understood. Policy studies are needed to improve that understanding

and to inform private and public decision-makers not only of the policy options open to them but also of the probable costs and benefits associated with each.

The Interdependence of Policies and Technologies

The present awareness of the mutual sensitivity of technological change and development seems to have grown in tandem with four not unrelated experiences. First, the public role in generating technological change has been expanding over time. Until fifty years ago technological research and the choice of technologies were overwhelmingly private affairs, accompanied, however, by a shift from individual invention to organized corporate research. The role of governments was largely to protect private rights and incentives through such devices as patents and copyrights, to establish safety standards, and to regulate working conditions. Since then, public research and development efforts have expanded considerably, most obviously through the maturation of socialist economies and the large financial requirements of nuclear and space research. Even more recently, due in part to experiences outlined below, public efforts have been directed increasingly to the other end of the technological spectrum, to the development and modification of small scale technologies needed to improve the productivity of the poor. The rapid increase in public research on these problems reflects an apparent recognition that existing incentive systems have failed to direct private, especially corporate, research and development energies toward these technological needs with the force that

effective social and economic development requires.

Second, the conception of technological control and regulation has expanded well beyond the definition of safety standards and working conditions at the factory level to include global concerns with pollution, environmental quality, the use of natural resources, and ecologically sound life styles. Hence, the very nature of optimal, and even acceptable, technological change is in the process of transformation. There is a growing awareness of (1) the mixed effects of technological change on development and welfare and (2) the strong influence exercised by the expenditure patterns of families, communities, and governments on the direction, composition and magnitude of technological research. Means are sought for shaping technological change in beneficial ways and for apportioning the costs of reforming and preventing environmental decay. Even the complex challenge of sharing those costs and benefits that are international in scope - air and water pollution, the protection of wildlife migratory patterns, and the regulation of the seas, is being addressed.

Third, the naive belief that technologies could be easily and effectively transplanted into settings foreign to those in which they were developed has withered with the experiences gained during the fifties and sixties. Technologies require complementary resources, not the least of which is a technologically acclimated and trained populace, and often elaborate supporting systems such as those for repair, maintenance, marketing and storage. Indeed, it is now recognized that similar absorption problems exist for the transfer of soft technologies, such as management, education, health and extension systems. Any system based on specialization, for example, requires not only appropriate

skills but also a willingness to delegate and assume responsibilities, confidence in the consistent performance of others, and effective means of communication. In turn, the extent to which such prerequisites exist in any social setting may be culturally biased. The awareness of relationships of these kinds has emerged from many shattering experiences of the last several decades. The need for mutual adjustments between technologies and the settings in which they will be deployed is now apparent and the search for policies which will promote appropriate adjustments is beginning.

Fourth, experience has shown that the effects of new technologies on development may differ widely even among settings that could technically assimilate the technologies without the absorption problems noted above. The introduction of high yielding varieties associated with the "Green Revolution" has in some settings improved equity and welfare while in others it has served to increase inequality. The nature of land tenure systems and policies with respect to production and marketing incentives may overwhelm the intrinsic potential of the technologies introduced. This experience, like the others, has demonstrated that technological change cannot be evaluated in isolation but must be assessed in reference to the cultural, social, political and economic setting in which it is introduced.

A principal outcome of these experiences has been the concept of appropriate technology. Coined initially for developing country situations, the genuine concern it encapsulates was not infrequently misinterpreted in two extreme ways-- (1) that inferior or second-hand technology was to be foisted on the developing countries and (2) that

the elimination of transfer problems would require self reliance in the development of technologies suitable for developing countries. These extreme views seem to be dissipating as the concept has assumed a more universal definition and applicability. A technology should be appropriate to its setting and in its effects.

The earlier mistake was in assuming that the universality of scientific principles extended to their technological applications and indeed to the specific technological choices that had "proven" themselves in advanced country situations. It is now recognized that most of those applications and choices were those appropriate to the life styles and resource endowments of the advanced countries in which they were made, but not necessarily appropriate elsewhere. Moreover, while those applications and choices were appropriate as ex ante formulations, experiences with them have raised serious questions about their appropriateness ex post, and about the appropriateness of the life styles they have served. The search for appropriate technology is today a substantial problem for the advanced countries as well as developing nations.

To recognize the bias in these technologies is not, however, to dispel it. Indeed, the magnitude, composition and location of effective demand for goods and services are major factors determining the magnitude, composition and location of technological research. It is reasonable to expect that the force of effective demand, and the financing associated with it, exercises an influence also on the direction of scientific research; in that case the direction of scientific advancement may also be biased.

Technology, wherever it is applied, should be appropriate to its

setting. That setting encompasses political, economic, social and cultural factors. Describing specific settings and inferring from those descriptions desirable characteristics of needed technologies, hard and soft, is no small task. Technology must also be appropriate in its effects on growth, employment, conditions of work, distribution of incomes, resource use, and environment. Estimating the costs and benefits of technological change in these several dimensions is a difficult problem.

The essential point is that "appropriate" is not a technical description of technology at all but rather connotes an optimal development decision in which technology is one of several variables considered. Hence, appropriate technology cannot be described as large or small scale, labor or capital intensive, automated or customized because such descriptions are descriptions of technology without reference to settings and effects. Viewed as optimal development decisions, the invention, modification and selection of appropriate technologies requires the application of advanced knowledge from both the natural and social sciences. The technological outcome may be a simple tool or form of organization, but it will not be an inferior technology.

In this context what is the role of public policies in promoting appropriate technological change? Such policies normally manipulate variables which affect or condition behavior and may prohibit or require specific kinds of behavior. With respect to appropriate technology, public policies may (1) stimulate the development, transfer and modification of technologies to meet social and economic needs, (2) improve the absorptive capacity of settings, (3) influence

the choice of technologies by private and public decision makers, and (4) modify the development effects of the technologies adopted. Technological change should serve the objectives of development and public policies are the principal means of attaining this compatibility at community, national and global levels. Policy studies should have the objective of improving the quality and effectiveness of such policy decisions by advancing knowledge and understanding of (1) the hierarchy of relevant decision and control centers, (2) the variables which affect behavior in different settings, (3) the benefits, costs and risks associated with different policy options, and (4) the means of communicating new knowledge to the public and those in positions of social responsibility.

The Management of Technological Change

In a very real sense a focus on policy studies is itself a study of technology--a study of the global management system for promoting appropriate technological change. Because decisions and policies on technological change and development are taken at many levels with different objectives and complex interactions, the general thrust of these substantive decisions cannot be comprehensively evaluated by considering each in isolation. The specification of the present management system at global, national and local levels and the evaluation of its potential and its weaknesses should be subjects of early policy study. Indeed, the major long run objective of policy studies could be conceived in terms of improving this global

management system by identifying better means of coordination and by considering and evaluating allocations of responsibilities and powers of implementation among management centers.

In order to illustrate the information required to specify a management system for technological change in this global sense, consider the following general sketch. Decisions relevant to development and technological change are made at all levels from the individual and family (choosing technologies for household, farm and small business needs) to global forums, public and private, at which many development-relevant decisions are reached. The decisions taken at these management centers will serve different constituencies, seek different objectives, and be based on different sets of information. Hence, the effectiveness of management and of its decisions will be judged against different criteria at each center.

In general terms, effective management at any center will require in simple or complex forms the following functions or characteristics (reflecting in their very formulation, no doubt, a western bias):

1. A knowledge or an informed perception of
 - a. the constituency being served,
 - b. the objectives, benefits or values being sought,
 - c. the parameters or constraints which limit or restrict choice, and
 - d. the variables subject to policy manipulation by the center.
2. The identification of development (technological) problems and policy needs--both present and prospective.
3. The assembly of social and technical information and the

focusing of analysis and research on those problems and policy needs.

4. The definition of options, and analyses of the costs and benefits of each.
5. Forums for discussion--opportunities engineers, analysts, decision-makers and managers together, to enable groups with different interests and perceptions to exchange views and to seek accord between private and social perceptions of net benefits.
6. An authority for decision.
7. Powers to implement.
8. A means of monitoring, review and evaluation.
9. Procedures for revision.

The decisions on technology and development taken at any center are not independent of decisions taken at others. The nature of these interdependencies and the characteristics of actual and optimal allocations of authority and responsibilities among centers deserves serious policy study. A few hypotheses can be advanced which may indicate the nature of such studies:

1. No locus of management can exercise effective control over system variables lying outside its authority.
(Responsibilities may often be allocated to the wrong centers.)
2. What are constraints to some centers, such as prices, interest rates, market opportunities, and the availability of inputs, may be decision variables to other centers; they are system variables but not necessarily center variables.

3. Similarly, decisions bringing benefits to a constituency served by one center may also have favorable and/or adverse effects on constituencies--other peer groups or future generations--not subject to that center's jurisdiction. Hence, higher or other authority may require powers to modify such decisions and arbitrate disputes.
4. Families, communities and nations are not equals in the global setting. Their incomes, resources, life styles, cultural backgrounds, environmental settings and decision variables vary widely. A small nation may have to seek regional agreements with other nations, i.e., establish a new and more centralized management center (modify the setting), in order to absorb technologies requiring large markets.
5. Power tends to gravitate to those management centers already having substantial control. Hence, within nations decisions tend to centralize while global matters tend to be decentralized to nations for decisions. An optimal, or even a more effective, global management system may require allocations of authority and responsibility different from those which currently exist.
6. Constituencies need not be geographically defined though of course many of the more important ones are. Multi-national corporations, unions, cartels and commodity organizations, for example, often cut across geographic designations and relate mainly to selected strata at community, national and global levels.

7. Similarly, many decisions may be differential in effect, forcing difficult choices. Medical technologies may be chosen which benefit the young or the old, educational technologies may favor school leavers or prepare others for more advanced education, and agricultural technologies may benefit large or small farmers. Preferences are implicit in any of these choices.

The purpose of any global system analysis is to disclose the critical decision centers, the biases they may introduce into the system and the variables which might modify their behavior and effectiveness. Can improvements in the distribution and exercise of responsibilities be introduced and implemented? Can the system be given the adaptability needed to meet future challenges more effectively? Policy studies, like technological research, cannot be conducted in isolation from the decision-making and implementation apparatus through which recommendations must be executed.

The Availability of Technology

Among the forces that shape technological change are those that determine the supply of technology and its availability through transfer and modification to those settings in which it can be effectively employed. Understanding the global configuration of those forces and the variables to which they respond is essential to the definition of policies (at all levels) which may modify technological change in ways perceived to be beneficial. Policy studies directed to this task will inevitably confront the problems of reconciling different perceptions of beneficial change and of clarifying the

various value systems from which the perceptions stem.

