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PROGRAM EVALUATION PLAN REPORT

Rural Satellite Program:
Evaluation Management Contract

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Preface

On August 17, 1981, Abt Associates Inc. (AAI) and the U.S. agency for International Development (AID) executed a contract for the Rural Satellite Program: Evaluation Management Contract. Since that time (and before), the AAI project team has been heavily immersed in finding out all we could about the Rural Satellite Program (RSP) and the evaluation objectives in order to prepare this first major, and important, report of the contract, the Program Evaluation Plan Report.

The present report is the product of review of related documents, of several formal meetings, and of numerous informal information exchanges. On August 12, the RSP Program Officer, Dr. Clifford Block, met with AAI contract staff to discuss the program and the Evaluation Management Contract (EMC) objectives. On August 18, the "formal" contract startup meeting was held in Washington with key representatives of AID's Rural Satellite Program, of the Applications Management Contractor, and of the Evaluation Management Contractor in attendance. Then, on September 3 and 4, an intensive two-day-long Program Evaluation Plan Conference was held at Abt Associates to discuss the RSP and the evaluation objectives and to start the EMC team off on a consistent and comprehensive footing to prepare this report.

Abt Associates is extremely fortunate to have as its partners in this exciting venture three major subcontractors, each of whom brings to this project a depth of understanding and experience in an area or areas of great importance to the contract. These subcontractors are Massachusetts Institute of Technology, Research Program on Communications Policy; Communications Studies and Planning International, Inc.; and Cook and Cook, Inc. These subcontractors have functioned as integral members of the contract team and have contributed greatly to the total team's understanding of telecommunications policy, telecommunications economics, and evaluation of communications programs.

In a report as comprehensive as this Program Evaluation Plan report must be, many people have tangibly contributed as authors. Since listing all the authors on the title page would be close to impossible, they are listed here:

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1.0 INTRODUCTION

The U.S. Agency for International Development has launched a major program to demonstrate the applicability, reliability, and cost-effectiveness of satellite communications in rural areas of developing countries. The AID Rural Satellite Program (RSP) is a $24-million, seven-year-long demonstration of pilot experiments to transfer the range of appropriate, cost-effective communications technologies to the developing nations. The program will encourage the use of existing satellites to provide domestic communications for rural areas in the developing world. Small earth stations installed in rural areas of five demonstration countries will make telephone, radio, and other communications modalities available to support rural development activities in the health care, education, and agricultural sectors of each country.

Major segments of the RSP include:

1. A demonstration project in Peru.

2. Investigation of innovative systems designs and technologies.

3. Development of policy studies on satellite services for rural areas of developing countries.

4. Information gathering and dissemination on the RSP and other satellite related activities.

5. Implementation of pilot projects in five developing nations over the next five years.

6. Evaluation of the pilot projects and the RSP as a whole.

Abt Associates Inc., as the Evaluation Management Contractor (EMC), is responsible for the implementation of the evaluation activities in Item 6 above. This report presents an Overall Program Evaluation Plan for the RSP.

The Overall Program Evaluation Plan described in this report is both superordinate to, and a prototype for, individual Project Evaluation Plans that will be developed subsequently. It is superordinate in the respect that it is more than the summation of five individual pilot project

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evaluations. Rather, the aim of the Program Evaluation will be to inform AID and other interested audiences of the workings and impacts of the Rural Satellite Program in its broadest possible institutional context, i.e., the context in which satellite communications programs generically can be expected to operate in developing countries, generically. In addition, the evaluation of the Rural Satellite Program, as distinct from the five pilot project evaluations, must yield information on the financial and market aspects of satellite communications in rural areas of developing countries. This information is essential if international lending agencies and international carriers are to be asked to invest in such projects in the future.