The supply of technology is determined mainly by research and development, while the degree to which technology is available to those who might need it depends upon their access to the technology and their ability to absorb it. Concern has frequently been expressed about the present geographic distribution of research and development expenditures and about the technological needs presently addressed by research in each setting. Policy-oriented studies on research and development should include:

1. A comprehensive description of the present distribution of technological research and development by location and by needs addressed, including responsible decision centers, their objectives, their financial, legal and other constraints, and the variables to which they respond,
2. A description of at least the criteria needed to define optimal distributions of research and development efforts, and
3. An identification of a configuration of policies encompassing the most important private and public decision centers which will move the present research and development system toward a more optimal one.

If it is accepted that the benefits of technology should reach the masses of the poor throughout the world, then research and development should address the problems of the poor and the technological changes which would improve their conditions, opportunities and absorptive capacities. In contrast, the present global R&D system responds mainly to the present distribution of incomes, not to

the present distribution of population. Many would argue, that the system tends on that account to strengthen and perpetuate existing inequalities in income distribution.

Indeed, the bias would appear to be even larger than that suggested by income distribution. It seems to be magnified through a kind of balloon effect that is not yet well understood. The OECD (1978, p. 41) has reported that Gross National Product in the advanced countries (excluding centrally planned economies) was \$4,150 billion in 1976 while GNP in developing countries (excluding China) was \$1,170 billion, an AC/DC ratio of approximately 3.5:1. Production in the advanced countries is, however, much more capital intensive on the average than it is in the developing countries, not only because each industry is more capital intensive but also because the industrial mix is biased toward capital intensive industries. Hence, the AC/DC ratio for the value of capital employed in production may be of the order of 10-15:1. Yet, if the commonly quoted statistic that only 2.5 percent of the world's expenditure on R&D takes place in developing countries is correct, the AC/DC ratio for R&D expenditure is 39:1.1/ These ratios would suggest that as a percentage of GNP, R&D expenditures in advanced countries are on the average eleven times (39/3.5) greater than in developing nations.2/ Moreover, total innovation costs, including R&D, engineering design, tooling and manufacturing and marketing startup costs, are probably even more heavily weighted toward advanced countries than R&D expenditures alone, say, 60:1. Hence, expenditures on innovation are not simply weighted by incomes (4:1) but are biased toward incomes by perhaps 17 times the weight justified by incomes alone. Clearly, improvements on the rough

estimates of bias offered here are possible and deserve study if efforts to reduce the bias are to be effectively evaluated.

The inflated bias toward incomes is even more pronounced if population distribution is taken as a standard of comparison. When the GNPs of the advanced and developing country groups in the OECD study are weighted by population, the per capita incomes disclosed are \$6,300 and \$550 respectively, an AC/DC ratio of 11.5:1, or 3.2 times the AC/DC ratio for GNPs themselves. Hence, on a per capita basis R&D expenditures are biased against an equal allocation per person by 125:1 and total expenditures on innovation by perhaps 190:1. Finally the bias against the poor may be even greater if research in the developing countries is biased in favor of the needs of those in higher income groups, as for example, the progressive farmer on irrigated land.

Even if account could be taken of the (small) portion of R&D effort in advanced countries that is directed toward developing country needs (which may be offset by R&D in developing countries undertaken for the benefit of advanced country sponsors), the bias toward high incomes is substantial; the technological needs of developing countries are the subject of relatively little research. It is equally clear that the objectives of distributing R&D according to population is not in the foreseeable future a feasible one; it is also questionable whether such an objective is optimal. Indeed, achieving an AC/DC distribution of R&D which reflects relative capital endowments, say 15:1 would be a major achievement requiring substantial changes in policies affecting the distribution of R&D spending and probably the division of spending authority between

public and private sources.

Wherever research and development is located, the problem of defining an optimal allocation of effort among competing needs must be addressed. Ex post judgments suggest that in advanced countries too much effort has gone into production technologies and too little into technologies for preventing their negative effects, such as pollution, other forms of environmental decay, and the profligate use of natural resources. In the developing countries, on the other hand, too much attention may have been given to the direct transfer of advanced country technologies and too little to the local development of locally appropriate technologies for industry, agriculture, health, education, soil conservation, the preservation of water supplies, and reforestation. Many of the negative effects of technology were not anticipated. As a result, incentive systems for allocating private sector R&D efforts were badly designed when judged ex post. Most still are and many nations have only recently begun to grapple with such problems.

Studies will need to be directed toward policy variables which affect the distribution of research and development efforts among needs and nations in order to design improved incentive systems for the private sector. While the outcomes of such studies cannot be anticipated, it can be presumed that they will shed light on the following issues inter alia:

The way in which life styles and final expenditure patterns of households, public institutions and private organizations affect the location and composition of output and hence the allocation of expenditures of tech-

nological research and development; how such life styles can be modified to induce improvements in the geographic and need distributions of R&D and to reduce pressures on natural resources (e.g., by shifting life styles toward leisure, services and conservation)

2. How perceptions of investment and research risk now associated with neglected needs and geographic areas can be modified or insured against in order to reduce the returns now demanded and to extend the time horizon considered by R&D managers in both public and private sectors
3. How price and tax incentive packages can be fashioned to induce better international and global allocations of R&D efforts; how such packages can be coordinated in their implementation so that partial applications, which might be self defeating (as when, e.g., some nations impose disincentives on environmentally threatening technologies inducing industrial developers to locate in other nations not imposing such disincentives), are avoided
4. How interest and exchange rate policies can be managed in order to improve global patterns of investment and R&D expenditures
5. How R&D resources can be attracted to the development of small scale technologies, many of which may be profitable but in conflict with the vested interests of those in control of R&D resources (e.g., utilities interested in centrally produced power and its transmission may not be interested in

improving small scale wind, organic and solar generators that do not require the centralized production of power and which avoid transmission costs and losses); should more R&D capacity be organized as an independent industry responsive to demands from any source, public or private?

A major advantage of R&D efforts in the private sector is that the link between research and implementation is usually clear and well defined, whereas public sector research is often more distantly removed from potential users of research results. Nevertheless, if R&D patterns are to be visibly and quickly improved, it is not clear that the redefinition of private incentives, either within nations or globally, will suffice. Public sector involvement may be largely financial and hence affecting the demand for research, or participatory and thus affecting directly the supply of research. The merits of these two kinds of public sector involvement deserve study as well as the conditions under which either will be effective. Without substantial increase in public sector involvement, it is unlikely that the low ratios of R&D expenditures to GNP in developing countries will be quickly improved. But expenditures are not results. Hence, the issues of improving the productivity of public sector research and of linking research more closely to potential users must also be addressed.

Realizing the full social benefit of technology depends in part on its disclosure and demonstration to potential users. Yet the sharing of technology may reduce incentives for further technological change. This dilemma, which patent systems are intended to surmount, is not easily resolved. The market process is the dominant method by

which technology is shared--those who want it and can afford it, buy it. Potential users interested in initiating production or increasing efficiency either transfer knowledge they already have (multinational corporations, for example), retrieve it from public sources, pay royalties for it, contract with suppliers for technology packages, or hire knowledgeable people. But the system works imperfectly and efforts are needed to improve the effectiveness of the market in technology. Moreover, as the market system responds to those who have the ability to pay, other institutions must assume the burden of addressing less profitable social needs by providing supplementary means for the storage, retrieval and dispersal of technological knowledge.

Finally, knowledge transferred should usually be modified to suit its new setting. Unfortunately, national policies designed to attract foreign investment and technology have often had the effect of stimulating the infusion of inappropriate technologies. Investment allowances for example, reward the introduction of capital-intensive technologies in each industry (including agriculture) and favor the development of those industries that are most capital intensive so that the industrial mix associated with development is strongly biased against the creation of badly needed employment opportunities. There is a need to devise more effective systems for attracting capital and technology while at the same time stimulating their appropriate use and allocation.

Modifying Settings

Some studies of appropriate technology proceed as though the

settings which must absorb the technologies are themselves fixed. Yet if technological change is introduced successfully, the settings as well as the welfare of their inhabitants will certainly undergo change. More to the point for this discussion, policies may be adopted which would enhance the absorptive capacity of settings. Policy studies are needed not only to promote more appropriate technology but also to engender more appropriate settings for its absorption.

It is perhaps natural to judge the appropriateness of settings in terms of their abilities to absorb existing technologies, but the adjustment should be seen as mutual. Indeed, where cultural prerequisites for the effective utilization of present technologies are absent, the principal burden of adjustment may of necessity be technological in nature for some time to come. Cultural characteristics, such as the inquiring mind, the attitude that destiny can be controlled, the acquisitive motivation, faith in specialization, the willingness to depend on others, and mechanical aptitudes, cannot be achieved overnight. Moreover, the desirability of these characteristics is inferred from those settings in which existing technologies have apparently worked well and the characteristics themselves may therefore be specific to the technologies rather than being universally essential. If technologies can be devised which will yield benefits in other cultural settings, present concepts of essential cultural characteristics may be shown to be unnecessarily rigid and culturally and technologically biased. Even in the advanced countries, the concept of specialization which underlies much industrial, urban, health and educational technologies is beginning to

be questioned and the risks of social breakdowns through irresponsible behavior and bottlenecks are being reassessed.

In any event, cultural change is a slow process about which too little is known. Changing the attitudes of future generations probably begins with the preschool child and the family and social setting in which children are reared. If policy is to be directed toward cultural change, more must be learned about the variables which affect the behavior of children. The roles of family, health, nutrition, education, religion and the state are far from clear. Effective policies will not be devised soon, but studies of policy variables in specific settings could be considerably expanded. In addition to deeprooted cultural concerns, such studies should address factors determining choices between the quality and quantity of children, systems of social security, and traditional methods and content of health care and learning.

Political and administrative systems are technologies in their own right and at the same time aspects of the setting that influence its ability to absorb other technologies. Differential effects of new agricultural technologies have often been traced to differences in land tenure, systems for delivering inputs, marketing arrangements for outputs, and the degree of participation in the decision-making process by small farmers. The policy of introducing new technologies and extension services through the progressive farmer with the expectation that the demonstration effect will induce others to follow is being questioned. How the benefits and risks of new technology are shared between landlords and tenants is a matter of growing concern, the fear being that the sharing may take the form of benefits

to landlords, risks to tenants.

Decentralization and participation are increasingly regarded as essential to an equitable distribution of technological benefits. But what forms decentralization and participation should take in different cultural settings and what forms are feasible in different political settings are difficult to define. Is decentralization and participation in a political sense required or can most of the benefits be obtained through administrative delegation and the instruction that responsiveness to the needs of small farmers is an overriding criterion for judging performance?

Some argue that decentralization of either form may only transfer power and benefits from central to local elites having little effect on either the pace or equity of rural development. Democratization in situations where allegiances are dominantly vertical, as in feudal-type settings, may be a matter of form only, not substance, and the decentralization of administrative authority to local elites may only serve to increase inequality at local levels.

In such settings, new technologies alone may increase local inequalities, and policies intended to bring about gradual reform of the settings themselves may require only minor sacrifices by local elites while strengthening their dominance. This reading suggests that only radical social change will make the introduction of new technologies effective. Policy studies must clearly be concerned with the forces resisting change in order to improve understanding of the policies that can feasibly be implemented through legitimate channels.

Management systems, too, are a form of technology as well as a condition of absorptive capacity. Appropriate systems for managing

such things as extension services, repair and maintenance, rural agricultural and industrial development, marketing boards, and cooperatives, must absorb and give experience to local talent, use a mix of public and private channels that is politically acceptable and economically effective, and employ reward and incentive systems that are compatible with the culture. Yet, in common with hard technologies, most research on management systems has been directed to advanced country settings. More studies should be directed to management systems that are appropriate to the needs of developing nations.

Extending development to the rural poor also involves policies having a more direct effect on local settings and on their links with the more modern sector. Policies with respect to the allocation of government expenditures are a case in point. Judgments ex post suggest excessive allocations to urban infrastructure, curative health facilities, large scale urban industrial development, trunk roads, and university level education as opposed to rural infrastructure, preventive medicine, rural industry, rural access roads and basic education. These judgments suggest that the criteria for determining such allocations in the past have been faulty being based on a trickle down theory that has failed to be justified by events. This disclosure does not, however, supply alternative criteria for allocating resources. Policy studies might do so.

The introduction of linkages between traditional and modern sectors is a means of weakening the dualistic character of development. Productive agricultural technologies introduced in settings with no access to markets may only increase leisure and if

the technologies favor some crops over others, their introduction may affect nutrition adversely. Hence, linkages required to make new technologies effective include not only access to repair and maintenance skills and facilities and complementary inputs such as water, power, fertilizer, credit, advice and training--all conditions of effective utilization on the supply side--but also access to output markets (for incomes) and markets for consumer goods (as incentives).

A particularly intransigent problem is the local counterpart of the international brain drain. How do you keep qualified people down on the farm? First, there is as yet no clear consensus on what types of education and training are appropriate to the solution of local level problems. Second, those with education and training tend to migrate to the cities. The movement seems to reflect several factors: (1) the education and training is most appropriate to urban needs; (2) the rewards are greater in the cities; and (3) the social amenities and opportunities are seriously deficient in rural areas. Rural-urban migration seems to skim out of rural areas those who are better qualified and educated, thus increasing economic duality and class differences. Policy studies on these issues are needed.

Perhaps most policies must be directed toward appropriate rural education and training, the upgrading of rural social and economic infrastructure, the dispersion of economic activities toward rural areas, and the improvement of rural-urban linkages. This concentration on rural settings should not, however, obscure the possibility of improving the lot of the poor by facilitating their migration to settings that are inherently more productive. Constraints on internal migration, as on international migration, tend

to reinforce the established pattern which discriminates against the movement of those most in need to areas that are highly developed. More informed policies are needed on such issues at both national and international levels.

The concern with settings seems naturally to become microscopic. Yet the opportunities open to many developing countries are often limited by small populations and low per capita incomes. The size of the market is an effective constraint limiting the utilization of many types of technology. Hence, there is also a need for more informed policies which have the effect of centralizing certain kinds of decisions. Customs unions, common services, common clearing arrangements, and common markets are all means of realizing certain kinds of economies of scale without sacrificing national identities. That such arrangements may yield net benefits is not usually disputed but efforts to build them often founder on formulas for dividing those benefits among member states. Policy studies are needed to clarify the nature and quantity of economic benefits and the political considerations which so often prevent their realization in practice.

Common efforts to widen markets have their counterparts on the supply side. Commodity organizations and agreements are means of protecting supplies and stabilizing prices so that, among other things, the risks of investment and technological innovation are reduced. How common supply arrangements can be improved and extended (for example, to the storage of surplus supplies of food and other commodities) are appropriate subjects for policy study.

Modifying Choice of Technologies

The choice of technologies can be directly modified by shifting the locus of choice from one center to another, most usually from private to public. The shift from private to public is most often sanctioned as a means of introducing social considerations into decisions on technology, as with space programs, large irrigation schemes, and multi-national water control programs.

Social considerations may also be introduced through the imposition of government regulations and standards which constrain decisions that are otherwise private in character. Air and water pollution standards, reforestation requirements, soil conservation measures, mining regulations, and urban zoning are examples which pervade both advanced and developing countries. The establishment of standards, and means of implementing and monitoring them, is clearly a policy matter in need of continuing study.

Private decisions on technology are also influenced by a wide array of policies which modify the relative profitability of different technologies. These alter directly or indirectly the relative prices of inputs--land, capital, skilled and unskilled labor--and/or the relative prices of outputs--necessities and luxuries, imports and domestic production, and consumption and investment. They include policies with respect to wages, interest rates, exchange rates, tax rates and tax allowances. This policy area has attracted considerable research, but given its importance even more is required, particularly but by no means exclusively research with a focus on needs in developing nations.

As with technology, many policies affecting choices of technology in developing countries have been borrowed with little modification from the body of experience gained in advanced countries. But many of those policies were designed to stimulate capital-intensive means of production and the utilization of a highly trained and educated labor force accustomed to specialization and technology, and, in other respects, to be labor-saving. Minimum wages, accelerated depreciation, investment allowances, and low interest rates are policies which have, inter alia, served these ends.

As experience has been gained with these policies in developing nations, questions have been raised about their efficacy in these new settings. Efforts to conceive more appropriate policies have begun. These efforts deserve support, cooperation, and extension. A few examples may indicate the challenges involved.

Wage differentials in developing countries are pulled askew at the high end by demands emanating from international markets (the brain drain phenomenon) and at the low end by minimum wages. Can policies be devised which will retain professional skills in developing nations and in their rural areas and at the same time narrow the wide wage differentials that characterize most developing nations? Can policies be found which protect workers from exploitation without jeopardizing job opportunities for those in need of employment?

Investment allowances and accelerated methods of depreciation may attract capital from abroad but they also stimulate its use in capital-intensive ways. Can policies be devised which will promote employment without reducing the inflow of capital? Some studies of

employment allowances suggest they might be both useful and feasible but as yet no strong resource support for their practical application has been forthcoming.

Low interest rates, overvalued exchange rates, and transfer pricing mechanisms all favor the importation and use of capital-intensive methods in developing countries. Moreover, internally, low interest rates mean that scarce credit must be rationed in other ways usually favoring the well-positioned and depriving many others of the credit they could get at higher rates. How can these biases be overcome? Are there alternative policies which will divert capital to labor intensive methods and credit to the needy?

Programs to increase the productivity of the labor force through training levies in the industries requiring the skills often serve at the same time to discourage the employment of labor by making it too expensive. Some countries are considering alternative methods of financing which would place the burden of training costs on those industries which, through capital-intensive methods, have succeeded in avoiding labor force responsibilities; tax capital to train labor. Studies of these kinds merit support.

The introduction of new agricultural technologies has often encountered resistance among poor small farmers to whom failure would mean disaster. This perception of high risk is not always misplaced. Mono-agriculture is risky; other technologies that enhance specialization and dependence on linkages with outside markets for the purchase of inputs and the sale of outputs also increase risk especially as perceived by farmers accustomed to self sufficiency. Methods for sharing such risks may be essential if these and related

kinds of technologies are to be widely adopted by those they are intended to benefit. Methods of insurance and government guarantees need to be devised, improved and extended.

Moreover, if such technologies and the specialization they often imply become common, new forms of international insurance and risk sharing may also have to be devised. Indeed, some form of international risk sharing might today induce many private firms to extend the planning horizons they now employ in developing nations and encourage a more rational development and allocation of natural resources and industry at prices reflecting lower risk.

Closely related to such studies on risk sharing are studies of the rationalization of industry in advanced countries. The problems and costs entailed in winding down industries whose comparative advantages have disappeared are well known but effective and equitable policies for doing so still demand definition and implementation. Such policies should benefit both advanced and developing countries by improving both national and international allocations of resources.

Finally, studies on the choice of technology are needed which disclose the extent of international consistency among all national policy sets. National policies are not independent of each other and many policies, corporate taxation for example, may not be effective without international coherence.

External Effects of Technology

Much of the preceding discussion has been concerned with the direct effects of technology on those who utilize it, i.e., with interrelationships between technology and the constituency directly

served by it. The external effects of decisions on technology, i.e., effects on other constituencies, merit study partly because they are not yet thoroughly understood or quantifiable and partly because the global policy and management system seems to be poorly organized for coping effectively with them.

Decisions affecting technological change taken at any management center may affect, favorably or unfavorably, constituencies other than the one served directly by the center. The problem is to identify these external effects, to internalize them insofar as possible so that each center takes fuller account of external effects in making decisions, and to inhibit unfavorable effects when all else fails. The objective is to induce socially responsible behavior at all decision centers. Efforts to achieve this end may often entail agreements among centers and, if agreements cannot be reached, appeals to higher authority. In the global hierarchy, however, the highest authorities, such as the U.N. and related organizations, are notoriously weak and lacking in authority and effective sanctions. Hence, many international issues may remain unsettled, possibly at substantial social cost. While the resolution of some external effects may not require intervention at the global level, most have international dimensions of greater or lesser magnitude.

Externalities have both spatial (effects on peers) and temporal (effects on future generations) dimensions. Both have been the subjects of growing public concern and professional study over the last few decades. There has been a natural tendency in these studies to emphasize the negative external effects of technology in both dimensions--as examples, the pollution of air, ozone, water, soil and

food, health hazards of food additives and nutrition losses from food processing, the compression of living space through population growth, and the preemption of the opportunities of future generations through the exhaustion or profligate use of natural resources.

As a result, increasing attention has been given to the development of technologies which will either prevent further damage to the environment and the quality of life or reverse the negative effects already perceived. Studies have also been directed toward policies, regulations and constraints which will induce the development and adoption of environmentally sound technologies in the private sector. It is likely, however, that more intensive and diversified study of these policy problems will identify new policy options and improve the policy mixes now employed in both advanced and developing countries and at the global level as well.

Some external effects are less visible than those noted above which affect the welfare of others in fairly direct ways. New technologies usually have displacement effects on the opportunities open to non-users through their impact on market conditions. Experience with new agricultural technologies has demonstrated that their net benefits cannot be discerned merely by observing the net benefits accruing to users. Increases in production may reduce output prices and impoverish those who cannot use the technologies (because, for example, they require large quantities of water); similar consequences for non-users may occur if increases in demands for inputs raise the price of fertilizer or preempt water from downstream farmers. These displacement effects on the opportunities of others must be considered, together with the net benefits to

consumers, input suppliers and the users of the technology, if sound decisions on technologies and supporting policies are to be made. In such circumstances, appropriate policies are not easy to define. And when the effects are dispersed internationally, the problem is even more complex and political.