If we were to take a rigorous experimental point of view, we might consider ourselves hampered by having a sample of only five pilot projects from which to generalize, in this program evaluation, to the developing country environment. From the real-world evaluation point of view that we do take, however, we feel we have an unparalleled opportunity to provide valuable information to development officials, international lenders, international carriers, and developing countries themselves on the basis of a large, well-funded demonstration program consisting of five different, fully implemented pilot projects in five different developing country contexts. It falls upon us, then, as the Evaluation Management Contractor, to synthesize the commonalities, and discern the reasons for differences, in the pilot projects, their purposes, and their impacts, in order to provide evaluative information on the program as a whole.

The Overall Program Evaluation Plan is a prototype for the project evaluation plans that will be developed for each of the five pilot project countries in the sense that -- although the countries will vary and the systems applications will be different -- common threads of information will be needed in order to evaluate the RSP and compare pilot project experiences. The five areas of project evaluation will be technological, financial, economic, social, and institutional. Each of these areas is discussed in great detail in Chapter 5 of this report, and therefore they are not further described here. From this Overall Program Evaluation Plan, methods of conducting the five areas of evaluation will be derived. We anticipate that the five country project evaluation plans, which

will be developed at the beginning of each pilot project, will be modifications of this overall plan. The source of the modification will derive from the particular sociocultural and institutional context of the particular country, the nature of the application to be implemented in the country, and, we suspect, the application and evaluation experience from pilot projects that have gone before within the RSP.

While it falls to us to develop an Overall Program Evaluation Plan at the very beginning of this contract, vital pieces of information that might normally be available are unavailable to us, namely, identification of the countries in which the five pilot projects will take place and specifications of the telecommunications applications in each of the pilot project countries. The Applications Management Contractor for the RSP, the Academy for Educational Development, and AID are currently working diligently to negotiate the complex agreements that will eventuate in specific applications in host countries. This report is being written in the absence of information on specific pilot project countries and applications. As such, we are attempting to build an evaluation structure upon a foundation that is, at best, subject to considerable shifting as pilot project countries actually come on board and specific satellite communications applications are actually planned. The Overall Program Evaluation Plan, then, is likewise subject to modification as we obtain both knowledge of the applications and countries and experience in implementing specific project evaluation plans progressively over the 4-1/4 year span of this Evaluation Management Contract.

The Program Evaluation Plan presented in this report is not characterized by one "grand" research design or one overriding evaluation paradigm. The different audiences toward which our subsequent evaluation reports will be addressed, the various constituencies who may have an interest in the RSP evaluation, the number of areas to be covered in the evaluation -- all dictate that a simple, unidimensional evaluation scheme is simply not appropriate. Thus, this plan does not hold out one research design that will be applied to all five pilot project countries, or one major data collection method. In an endeavor as complex as this,

attempts to fit all evaluation designs into a single mold would be doomed to failure. That is not to say that the Program Evaluation Plan presented here is a hodgepodge without any unifying elements. Rather, it is a complex, multifaceted plan that, for each pilot project country, will be adapted to the specific details of the project in question, but, for the program as a whole, will provide an overall, integral evaluation of the RSP.

The Program Evaluation Plan presented in subsequent chapters of this report defines data requirements across a host of dimensions. Many of these requirements will have implications for the design of the satellite communications application in each pilot project country, as well as the implementation and the monitoring of that application. It is therefore extremely important that all applications arrangements recognize and consider the evaluation data requirements elucidated in this report. The working arrangement developed thus far among the Applications Management Contract (AMC), the Evaluation Management Contractor, and AID has been a good one, and we trust that it will continue in that vein. Certainly, the AMC and the EMC need to discuss fully, and take into account, each other's requirements as the RSP unfolds in order for the RSP both to work and to be evaluable. From the EMC's standpoint, we need to be sure that the AMC is fully aware of our evaluation requirements as they effect project application designs, and it is therefore crucial that evaluation requirements be discussed at the earliest possible time in the development of a pilot project application scenario.