Like technologies, life styles have external effects by limiting or improving the opportunities open to others. Moreover, as technological change is responsive to life styles as they are expressed through public and private expenditures in the market place, socially responsible life styles should induce the development of more socially appropriate technologies. Technologies for shaping preferences are not widely used to advance socially responsible life styles, although commercial organizations have developed substantial expertise in influencing life styles for commercial purposes. Bans on uses of drugs and food additives, rationing to limit resource use or divert resources to public ends, and taxes on selected commodities such as alcohol, tobacco and large cars are used to affect or limit choice. Income transfers modify income distribution and hence the aggregate composition of expenditures. But direct public efforts to modify preferences are not widely or at least openly employed. This is a sensitive area involving policies and powers which may be misdirected or abused. Yet life styles are critical variables influencing technological change. No comprehensive set of policy studies can ignore policies which might make life styles more socially responsible.

The development of certain technologies may lag behind because external benefits are not fully considered by the management centers

responsible in the present hierarchy of management responsibilities for R&D expenditures and related investments. The development of technologies for preserving the diminishing habitat of wildlife and cultural phenomena of ancient and traditional life styles may suffer from this deficiency. The benefits of preserving wildlife in natural habitats and the architecture, arts, crafts, dance forms and verbal histories of disappearing cultures are global and temporal in nature. It is unlikely that present levels of tourist expenditures alone adequately reflect these benefits as they may accrue to either present or future generations. Yet in many cases the burden of preservation falls on nations with limited resources. Their budgets for preservation must usually be justified by early returns from tourism, i.e., from the share of global and future benefits accruing directly to them.

This same effect may account also for the relative dearth of R&D on appropriate small scale technology for developing nations. Those with the required R&D capability (say, a public utility) may feel that the benefits of such technology (say, small scale solar or wind energy units) would largely accrue to others and the benefits that would accrue to the shareholders (of the utility) cannot alone justify the research expenditure.

Another form of external effects should also be studied. If the several efforts to modify the location and composition of R&D expenditures in favor of the developing nations are successful, what feedback effects on advanced countries should be anticipated? Certainly a bilateral agency, cannot ignore the effects of its actions on the constituency responsible for its financing.

While policy studies of external effects should improve policy decisions in existing management centers, they are likely to expose even more pressing needs for improvements in (1) machinery to arbitrate among centers and (2) the allocation of management responsibilities among centers. In particular, recommendations are needed for strengthening discussion forums, authority and powers to implement decisions at the global level.

Conduct of Policy Studies

To be effective policy studies for appropriate technological change should involve an international dispersion of research, a multi-national composition of scholars, an interdisciplinary research approach, and access to private and social perceptions of costs, benefits and risks. Those involved will need close links to technological researchers, those in need of technological innovation and policy makers. These issues are discussed in other papers and need not be expounded here. However, the preceding discussion of policy issues does suggest three approaches to research on policy matters which may merit special attention.

First, policies may benefit from some studies that are clearly experimental in the usual sense of controlled experiments. Without a directly experimental approach, policy studies become either primarily theoretical in nature or attempts to order known policies by various criteria of effectiveness. Both of these approaches have important roles to play but a systematic approach to policy studies should not be limited to them. The first improves knowledge in an untested form. The second identifies the "best" of tried policy measures but runs the

same risks in the policy area as those disclosed by earlier efforts to transfer only the "best" hard technologies to settings for which they were not designed.

Controlled policy experimentation requires the cooperation of at least one management center, so that one or more policies intended to achieve an agreed objective can be introduced in a known setting or settings with procedures agreed for monitoring the outcomes and comparing the results with a controlled sample subject to existing policies. Knowledge about many policy issues might be expanded most rapidly in this way. Several approaches to risk sharing (insurance, government guarantees, subsidies, differential market prices) or the distribution of credit could be tested simultaneously in several sample rural areas that do not differ greatly in other setting characteristics. Monitoring information together with benchmark data might quickly establish the more promising approaches. Private, cooperative and government systems for providing farm inputs, tractor services and repair and maintenance facilities could be similarly tested as a basis for policy decisions. Different methods for instilling mechanical aptitudes in children, distributing health and family planning information, and generating appropriate rural technologies might also be tested in this experimental fashion.

Simultaneous testing of alternative policies is limited to policies that can be evaluated effectively on a micro basis. Policies that are global in effect, such as those affecting sea bed mining and the atmosphere, must be "tested" sequentially through the monitoring of actual practice. Yet even global policies may benefit from knowledge inferred from smaller scale experiments. For those who

distrust the experimental approach, it should be noted that many policies introduced on a national basis have had detrimental effects on large populations, effects that might have been largely avoided through smaller scale experiments.

The scope for policy experimentation should not, however, be exaggerated. In many cases, control features and opportunities will not exist. But in the context of changing preferences, shifting variables and learned reactions, the shifting setting in which all policies are introduced, every policy is in some respects new and different, i.e., a policy experiment. The element of control may be missing but opportunities to learn through evaluation are numerous. The policy study group should establish flexible procedures for monitoring and evaluating interesting policy applications at every level in the global management hierarchy.

Finally, much can be learned by initiating comparative studies when opportunities arise. Different management systems for rural development in Kenya, Tanzania, Brazil and Taiwan, different experiences with new agricultural technologies in Indonesia, India, and elsewhere, and different incentive systems for industrial dispersion are examples of technologically related policies which might be better understood through comparative evaluations. Most comparisons would be facilitated with advance planning so that relevant data are collected in comparable form, but even comparisons of retrospective experiences may serve useful purposes.

One note on Institute behavior may be in order. Many of the important policy issues concerning the promotion of appropriate technological change are global in character. Policy studies of

global matters may well result in recommendations on the bargaining machinery for settling differences among nations or on the appropriate powers of supra-national authorities to which nations can appeal. Such studies might best be arranged through consortia of donors and conducted by an international assortment of scholars in order to improve the international credibility of the studies and to protect the Institute from (Congressional) charges that it may be acting to undermine U.S. sovereignty on some issues.

Footnotes

1/ This is not inconsistent with a lower AC/DC ratio for scientists (perhaps 10-15:1). R&D itself may be a more capital intensive activity in advanced countries than it is in developing countries.

2/ The OECD (p. 54) quotes figures of 0.22 percent for Mexico (1973), 0.3 percent for Argentina (1971), 0.5 percent for India (1970), 2.4 percent for the U.K. (1969), 2.6 percent for the U.S. (1971) and 4.6 percent for the U.S.S.R. (1972).

References

OECD, Development Co-operation (November, 1978).

IV. ISTC AND SOCIAL SCIENCE

David Brokensha, Michael Horowitz and Thayer Scudder

SUMMARY

Our main conclusions and recommendations include:

1. "A technical element is basically a social factor."
2. ISTC should actively encourage the involvement of social sciences, including those fields other than economics.
3. There is a wide variation in research capacity, obstacles to development, and needs of developing countries.
4. ISTC should help the collection of basic information on Third World social science, much of which exists but is not readily accessible.
5. The main aim of ISTC should be to build up the social science capacity, in relation to development, of developing countries.
6. To achieve this, there is no general solution: emphasis should be on flexibility (see Warwick's paper).
7. Points to be emphasized in seeking solutions include promoting of social science constituencies in ministries, agencies, international agricultural institutes; stressing focus on one common problem, program, context when considering interdisciplinary cooperation; paying attention to indigenous knowledge and perceptions; building up networks of social scientists; becoming involved in many different forms of training, especially stressing the need for specific and local context; taking a long-term view; directing all research very specifically to development activities.
8. ISTC should see itself as a broker, a facilitator, a collaborator and a promoter of Third World social science.

PART I: INTRODUCTION AND BACKGROUND

This paper consists of three parts: the first part examines the questions, provides definitions, and considers major aspects of the present situation of Third World social sciences and development. The second part focuses specifically on some basic problems that ISTC will face, and the third part makes specific and practicable recommendations for appropriate action.¹

1. Questions

These are the three questions that we are asked to consider:

(1) Would it be worthwhile for the Institute to strengthen certain social science institutions abroad?

(2) If so, should they be encouraged to move in the direction of interdisciplinary work in the same manner that the Institute is being focused?

(3) How can the gap between research and action be bridged?

Although the three questions, to some extent, overlap, they can--and will--be considered separately. We first examine the relationship between the transfer of science and technology and the social sciences. Despite compelling arguments and accumulating evidence in favor of incorporating the social sciences into such transfer, there is by no means general acceptance of the place of the social sciences. There is resistance both from the scientific community in the U.S.A., and also from some Third World planners and officials. So a major task of ISTC will be to evaluate the place of the social sciences, and to take appropriate action to ensure that social sciences are properly used.

2. Technology

We emphasize that technology must be seen as a social event: it is not meaningful to consider it apart from its social context. Feller and Robinson make a similar point in their paper, when they say that "the technological structure of the society is the mediating force of knowledge, as filtered by institutions and customs." They define a technological capability as "a set of skills, resources, attitudes and institutional arrangements which promote the development, acquisition, diffusion and utilization of (cost-effective) new approaches." We shall be particularly concerned, as social scientists, with the "institutions and customs . . . the attitudes . . . the institutional arrangements."

The Swedish agency SAREC differentiates technique ("the physical tool . . . the prolonged arm of Man") and technology, defined as "the system of knowledge, skills, labour organization, decision-making and other factors required to produce, utilize, control and maintain a technique. . . .A technical element is basically a social factor."²

3. Social Sciences: The Different Disciplines

It may help clarify our later arguments if we try to define what we mean by "the social sciences" in this context. Surveys of social scientists who are engaged in development-related research and advising, in the Third World, show that one-third to one-half of the total are from economics,³ followed by agricultural economics, with others--sociology, anthropology, political science, geography--trailing behind. (In the U.S.A., geography occupies--or is thought to occupy--an intellectually inferior place, and is consequently frequently overlooked or underestimated. But the geographic

tradition in Britain, France, and other European countries is different, and stronger. The result is that, especially in former British and French colonies, geography and geographers continue to make significant contributions.)

There are indications that economics is losing its pre-eminence, partly because of too high expectations (for the contribution from economics) and partly because of a growing awareness of the potential contribution of other social sciences, especially social anthropology. One senior U.S.A.I.D. official, who is in charge of an evaluation unit, recently predicted that "within a decade anthropology would replace economics as the major discipline in development."⁴ This may prove to be an exaggerated view, but many people, both in academia and in the agencies, are encouraging increased participation from anthropology and other less quantitatively oriented social sciences. Paul Streeten has written: "The danger of social science research that attempts to emulate the 'hard' sciences is that it focuses on the measurable and neglects the rest. Some of the most important obstacles to the eradication of poverty and the promotion of greater equality lie in areas in which measurement is still very difficult or perhaps impossible." Streeten lists a wide range of political, social, legal, administrative and institutional obstacles.⁵ (These obstacles are considered in detail below, in Section 7.)

Dharam Ghai (then Director of the Institute for Development Studies, University of Nairobi), himself an economist, has also been critical of "the common tendency in both developed and developing countries for development research institutes to consist predominantly of economics."

This has some obvious advantages: training in economics is required for an analysis of most development problems; in a situation of scarce funds for research it makes good sense to aim for a minimum critical mass of specialists in a single discipline speaking the same 'language' and working with similar tools of

analysis; and concentration in one discipline also avoids many of the unnecessary clashes and misunderstandings from which multidisciplinary institutions suffer.

The weakness of a research institute based solely on economics are also obvious. Analysis of development problems cast exclusively in economic terms can be seriously deficient. It typically neglects such crucial issues as the values, social customs and traditions which motivate and influence people's behaviour, the role played by institutions, the administrative and bureaucratic constraints, and above all the impact of different pressure groups and economic interests in shaping socio-economic policy. Neglect of such factors not only seriously hampers an adequate understanding of a given developmental situation, but may also lead to policy prescriptions which are doomed to failure. The realisation of these problems is behind the rapid growth in Eastern Africa of multi-disciplinary institutes and a problem--rather than discipline--oriented approach to the study of development. The pattern in East Africa is now to involve interested specialists from a wide range of disciplines in research projects, evaluation teams, working parties, seminars and conferences. This has undoubtedly contributed to a better understanding of development problems and to more sophisticated approaches to their solution.⁶

Anthropology occupies a special and an ambiguous position in the world of development. Denounced as "the handmaiden of imperialism," anthropologists have at times been regarded with much suspicion.⁷ One indication is that there are few departments of anthropology at African universities (a notable exception is the University of Khartoum, Sudan); however, several distinguished African anthropologists work in departments of sociology or in research institutes. Attitudes are changing, as many Third World students choose anthropology as a profession nowadays. A social anthropologist, Arturo Warman, was appointed in 1978 as Director of Mexico's CIDER--The Research Center for Rural Development.⁸

We do not propose that ISTC should promote anthropology--or any other one social science--but instead urge that the Institute should have an informed and flexible attitude, so as to enable appropriate decisions to be made in particular circumstances. We also note that there exist great variations

within any one discipline: for example, it is unlikely that more than one-fifth of all established social anthropologists possess, in any noticeable degree, skills, experience and interests that enable them to make contributions to development.

4. Social Sciences: Interdisciplinary Cooperation

Cooperation between social science disciplines often means cooperation between economics and other disciplines. While this is often desirable, we have some cautions. First, the "transaction costs" are often high as participants have to learn each other's language and assumptions.⁹ Whether these costs are justified will depend on the particular circumstances.

Interdisciplinary cooperation is often less important than a common focus on one problem, policy, program or project. As Warren Ilchman has written, "Social science disciplines are redundant and overlap in subject matter--problems transcend disciplines and require a sensitivity to context (our italics) in which they arise and are affected."¹⁰ We illustrate this with an example from East Africa. Brokensha was (1970/71) one of a team of evaluators for the Kenya Special Rural Development Programme. The group included political scientists, economists, anthropologists and sociologists. All evaluators found that emphasis on specific problems--credit to cotton farmers, provision of rural water supplies, improved roads, reorganization of agricultural extension--provided a common arena, where all could contribute. Disciplines were less important than problems. In some situations it may be better to concentrate on improving those disciplines that are already strong, rather than trying to insist on a cooperation that will not be effective. Again, we stress the need for flexibility, and taking into account the needs, wishes and strengths of the Third World social scientists and officials.

5. Social Sciences: In The Third World

There is an enormous variety of social science research institutes in the Third World. To illustrate the numbers and variety, here are some examples: Twenty national institutes, from sixteen countries, were represented at a recent conference on "Social Science, Research and National Development in Africa." Also represented were four African organizations, four regional associations, seven funding organizations, two U.N. agencies and six government and inter-government organizations.¹¹

A World Bank report notes that in the Philippines alone there were:

- 31 organizations involved in some sort of social-science "R and D" at two main university campuses;
- 20 privately supported academic institutions;
- 8 public supported agencies;
- 6 non-academic privately supported agencies.¹²

The same report summarizes "The State of the Social Sciences in Latin America," noting that "the total number of institutes . . . doing some sort of social science research . . . must number several hundred," of which fifty or sixty are considered "good," in the sense of meeting international standards of research quality. The report mentions the Liaison Bulletin, which lists over 900 professionals in 49 independent and international organizations.¹³ India alone has 58 research institutes.

It is clear, then, that there are very many institutes and many individual scholars. ISTC should help in gathering information about the state of the social sciences in the Third World. We make more specific suggestions below (Section 12); here, we simply stress the importance of having good information about the types and quality of the individuals and institutions.

Another relevant question is whether there is "a Third World social science." Many Third World social scientists have expressed their concerns and fears about what they see as academic imperialism, and ISTC should be extremely sensitive to these fears. For example, at a recent conference in the Sudan, concern was expressed about the influence of North America and Europe on the organization of scientific knowledge and research. "Almost all social science text-books--and the research methodology and techniques--even the very concept of 'development'--come from outside. . . .Over the last two decades the majority of books, articles and other research papers on development problems in Africa, had been authored by scholars from Europe and North America."¹⁴ In response, many Third World scholars advocate increased training of their own people, rather than expulsion of foreigners. Dr. Samir Amin, an articulate and radical critic of international development, spoke persuasively at this same conference on the relationship between the universality of science and particular local conditions. He concluded by urging a continuance and strengthening of international collaboration: "It is most desirable for us to know the evolution of research in developed countries, not only the evolution of research on Africa problems, but also the evolution of theoretical research in general . . . for our problems are not independent, autonomous and cannot be separated from the problems of developed societies."¹⁵

Another example is provided by a 1978 Wenner Gren conference, chaired by Dr. Hussein Fahim (an Egyptian anthropologist) which considered "the universality of social science."

6. Social Sciences: In Other Settings

So far we have considered social sciences at research institutes and universities: now we turn to several "other settings" which may be of even greater importance for ISTC. In some circumstances, ISTC may be better advised to strengthen social science in these other settings, rather than in established social science institutions.

ISTC is likely to be more effective if there is a social science constituency in:

- (a) Third World ministries and agencies concerned with planning, development, finance, agriculture, health, education, natural resources, and public works;
- (b) the important donor agencies, such as U.S.A.I.D., World Bank and U.N. organizations;
- (c) the international agricultural institutes, such as IRRI, ICRISAT, ICARDA, IITA, ILCA and CYMMYT (these are crucial);
- (d) other schools of professional (engineering, medical and other) training and research.

These constituencies can be created by appointing social scientists to important posts within the ministries, and also by exposing senior civil servants to refresher courses, seminars and workshops. Many senior officials, in decision-making capacities, lack the requisite skills, inclination and/or time to read, understand, interpret and translate into action, the voluminous social science literature they receive. It is not a problem only of the officials, for many social science reports are presented in such a form as to be virtually inaccessible to officials seeking specific recommendations for practical actions.

But even if the reports are presented in readable and sensible form, there is still a need, on the part of the officials, for some understanding of basic social science. In some cases, it will be possible, with minor interventions, to help create or to improve understanding; in other cases structural and/or political impediments may retard the development of a constituency. Donor organizations like U.S.A.I.D. and World Bank have both come a long way in recent years in enlarging and strengthening their social science constituencies. This has meant, in practice, a shift away from an exclusive reliance on engineers, technicians and economists and a broadening of the base to include "other" social scientists.

We mentioned the possibility of short specialized courses for officials. There are many existing models: U.S.A.I.D. recently contracted for two Social Analysis Workshops for A.I.D. officials from two African regions.¹⁶ The aim of these workshops is to improve the capacity of A.I.D. program and project officers to assess the utility, relevance and quality of the social analyses which are required of all A.I.D. projects; it is also hoped to provide a social science optic on a series of special development actions with which the officers are concerned.

Another model, that could easily be adapted for these purposes, is the successful Economic Development Institute (World Bank) which offers seven- to ten-week specialized courses for up to 26 participants from the developing countries. "Courses are oriented towards concrete questions and the practical application of techniques to answer them."

The Brookings Institute's Education Program for Government Executives, now in its 21st year, offers three-day seminars for senior executives. This is another successful model.

One of our three basic questions focused on bridging the gap between research and action. The spread of social science to these other settings would undoubtedly help to bridge this gap, especially if "concrete questions" and "practical application" were constantly stressed.

Where should officials receive training, and in what form? Workshops, seminars, short courses, formal certificate and degree courses--each might be appropriate for specific groups and for particular needs. Some training can best be done in the U.S.A., but generally local institutions should be encouraged to provide training and to relate it to development-specific contexts.

We consider the training not only of officials already in agencies and ministries, but also of those preparing for development-related careers. What disciplines or combinations of disciplines should be studied? What is the role of economics for non-economists? How important is field experience? Which linguistic skills should be developed? What are the most important statistical, computer and quantitative techniques that need to be mastered? Should training take place where there is access to a professional school?

There is also the training, or at least sensitizing to social science, of engineers, agriculturalists, planners, physicians and other technical experts. Ideally, professional training should include, as an integral part of preparation, some concentration on the social sciences. We have a long way to go, for even in the U.S. there is still little attention to social factors. Occasionally medical training includes some consideration of social aspects, as happened in Ghana in the early 1960's when Brokensha collaborated with Ghanaian social scientists in discussing, with newly qualified Ghanaian physicians, the relevance of culture in the treatment of disease.

PART II: THE ROLE OF ISTC

In this part of our report, we examine some specific problems and suggest routes for ISTC, in light of Part I. Given its limited resources, ISTC will not be able to make major and universal direct contributions to social sciences and development. Nevertheless, it could be highly significant as a broker, a facilitator and coordinator: even with modest resources it could become a model for effective and sensible technology transfer. We spell out (below, Section 12) specific recommendations for retrieval and organization of information, for workshops and for training possibilities.

7. Problems: Obstacles

Paul Streeten has compiled a formidable list of "important obstacles to the eradication of poverty and the promotion of greater equality (which) lie in areas in which measurement is still very difficult or perhaps impossible. Amongst these are the following:

- (i) Unwillingness of governments to grasp the political nettles: land reform, taxation, labour mobilisation, widening access to education.
- (ii) Elitism, nepotism, corruption.
- (iii) Ologopoly and monopoly power: power of large landowners, of big industrialists, of multinational enterprises.
- (iv) Power of organised labour unions and the obstacles to an incomes and employment policy.
- (v) Restricted access to educational opportunities . . . reflects and reinforces the unequal structure of power and wealth.
- (vi) Weak entrepreneurship and defective management and administration.
- (vii) Lack of coordination between Central Plans and Ministries, Central Plans and regional, local and project plans; too many countries are long on planning, short on administration.

- (viii) The weakness of structure, area of competence, recruitment, training and administration of the U.N. agencies charged with development combined, sometimes, with a narrowly technocratic approach, encouraged by the origin and organisation of these agencies and their politically 'non-controversial' approach.
- (ix) Mass slaughter of ethnic minorities (often entrepreneurial and therefore hated) and political opponents, imprisonment without trial, torture, expulsion, the large sums spent on armies and the police and other horrors."¹⁷

ISTC will have to face this last item, especially with the current emphasis on Human Rights. It is probable that some, at least, of the social scientists, in any country grievously affected by these horrors, will be critical of the government policies. This means that collaboration might be doubly difficult; it also means that there will be a strong incentive for such critics to seek refuge outside their own country (perhaps even in the professional ranks of ISTC) which provides a temporary individual solution but which adds to the Brain Drain and further diminishes the supply of qualified local social scientists.