The remainder of this report proceeds, in a logical sequence, to inform the reader of the background and current plans for evaluation of the RSP. Chapter 2 briefly reviews the objectives of the RSP, while Chapter 3 briefly summarizes the objectives of the RSP evaluation (i.e., the EMC). Chapter 4 attempts to give an organized conceptual overview of what, as indicated above, is a very complex, multifaceted evaluation. Chapter 5 is the longest chapter of this report because it discusses in detail the five major areas of project and program evaluation--technological, financial, economic, social, and institutional. For each area, it discusses the

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evaluation questions to be asked, data requirements, and analytical approaches. Because it is frequently difficult to visualize an evaluation plan in the abstract, we have attempted, in Chapter 6, to apply the evaluation plan discussed in the preceding chapter to two hypothetical projects. The next three chapters attempt to synthesize some of the practical implications of the program evaluation plan described: issues of data collection, logistics, and work implications. In the final chapter, Chapter 10, we elaborate our scheme for tailoring the evaluation findings to its interested audiences and constituencies.

We turn now, in Chapters 2 and 3, to an exposition of the objectives of the Rural Satellite Program and of the RSP evaluation.

2.0 PURPOSES OF THE RURAL SATELLITE PROGRAM

The purposes of the AID Rural Satellite Program are:

- To develop and test the use of satellite communications to provide educational information and telecommunication services for rural development.
- To demonstrate to communication carriers and equipment suppliers the need and market for appropriate rural communication services.
- To help lower the cost of earth stations by demonstrating appropriate technology and applications.
- To provide international lending agencies and national planning and telecommunications agencies with evidence of the benefits of rural telecommunication investments.
- To support the growth of national capacities to integrate telecommunication investment planning with rural development programs in areas such as education, health, and agriculture.

The knowledge and experience that are gained as a result of the RSP's pilot and demonstration projects will be used in a number of different ways. The program's findings will provide valuable information for the governments of developing countries in planning sectoral development, particularly in defining the institutional and physical infrastructures that are required to bring satellite telecommunications into play to facilitate development. It will also provide evidence of the effectiveness of satellite technologies to the international carriers that provide satellite communications services and evidence of the costs and effectiveness of satellite communications programs to the lending institutions that play a vital role in the financing of development activities and programs. Finally, it will demonstrate to the rural populations in participating LDCs the ways in which communications, and the use of satellites in communications, can act as a spur to improving their livelihood and living conditions.

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There is, of course, a vast extant literature on the role of communications in development. The purpose of this project is to examine how satellite communications interact with rural development, and, as such, new, uncharted areas of investigation will be explored. It is anticipated that the following types of communications modes will be brought into play during the course of the RSP:

- radio broadcasting,
- telephone,
- teleconferencing,
- telex,
- facsimile transmittal, and
- slowscan video.

Conventional (normal-scan) television is not anticipated to be one of the communications media. The media that will be used will be packaged in such a way that they meet the needs of situations that are likely to be encountered in a developing world context. The RSP will examine the efficacy of different media mixes in a discrete set of development sectors: health, education, and agriculture.

The RSP, furthermore, will provide a significant opportunity to test a number of different communications technologies. Since one of the stated purposes of the program is to help lower the cost of earth stations for LDC rural development, the RSP will create a market for ground stations that use simple technology and can be manufactured either entirely or partially in the LDCs that will use them. The increase in the demand for equipment that will result from the RSP will affect a number of existing carriers and suppliers. The program could provide these firms with examples of how their technologies can be linked with software and the training and technical assistance that are needed to implement them.

The RSP will also have a training and technical assistance component. These activities will serve as the basis for developing procedures for technical assistance for application of satellite technology and associated programs in other sites in the developing world.

One of AID's primary objectives in sponsoring the Rural Satellite Program is to obtain data that can be used to demonstrate the feasibility of relevant technologies to communications carriers and equipment suppliers. The technologies that will be used in this program do not, as a rule, have much of a track record in the developing world. This lack of experience has the effect of making communications firms cautious about investing in these technologies. The RSP is intended to provide evidence of the need for the use of satellite technologies, of the hardware and software that is necessary to operate them, and of the costs and returns on investment that are associated with rurally oriented satellite communications systems in developing countries.