8. Problems: Sensitive Topics

Sometimes foreign social scientists can more easily report on politically sensitive areas than can local scholars. The I.L.O. series of country reports on "Employment, Incomes and Equality" deals with such sensitive areas as increasing social stratification, unbalanced land ownership, political interference in administration. These I.L.O. reports, mainly written by groups of foreign social scientists, have proved acceptable to the governments concerned, although the reaction might well have been different had the reports been presented by local scholars.

One way around this particular problem, and one that has not been used as much as it deserves, is to encourage local social scientists to serve for

varying periods as researchers and advisors in other developing countries. For example, Victor Uchendu, an anthropologist originally from Eastern Nigeria, has done extensive fieldwork in East Africa; other examples are cited by Owusu.¹⁸ Such cooperation has the advantage of making manageable the sensitivity factor, as well as of strengthening the base of comparative knowledge.

The applied payoff of such exchanges of Third World social scientists is likely to be great. Many developing countries face basically similar situations in regard to the same problems; also, almost every developing country can provide at least one success story--for example, agricultural research in Tunisia, parastatal management of the oil industry in Algeria, army loyalty in Tanzania, the harambee self-help movement in Kenya. Given these two factors, there is surely much of a highly specific and practical nature to share.¹⁹

ISTC will need to develop its own sensitive antennae in working out appropriate approaches in such situations.

Political sensitivities are not the only ones involved. There might also be a sensitivity to foreign researchers and to American (or western) dominance, so it is worth discussing the role of foreign social scientists. In some African countries, the R-and-D scene is still dominated by foreigners: this is true in most of the Sahel, where French influence is strong, and also in Kenya, where British and American participation is marked. Most developing nations, while rejecting any narrow cultural nationalism, are anxious to see more of their own scholars in important research and decision-making positions. Resentment has been expressed, in many areas and with varying degrees of validity, against "academic imperialism" (usually ill-defined),

bias, irrelevance, and exploitation.²⁰ Whatever the validity of the charges, this situation should be recognized as delicate and important, and ways to strengthen local self-reliance should be sought.

9. Problems: Indigenous Knowledge and Perceptions

This is only a problem to the extent that it is so often ignored by planners, both American and from the developing countries. The effect of western scientific and technological education is often to create negative attitudes to traditional culture, which is seen as pre-scientific, primitive, outmoded. Yet we have all had occasion to be much impressed by the extent--and relevance to development--of local people's knowledge of their environment, natural resources, farming and pastoral systems.²¹ To present examples from our own fieldwork, Brokensha has studied the extensive knowledge of the Mbere (Kenya) of the plant domain, and its relevance to rural development projects; Horowitz has written of his studies of nomadic pastoralists in the Sahel, stressing the impressive indigenous adaptive capacities of the herds-men to a bleak environment, and the predictable failure of western developments (sedenterization, cattle ranches) that ignore local knowledge; among Scudder's contributions in this field is his emphasis on the importance of floodwater agriculture practiced so successfully by many riverine peoples in Africa.

Development officials are beginning to recognize the validity of folk knowledge or ethno-science, and the need to understand local beliefs and perceptions before proposing any development plan. Unfortunately, the conversion is far from complete, and many officials and social scientists (especially economists), in both donor agencies and local institutions, regard local beliefs either as an impediment or as quite extraneous to development. This

may stem in part from the inadvertent brain-washing (mentioned above) that posits the superiority of things, and theories, western. Third World social scientists need re-educating in their own cultures. This is one area where foreign social scientists can make very real contributions.

Local scholars and research institutes should be encouraged to study what people do, and why. What is the traditional technology? How appropriate is the adaptive system to national policy? How can existing systems be used, perhaps modified, to fit in with new development projects? These are important questions that need to be asked.

ISTC should be able to take the lead here, providing there is some minimal support, as there usually is, within the developing country. This is an ambiguous area, for, while traditional culture is often publicly disdained, there is usually a wistful, perhaps latent, desire to re-establish something that is indigenous, is non-western, and is worthwhile.

10. Problems: Appropriate Technology

The basic question here is, "Is 'appropriate' technology for poor countries really appropriate?"²² However, there are situations when new forms of technology should be considered. Charles Weiss, Jr. (Science and Technology Advisor at the World Bank) wrote a splendid recent article, from which we quote:

This increased understanding of the impact of technology on developing countries has led policy-makers to recognize the need for a more appropriate technology--which has come to mean technology that is smaller in scale, more labor intensive, more subject to local mastery, repair, and control, and more in ecological and cultural harmony with its surroundings than the technology that would likely be used in an analogous situation in the North--and to recognize that the obstacles to the development and use of such a technology are as much social and political as technological. . . . This requires an intimate knowledge of the effects of market, social, and administrative forces on technology.²³

Weiss' comments underline our initial remarks on the social nature of technology, and also point the direction for what should be one of ISTC's main areas of interest. Fortunately, no large expenditures are necessary here, and Weiss cogently points out why.

Many of the seminal ideas in small-scale, ecologically appropriate technology . . . are due to small, informal groups who are working with minimal equipment and financial support and often with missionary zeal for a particular technology or pattern of life, which may be contrary to the ideas prevailing in their country . . . a dilemma for those . . . who agree that it is essential to devise simpler, cheaper technologies. . . .It is far easier to set up international institutes to do this than it is to nourish the fragile grass roots institutions. . . .There is a need for modest international support for these institutions. But it is essential that the international structure not swamp the fragile national institutions it is supposed to serve.²⁴

One example is the Karen Village Technology Centre, in Nairobi, Kenya, which has produced an impressive range of modest practicable appropriate technological innovations, especially in the areas of food preparation, cooking and storage.

Labor intensive methods, related to appropriate technology, are also sometimes regarded with suspicion by Third World planners and social scientists as attempts by selfish industrialized nations to push them back to a primitive past. Any attempts to strengthen social science research institutions needs to take these approaches into account, though it requires tact and care in making, receiving, and evaluating proposals.

The ISTC should be aware of the dilemmas and difficulties, but should on no account abandon appropriate technology.

PART III: RECOMMENDATIONS

11. Social Science Networks

We mentioned earlier the desirability of establishing social science constituencies in government ministries and international agricultural institutes. Another useful action would be systematically to develop networks of individuals and institutes with an interest in the same basic problems as ISTC, which should recognize that there is a huge existing store of relevant knowledge--and this can be tapped. There are three main geographical bases for such networks: we give brief details of each.

- (a) The U.S.A. The universities would be the main source of people and ideas, especially those that have a long involvement with international R and D, such as Harvard, Cornell and Michigan State. Then there are other institutions like the Inter-American Foundation and other smaller publicly supported bodies. Lastly, the experience of Oxfam, and of some other private agencies, should be tapped.
- (b) Other First World agencies. It is imperative to include major donor agencies and institutions from other countries. Two names immediately come to mind: the Canadian IDRC (International Development Research Centre) and SAREC (the Swedish Agency for Research Cooperation with Developing Countries). SAREC "promotes research that can support . . . self-reliance, economic and social development," notably in Vietnam, Tanzania and Sri Lanka, "to frame a development-oriented research policy and to expand and use its research resources in a more efficient way."²⁵ (The director of

SAREC is a social anthropologist, Dr. Karl Eric Knutsson, who is well aware of the contribution that anthropology can make to his efforts.) DANIDA, the Danish agency, emphasizes the improvement of research capacity for development, and other European donors provide useful lessons: the Swiss agency has been active in supporting ENDA, Dakar.

Some major European universities and academic institutions are highly relevant: the Institute of Development Studies at the University of Sussex, England, and the Institute of Social Studies at The Hague, Netherlands, both offer imaginative and effective approaches in training and research, with close cooperative links with Third World social scientists.

- (c) Third World social scientists and institutes. We gave (in Section 5) some figures on these institutes, stressing the numbers of people involved. Despite the quantity, it would not be too difficult, using--as anthropologists do--"key informants" to establish a network of relevant people and major centers. The purpose of these networks would be to exchange ideas and information, and to ensure that the Third World was involved in every stage of ISTC activities.

12. Information Retrieval

ISTC would facilitate its task if it helped retrieve existing information. This might well be done as a collaborative venture with one of the private foundations. A wealth of information is available, much of it in the form of relatively inaccessible reports and internal memoranda, mostly unpublished. An essential first step is the retrieval and analysis of existing information,

concentrating on Third World social science institutions, and then proceeding systematically to collect whatever information is needed to fill gaps. Sources include, beside the Third World centers,

- (a) U.S.: private foundations. Both the Ford Foundation and the Rockefeller Foundation have for many years been engaged in massive and carefully devised attempts to improve Third World social science. A good start would be to examine their reports, and also to interview key officials of the foundations.
- (b) U.S.: public institutions. Here, the overwhelming bulk of material has been produced by U.S.A.I.D. There might be some problems in information retrieval, and in classifying and analyzing the formidable bulk of material, although a start has been made (by A.I.D.) on a computerized access system. A systematic retrieval of relevant information, surveys, questionnaires, analysis and interviews could result in a comprehensive and detailed overview in a relatively short time, and at no great expense. This is an essential first step: it would be a mistake to take any action until basic information is gathered. It is encouraging that there already exist several prime documents, the single most relevant being the World Bank Report of the 1974 Bellagio Conference, which was "the first of its kind . . . to examine the worldwide system of social science research on development and to consider what ought to be done to improve the system."²⁶

13. Questions for Third World Social Science Institutes

If ISTC used key informants and other short-cuts, and if it concentrated on major institutions, it could collect some extremely useful information.

This exercise would also serve to familiarize ISTC officials with individuals, institutions and main R and D profiles of the major developing countries. Care should be used in using official reports and brochures, as these seldom present adequate details to evaluate the success and effectiveness of the institutes. Here are some guidelines for gathering data.

For each institute collect basic information on numbers, levels (Bachelor's, Master's, Ph.D.), disciplines of students, researchers, faculty.

- (a) How many of present faculty are foreign nationals? From which countries? What is the rate of "localization"?
- (b) What are the main research activities and priorities? To what extent is the institute involved in development research and planning? Does it compete with other research institutes?
- (c) What are official (governmental) attitudes to, and policy on, research? Do researchers sit on government boards or join ministry discussions? Is there a national social science research council? Are there any regional groupings, such as exist for Asia and Latin America? Do trained social scientists work in government ministries? What is the planning capacity within ministries?

We note such units as the newly established Monitoring and Evaluation Unit in Kenya's Ministry of Works, and the Integrated Rural Survey in the same country's Central Bureau of Statistics. On a larger scale is Mexico's CIDER--Centro de Investigaciones del Desarrollo Rural, the Research Center for Rural Development--which was established in 1975 and had a multi-disciplinary professional staff of 47 economists, sociologists, anthropologists

and others by 1977.²⁷ At a recent CODESRIA/DSRC Conference, the role of African Research Institutes in National Development was examined. Each participating institute was asked to explain its research priorities and activities; the relationship between the institute and the government, and the policy-making role of the former; and "a clear and open assessment of the problems concerning the relationship between research and development in general and between the input of the research institutes to decision-making processes of government institutions in their respective country." This was followed up by an examination of how African research institutions relate to each other, noting that they often have more to do with European and American organizations than with each other. How can CODESRIA strengthen inter-African links and research cooperation? Relations between African research institutes and external organizations, both for research and funding, were stressed, as was the question "How can African institutes relate to other Third World groups in Latin America, the Arab region, and Asia?"²⁸

- (d) What are the sources of funding? How much comes from government, from donors, from private sources? What constraints does the funding system impose?
- (e) What supplementary facilities exist by way of space, equipment, computers, secretaries, key-punch operators and data-processors, libraries? What opportunities and rewards are there for publication?
- (f) What are the external links of a research institute? Is there any special connection with a former colonial metropolitan country

(Britain, France)? Is the institute mainly financed by one donor agency? Does the donor treat local scientists as colleagues--or as wards?²⁹ The problem for donors is to provide financial support and advice without imposing their own priorities, "solutions," and personnel on local research institutes, which should be allowed a freedom of experimentation, even if it means that some blind alleys are explored.

- (g) Is there any decentralization of research institutes, small branch institutes in different areas of the country? This has been done with some success by I.R.S.H. (Niger) which has a branch at Maradi.
- (h) Is there any trend to sectoral rather than disciplinary emphasis? Ilchman recommends an emphasis on problem-oriented social science, so that "social scientists should be associated with sectoral international networks--in rural development, communications, nutrition, labor migration. . . ."30
- (i) Finally, what is the type of the research institute? Is it disciplinary (often economics) or inter-disciplinary? Is research primarily determined internally, or is there creative participation in research problem formation, or are research priorities decided from outside? Is it affiliated with a university or with government?

We need to examine each case, asking which fits the local situation best, which institutes have failed, which have been effective, and how this is related to the degree of involvement in economic and development research.

There may be an argument in favor of dissociating institutes from universities and having a closer relationship with government. Both the Institute for Development Studies, University of Nairobi,

and CERES (the Center of Economic Research and Social Studies at Tunis University) suffered from a government-academia polarity, which reduced their effectiveness. The Nigerian Institute of Social Research, which is directly supported by the Nigerian government, is reported to be more responsive to current development problems. However, too much government control can be dangerous in inhibiting true research and in curtailing criticism. What is needed is a comparative survey of a wide range of research institutes.

All collection and analysis of information should be geared to the needs of ISTC. One basic aim is to learn from past mistakes; another is to achieve familiarity with what exists, and with what has been tried in each country, so that any proposals can build on the existing structure. This information would be useful to ISTC in three key areas: in organization, in assessment of the "fit" between technology and culture, and in implementation (see D. Warwick's paper for more extended arguments).

14. Training

While ISTC might not wish, nor be able, to become directly involved in training, this is an aspect that deserves attention, and about which ISTC should be well informed, and in a position to offer sound advice. We think of this in relation to both social scientists and officials, to people from the Third World and from U.S.A. In seeking to develop local capacity to formulate and implement R and D policies, ISTC must be aware of training problems, considering questions such as "How many Ph.D.'s, and in which disciplines, should a country be producing?"

Short courses. What are the prospects for specialized intensive short courses separate from the formal degree structure, specifically designed for particular clients? One prototype was the successful "Devonshire" courses developed by the British Colonial Service in the 1950's, when middle-level administrative officers returned to Britain for a specially designed intensive three- to six-month course. PAID specializes in short courses: the Pan-African Institute of Development has for some years (with substantial contributions from U.S.A.I.D.) offered short courses at Douala, Cameroon. Other African centers have been established at Buea, in the English-speaking part of Cameroon, and at Ouagadougou, in Upper Volta, for Sahelian countries. Another center is proposed at Lusaka, Zambia. One problem is in persuading participating governments to make concessions for officials who attend courses, and to institutionalize the courses, as happened in the Ghana example cited above. The aims are admirable--to improve indigenous capacity in several fields of development--and it should be feasible to devise a means of encouraging formal acceptance of the courses.

Such courses are not always successful: the Kenya Institute of Administration offers short courses, which are seldom taken seriously by participants because there are no institutionalized rewards and penalties. Courses should be an essential part of a merit promotion, an indispensable step in career advancement. The University of Michigan offers a six-week course on advanced quantitative research skills in political science, and in Britain the University of Essex gives a similar course. Perhaps a more simple course on applied research techniques could be offered at some Third World universities.

Another possibility is to have a certificate or diploma issued at the successful completion of a course. The most effective way of establishing

valid credentials for diplomas is to institutionalize them in career terms. Brokensha directed a course, "Certificate in Social Administration," at the University of Ghana some years ago. This was a special non-degree course for government officers with at least five years' service in department of social welfare, labor, health, probation or community development. On successfully completing the course (which was based on classroom and field studies in economics, sociology, anthropology, political science and public administration) the officials were promoted to the senior service, which entailed extra privileges of pay, housing and automobile allowance. These were strong incentives: the passing rate was high.

The University of Khartoum offers a one-year diploma for Sudanese officials at the Development Studies and Research Center, and similar courses are offered with varying degrees of success in Kenya, Indonesia, Pakistan, Bangladesh and the Philippines. Such courses have advantages not only for the students, but also for participating universities and research institutes, which are exposed to a range of practical aspects and problems of development.

Where should such courses be held? According to specific needs, it might be appropriate to have some courses at American universities, provided that they are really aimed at the particular groups, and not just tagged on as an adjunct to existing courses. Generally, in-country training is likely to be more effective, as well as much cheaper.

Surveys and research design. "The number of social scientists in each country is quite small (and) there is considerable unevenness in their training. Many show serious weaknesses in quantitative skills especially, although they may also be rather shaky in research design." "The intellectual demands inherent in most of the research (in Southeast Asia) are minimal. A single technology is commonly required: the sample survey, contextual observation,

uses of literary evidence, regression analysis, are seldom if ever demanded of researchers. Nor often is interpretation. Marginal tabulations and a summary of research results are the usual requirements . . . usually (there is) little foresight as to design, relevance and utilization."³¹ These two statements emphasize that any consideration of training should include a careful examination of techniques and methodologies of field investigation, data collection, analysis and interpretation. It is in these areas that, for some countries, foreign scholars and institutions can continue to make their most valuable contributions.

15. Other Considerations

Here we group together several courses of action which are of some potential interest to ISTC.

- (a) Conferences/workshops are sometimes useful, not on a vast international scale but for national or regional groupings of social scientists. There is, according to Winans, "a need for an interdisciplinary organization which can bring together the modest numbers of scholars with on-going interests in research and the dissemination of social science findings."³² He also advocates the development of some kind of regional social science research council.
- (b) Regional networks. Many opportunities exist for the establishment of useful regional associations, such as the North African Management Organization. These help to focus on problems rather than on countries or disciplines, and also help lessen reliance on old colonial-metropolitan links. Not all regional efforts are successful:

for political reasons UNESCO established CERDAS, the Centre for the Coordination of Social Science Research and Documentation in Africa South of the Sahara in Kinshasa, Zaire, when half-a-dozen other centers offered superior advantages.

Regional networks are often hard to start, expensive to operate and politically shaky; but the logic of regional efforts remains attractive.

- (c) Localized case studies and textbooks. These two questions are related. Many Third World institutions suffer from having to use textbooks which are inappropriate in theoretical approach or in context to their specific situations. We reject, of course, the South African solution, which proposes not only "Bantu education" but also a specific ethnic curriculum for Zulu, Xhosa, Sotho and other groups. Nevertheless, there does need to be more attempt to draw on local examples, one way being the encouragement of local production of textbooks. For example, the Ford Foundation in Tunisia supported the production of what was described as "the first social science text for North Africa, in Arabic, since Ibn Khaldun in the fourteenth century."³³ We are not suggesting that ISTC should be producing texts, merely that this is yet another complicated factor.

In Tunisia, students made case studies of Tunisian administrative problems. This project-centered rather than discipline-centered approach has been recommended by many commentators. According to Weiss, "Basic research in developing countries should be organized around a local problem that is both scientifically challenging and of major importance."³⁴

(d) Research competitions and other unorthodox training. This somewhat unusual approach to improving training of social scientists has achieved considerable success. Winans describes his work as Social Science Advisor to the Ford Foundation in East Africa, 1976-78: "The focus of (my) position . . . is the annual social sciences research competition." Graduate students from the twenty-odd countries concerned were invited to submit proposals for research, the best ones (as judged by a committee consisting mainly of local scholars) being funded. Winans found that it required enormous input in terms of time and supervision, being essentially "a tutorial process," because most students were weak in research design and methodology. He had actively to canvass applications, to give detailed guidelines, and to help in proposal preparation. But the results have been impressive, in that there has been a clear improvement in local research capacity. The competition encourages team projects, inter-disciplinary cooperation, and applied research, all central to the development process. Some students have based doctoral dissertations on research projects.³⁵

One of the goals in strengthening social science in relation to international technological cooperation must be to create an indigenous capacity, among social scientists, to work in more active ways with donors on development projects. For example, U.S.A.I.D. and other agencies increasingly require social and environmental analyses of projects, yet few Third World social scientists are at present able to do this effectively, because of inadequate training. In this connection with international cooperation and encouragement of local scholars, we note and commend the Canadian IDRC

(International Development and Research Centre) for emphasizing two major aspects in their research support: first, grants are made only to Third World researchers; Canadian or other scholars may be written into projects as associates, but the major responsibility must be taken by a local scholar. Second, only applied research is supported. These two principles could be promoted by ISTC.

- (e) Long-term research. The value of long-term field research in social anthropology has been recognized and detailed in a recent book of that title.³⁶ Agencies are also beginning to recognize the need for long-term studies. One recurring complaint on social science R and D is that non-economists are brought into the project far too late, long after planners have decided on policy, and when alternative means can no longer be proposed. Social scientists are often brought in on "a one-shot deal," when what is required is the opportunity to contribute before, during and after the development project: social scientists--and not only the economists--should actively participate in the design phase, they should monitor the project as it is carried out, and they should evaluate it after completion. One recent, encouraging example comes from U.S.A.I.D., which requested proposals that would undertake a social impact study of new and improved roads in Western Kenya. The proposal envisages a team of three social scientists who will spend from one to two months each year in Kenya for a period of five years. Their task will be to evaluate a series of goals and aims, relating to spread of benefits, equity,

role of women, local participation and other factors. This is a welcome opportunity, if properly handled, to make a real contribution to social impact studies, and also to help significantly in training of local (Kenyan) social scientists in the techniques and methods of this type of fieldwork and data analysis.³⁷

- (f) Collaboration. ISTC will have many opportunities of encouraging collaboration between social scientists. There are several models of collaboration, one of the most common being between U.S.A. and one developing country. H.I.I.D. has been coordinating a broader collaborative project, where social scientists from four countries --Mexico, Egypt, Philippines, Kenya--meet to discuss population problems. The most interesting dimension of this was the learning between Third World participants. Another H.I.I.D. proposed project will be concerned with one country, Indonesia, but has interesting and unusual aspects. Research will be conducted by teams (from economics, sociology, anthropology) on three development projects in two villages, as a comparative venture. This will provide a clear link between research and action, and will also provide on-the-job training for Indonesian social scientists, who will be combining their study of actual government programs with their theoretical backgrounds.³⁸

ISTC should be similarly innovative, looking at a wide range of models of collaboration.