The Agency for International Development believes that this program will provide a concrete demonstration of the utility of this development resource and that that, in turn, will convince the carriers, equipment manufacturers, and sellers that there is a sizeable market for the equipment, the support networks that are required to operate it, and the services that it can provide. The RSP may serve to demonstrate how various combinations of technologies and backup support could be packaged in order to provide communications services that address the specific needs of developing countries.

As suggested by the foregoing discussion, the RSP is also intended to assist developing countries in acquiring the capabilities to plan for and use communications to support their programs to develop their rural sectors. Not only will the experiences of this program impact upon the countries in which the demonstrations are held, but also it will package the findings from these demonstrations in such a way that they will be useful to non-participating LDCs in designing their rural development programs.

Since the RSP will be implemented in five pilot projects in different developing countries, it will also examine and compare the types of institutional and organizational structures that are most suitable for the initiation of satellite-based communications systems. The technical and human skills that are requisite for the implementation of these

systems will also be examined in the pilot projects. At present, neither the RSP pilot project countires now the types of pilot project applications are known with any assuredness. Several generic types of applications have been considered, however, and to provide the reader with a backdrop against which to understand the kinds of RSP pilot project applications that might be implemented, brief illustrations of applications include:

- Telephone and teleconferencing links among the far-flung isolated university or college campuses of island countries or regions to facilitate distance teaching and more efficient administrative links.

- Telephone links among rural population centers where none now exist to foster information exchange that will facilitate agricultural marketing and planning.

- Telecommunications links of various kinds to assist in opening up arid and semi-arid lands to agriculture.

- Telecommunications linkages among existing earth stations in a country where these linkages have ceased to function -- the major aim being, in this case, to provide hands-on planning and technical assistance to make at least part of the existing ground system function efficiently.

These, then, are the objectives of the AID Rural Satellite Program and some of its possible applications. We turn now, in Chapter 3, to a discussion of the objectives of the Evaluation Management Contract, for it is in the context of these evaluation objectives that the remainder of this Evaluation Plan Report is written.

3.0 OBJECTIVES OF THE RSP EVALUATION

In order for AID to demonstrate the usefulness of satellite communications for rural development, it must provide persuasive evidence of the efficiency and effectiveness of a number of applications to a number of constituencies. Three arenas of interest can be distinguished. Proceeding from the narrower to the broader, these are: a market-oriented arena, a sectorally-oriented arena, and a societally-oriented arena.

In the market arena, AID is interested in developing investment decision information for international lenders and national and international telecommunications carriers. Thus, the first objective of the evaluation for this arena is to identify the kinds of key decision-makers in various market constituencies, and the second is to discern the kinds of questions they would ask in regard to rural satellite communication. Of course, a third objective would be to develop the data to provide answers to these questions, and a fourth is to present these answers in a format that is both credible and comprehensible to those groups. Exhibit 3-1 illustrates the kinds of outcomes in which these various constituencies are interested.

Sectoral evaluation will focus upon the impacts of rural satellite communications systems on:

- Health and family planning services,
- Agricultural extension, and
- Education (both formal and non-formal).

In each pilot project country, a specific set of activities using the satellite communications technology will be carried out in at least one of these sectors.

The rubric we have chosen to label "societal" encompasses evaluation issues that have a broader range than those discussed above. The evaluation activities in this arena will include examination of:

- Institution-building;
- Improving the administrative effectiveness of local institutions;
- Disaster preparedness and relief;
- Commercial activity;
- Rural development in general; and
- Assisting AID Missions in their missions.

Exhibit 3-1

Outcomes in Which Various Constituencies are Interested

CONSTITUENCY	OUTCOMES TO BE DEMONSTRATED Benefits/Costs of: Investment in Satellite Communications	Satellite Communications to Development
International Lenders	X	X
International Carriers	X	
Equipment Suppliers	X	
Developing Countries		X
AID/Washington	X	X
AID Missions		X

Crosscutting these three arenas are the five types of analysis that were discussed in Chapter 1. Within all of the arenas, the five types of evaluation -- technological, financial, economic, social, and institutional -- will be applied. In certain cases, the application of each of these five types of analysis may not be appropriate, or alternatively, the various arenas of application may not all come into play in a particular project. Nevertheless, we intend to apply the template formed by crossing the arenas of interest with the five types of analysis in order to ensure comprehensive, well-thought-out project-specific evaluation designs.

Any large-scale program evaluation such as this one also has (or should have) an additional agendum, namely it should be sensitive to unanticipated events and unintended outcomes. The RSP has its objectives (as outined in Chapter 2), and we shall be examining the fulfillment of these objectives through the analyses summarized briefly here and discussed more fully in subsequent chapters. But we need to be explicit in stating that our evaluation procedures will also be sensitive to the unexpected or the unintended. Sometimes programs have unanticipated impacts (good and bad), sometimes they reach unexpected audiences, and sometimes they (or components of them) fail for unanticipated reasons. For example, the RSP may introduce a telephone link between an isolated rural area and the nation's major city with the intention of having that link used by local health personnel for emergency health care purposes, i.e., to access the concentration of medical care knowledge in the main city. It may turn out, though, that an unanticipated large proportion of the traffic may be initiated by local farmers attempting to obtain the latest agricultural prices from the main city, thus allowing them to market their products for greater profit. This evaluation must be sensitive to such unanticipated uses if it is to be maximally useful. Likewise, this evaluation must be sensitive to the many subtle processes that could occur -- again, outside of the realm of the formal areas of evaluation inquiry -- that may unexpectedly undermine or enhance the program's effectiveness.

No doubt, the formulation of specific project evaluation plans will involve tradeoffs and compromises, for two principal reasons. The first is that we cannot expect to burden host country agencies and individuals with data collection to the point that it disrupts their day-to-day operations. To do so would run the risk of hobbling the satellite communication application by extensive and intrusive data gathering or so unreasonably burdening host country individuals that their cooperation would be lost. A second reason that tradeoffs and compromises will be involved in developing and carrying out the evaluation is that resources for this evaluation are not unlimited. Undoubtedly, both AID and the host country will be required to prioritize the evaluation objectives because of these constraints, and, undoubtedly, as a result, both the program evaluation and individual project evaluations will not address (nor answer) all the evaluation questions that conceivably could be addressed. It should therefore be borne in mind in reading subsequent chapters, especially Chapter 5, that while we may list all the questions that might be asked and all the data that could conceivably be gathered, these would not all be played out in any one pilot project country, because of either inappropriateness or resource constraints.

4.0 CONCEPTUAL APPROACH TO THE RSP EVALUATION

This chapter presents an overview of how the various elements of the Rural Satellite Program evaluation relate to each other. Although there are a number of ways to conceptualize these interrelationships, the approach that is presented here has two major advantages. First, it ties together all the key elements of the program evaluation in one logically consistent framework. Second, it establishes the foundation for a division of contract labor that is viable operationally and that can marshall and integrate the different strengths of Abt Associates and its subcontractors.

The approach to the program evaluation that we propose to adopt is summarized in Exhibit 4-1. The exhibit consists of seven different sets of boxes:

- Purposes of the RSP
- Constituencies of the RSP
- Types of Analysis
- Evaluation Methods
- Data Requirements and Collection Mechanisms
- Analysis
- Expected Results of the Program Evaluation