16. Conclusions

(a) Variation. Note the great differences in research capacity between continents (Southeast Asia and Africa) or between countries on same continent (Argentina and Ecuador; Kenya and Chad). With the proposal to include, in ISTC, some middle-tier developing countries such as Mexico, Lebanon, Nigeria, differences will become even more noticeable.

Differences exist in

- numbers and quality of researchers (Sri Lanka has many social anthropologists with Ph.D.'s; in the whole Sahel there are one or two). We do not mean to imply, however, that a Ph.D. is necessary in order to do useful research;
- types of disciplines favored;
- amount and sources of funding;
- adequate data base;
- contributions and role of foreign social scientists;
- relations with government officials;
- appropriate types of assistance.

(b) Foreign social scientists. Noting the great variation in research capacity, ISTC should concentrate on increasing local capacity to deal with development problems, while recognizing that "complete self-sufficiency (is) undesirable, and there remains a role for development research in developed countries--and for a fruitful exchange of knowledge and personnel between the two types of country."³⁹

(c) Inventory. An essential preliminary step, before deciding on any specific courses of action, is to find out what major Third World social science institutes are doing, and to evaluate their research capacity and

that of donor agencies in other countries, especially IDRC (Canada), SAREC (Sweden), the United Nations University in Tokyo, and the British Overseas Development Institute, among others.

(d) Training. Many opportunities exist for improved training of Third World social scientists, in their own countries, in other developing nations, or in U.S.A. or other North American or European countries. Training should not be confined within the orthodox western degree structure, nor should it be restricted to universities, which are often either unsuitable for these sorts of training or are reluctant to try. Are there new and more appropriate ways of bridging the gap between the universality of science and the particularity of local aspirations and conditions? "There is a need . . . to develop new concepts, analytical categories and models to fit the situation prevailing in developing countries . . . data and statistical systems need to be adapted . . . this can only come about if the social scientists have an intimate understanding of the institutions, traditions and values of people in developing countries."⁴⁰

(e) Selective approach. Assistance should be on a modest basis, carefully selecting different countries and different types of social science research institutes. It is essential to be innovative, imaginative, flexible and--above all--to be fully cooperative with Third World social scientists.

(f) Disciplines. Inter-disciplinary cooperation should in certain circumstances be promoted by stressing project- and sector-centered research, and also by including social sciences other than economics.

(g) Research and action. ISTC will concentrate on policy issues; links between researchers and policy makers should be examined and strengthened.

(h) Regional cooperation. Regional networks and associations, at various levels, may serve very useful purposes, and should be established, or existing ones strengthened, where appropriate.

(i) Long-term research and training. Training has a lead time of the order of ten to twenty-five years, so immediate results should not be anticipated. Development research will be much more effective when social scientists are associated with programs and projects from the design phase, continuing until after completion.

(j) Funds. Social science institutes should receive funds from several sources, government and private. Undue reliance on any single source may produce an imbalance.

(k) Local participation. One main theme is the overwhelming need for donor agencies and American social scientists to be more aware of local knowledge, capacities and perceptions at all levels from that of peasant farmers to directors of research institutes. The ISTC offers splendid opportunities, provided it has the necessary patience, understanding and imagination to work with local people.

17. Answers

We return to the original three questions, concluding that there is no simple answer to the first two, on strengthening social science institutions and encouraging inter-disciplinary work. ISTC must be flexible, must take a situational approach, must decide on appropriate action according to the particular circumstances. In our report we have suggested several promising leads, and also stressed the need, in training, to focus on actual case studies, as a means of bridging the gap between research and action. Any

ISTC sponsored research should be quite specifically directed to action: there are numerous possibilities.

ISTC should concentrate (using the variety of methods, which we mention) on building social science capacity in Third World countries. There should not be an attempt to find a general solution, but rather an ad hoc approach, taking specific programs and supporting the capacity to tackle specific problems.

Finally, we express the hope that the 100 or so professionals on ISTC staff will include social scientists--both economists and non-economists, both American and Third World people.

FOOTNOTES

1. We gratefully acknowledge written and verbal contributions to this paper from the following scholars: Michael Cernea, World Bank; James S. Coleman, Rockefeller Foundation and University of California, Los Angeles; Liberty Mhalanga, ENDA, Dakar; John Nellis, Ford Foundation and Carleton University (Ottawa, Canada); Edgar V. Winans, Ford Foundation and University of Washington. The interpretations and conclusions are, however, our responsibility.
2. SAREC, 1979: 9-10.
3. Ilchman, 1977: 27c; Cernea, 1979: 17.
4. Robert J. Berg (Associate Assistant Administrator, Policy and Program Coordination), at a meeting of the Society for Applied Anthropology, Philadelphia, 17 March 1979.
5. Streeten, The Social Sciences and Development, 1974: 48.
6. Ghai, The Social Sciences and Development, 1974: 60-61, emphasis added.
7. Brokensha, 1966: 14-17; Asad, 1973; Lewis, 1973.
8. Cernea, 1979: 18.
9. Donald P. Warwick, personal communication. Warwick states that H.I.I.D. (the Harvard Institute of International Development) has had good experience of inter-disciplinary cooperation, and they are actively recruiting non-economists to work with economists on development problems.
10. Ilchman, 1974: 22.
11. Codesria, 1978: 5-6.
12. The Social Sciences and Development, 1974: 186-187.
13. Ibid., 1974: 193-197.
14. Codesria, 1978: 2.

15. Ibid., p. 11.
16. Organized by the Institute for Development Anthropology, Inc., one workshop was for A.I.D. officers serving in The Sahel, and was held in Mauritania in April 1979; the second, for A.I.D. officials from Sudan, Somalia and Tanzania, will be held in Washington, D.C., in May 1979.
17. Streeten: The Social Sciences and Development, 1974: 48-49.
18. Owusu, 1978: 329.
19. John Nellis, personal communication.
20. Streeten, op. cit., pp. 4-26.
21. See Brokensha, Horowitz and Scudder, 1977. Other scholars who have written on this subject include the geographers Paul Richards and Gregory Knight, and the anthropologists D.M. Warren and Oswald Werner.
22. The Economist, 26 March 1979: 122. This is a good account of the main objections.
23. Weiss, 1979: 1084, emphasis added.
24. Ibid., p. 1088.
25. SAREC, 1979: 30-31.
26. The Social Sciences and Development.
27. Cernea, 1979: 2.
28. Codesria, 1979.
29. Denn, 1979: 961.
30. Ilchman, 1977: 29.
31. Winans, 1978: 7; Ilchman, 1977: 16.
32. Winans, 1977: 6.
33. John Nellis, personal communication.
34. Weiss, 1979: 1088, emphasis added. See also Winans, 1978: 11.

35. Winans, 1978: 1, 2, 6-8.
36. Foster, 1979.
37. Thayer Scudder has written extensively of the need for social science, especially social anthropology, to be associated over a long period with resettlement projects, particularly in connection with man-made lakes. See Scudder, 1978.
38. D. Warwick, personal communication.
39. The Social Sciences and Development, 1974: 237-238 ("Conclusions").
40. Ghai, The Social Sciences and Development, 1974: 63-64, emphasis added.

REFERENCES

- Amin, Samir
1978 "Conference on the State of Social Science in Africa"; mimeographed paper presented at the Conference on Social Science, Research and National Development in Africa, 4-8 November, 1978 organized by CODESRIA (Council for the Development of Economic and Social Research in Africa) and DSRC (Development Studies and Research Center, Sudan).
- Asad, Talal (ed.)
1973 Anthropology and the Colonial Encounter. London: Ithaca Press.
- Brokensha, David
1966 Applied Anthropology in English-speaking Africa. Lexington, Kentucky: Society for Applied Anthropology (Monograph No. 8).
- Brokensha, David W, Michael M. Horowitz and Thayer Scudder
1977 The Anthropology of Rural Development in the Sahel. Binghamton, N.Y.: Institute for Development Anthropology, Inc.
- Cernea, Michael M.
1979 Monitoring and Evaluation: PIDER Rural Development Project in Mexico. Washington D.C.: World Bank (Staff working paper, mimeo. 70 pp).
- CODERIA/DSRC conference
1978 "Social Science, Research and National Development in Africa". Conference outline. Khartoum.
- Denny, Brewster C.
1979 "FITC: Something New or More of the Same?" Science Vol. 203, 9 Mar 79:961.
- Directory of Selected Scholars and Researchers in Southeast Asia.
1974 Singapore: Regional Institute for Higher Education and Development (Annuaire Tapingkae, director).

Foster, George M. Thayer Scudder, Elizabeth Colson and Robert V. Kemper
(editors)

1979 Long-Term Field Research in Social Anthropology.
New York: Academic Press.

Ilchman, Warren

1977 "Social Sciences and the Universities in Southeast Asia"
Mimeographed paper, 42 pp.

Lewis, Diane

1973 "Anthropology and Colonialism"
Current Anthropology 14, 5, Dec 1973: 581-602.

Owusu, Maxwell

1978 "Ethnography of Africa: the Usefulness of the Useless"
American Anthropologist 80:2, June 1978:310-334.

Pan African Institute for Development (PAID)

1978 Progress Report 1977-1978. Geneva.

SAREC (Swedish Agency for Research Cooperation with Developing Countries)

1979 SAREC's Third Year (Annual Report 1977/78)
SIDA: Stockholm.

Scudder, Thayer

1978 "River Basin Development and Local Initiative in Savanna
Habitats" in Human Ecology in Savanna Environments
(New York: Wenner-Gren Foundation).

The Social Sciences and Development

1974 Papers presented at a conference in Bellagio, Italy, on the
financing of social science research for development,
Feb 12-16, 1974. (Sponsored by Ford Fn. Int. Dev. Res.
Center, Rockefeller Fn, USAID and World Bank)Pub. Washington,
D.C. World Bank. Papers by Paul Streeten et al.

Weiss, Charles Jr.

1979 "Mobilizing Technology for Developing Countries"
Science Vol 203, 16 Mar 79: 1083-1089.

Winans, Edgar

1978 "End of Tour Report" after 2 years as Social Science Adviser
to Ford Foundation, Nairobi (mimeo).