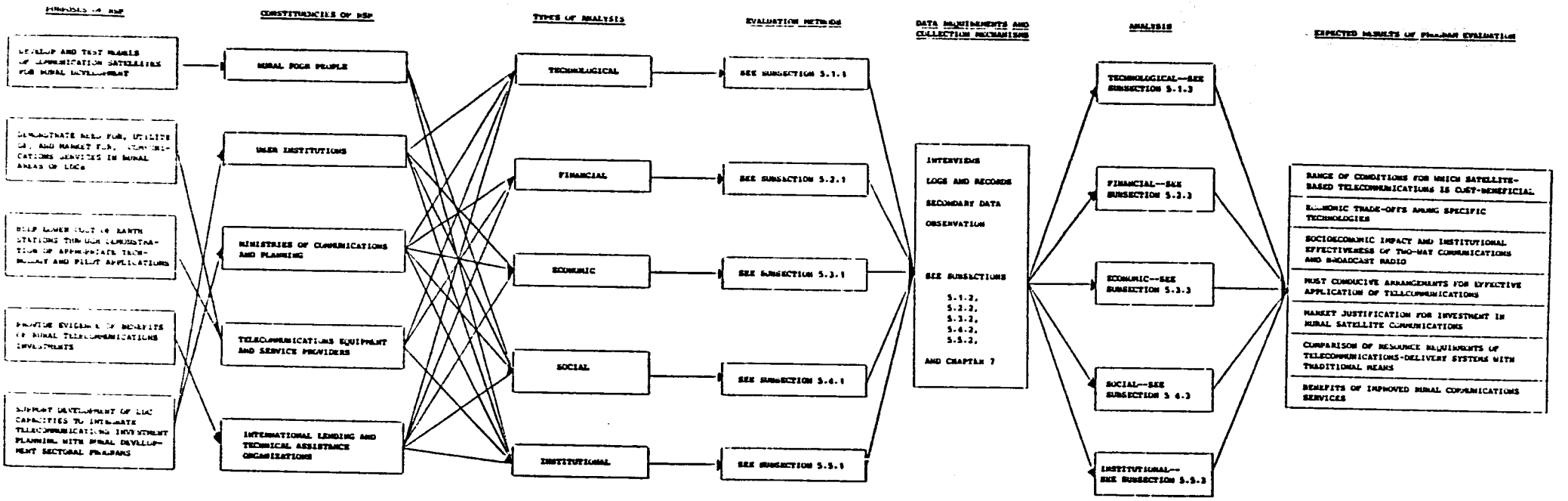
In the sections that follow, we discuss each of these sets of boxes in turn. As part of this discussion, we also explain the meaning of the arrows that connect the different boxes.

4.1 Purposes of the RSP

From a logical point of view, the starting point for the evaluation of the RSP must be the purposes of the RSP. These purposes have been discussed in Chapter 2 and need no further elaboration at this point. For ease of reference, however, we simply repeat here the full wording of the purposes of the program as set forth in the RSP Project Paper:

Exhibit 4-1

Conceptual Framework for RSP Evaluation



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1. To develop and test models of how communication satellites can help provide information and services necessary for rural development.

2. To demonstrate to communication carriers and equipment suppliers the need for, the utility of, and the market for communication services in the rural areas of developing countries.

3. To help lower the cost of earth stations appropriate for LDC rural development use through demonstration of appropriate technology and application on a pilot scale, in anticipation of later large volume markets for operational systems.

4. To provide evidence of the benefits of rural telecommunications investments to international lending agencies investing in rural development.

5. To support the development of national capacities within LDCs to integrate telecommunications investment planning with sectoral programs for rural development in education, health, agriculture, or other rural development activities.

4.2 Constituencies of the RSP

The RSP is designed to have impacts on a number of different constituencies. Moreover, as the wording of the purposes of the RSP makes clear, the impacts of the program can be expected to vary substantially by type of constituency. In evaluating the RSP, therefore, it is essential that clear distinctions be drawn among the different constituencies of the program. Furthermore, if we are to be assured that the results of the evaluation will address the varied needs of the program's diverse readership, these distinctions must be built consciously into the initial stages of evaluation design.

The constituencies of the RSP can be classified as falling into five groups:

- Rural poor people
- User institutions
- Ministries of Communications and National Planning Ministries
- Telecommunications equipment and service providers, including international communications carriers such as INTELSAT
- International lending and technical assistance organizations

The arrows connecting the first and second sets of boxes in Exhibit 4-1 indicate the constituencies that are the principal targets of the different purposes of the RSP. We fully acknowledge that the achievement of any one purpose of the program can be expected to affect virtually all program constituencies in one way or another. For facility of exposition, however, only the principal relationships among purposes and constituencies are presented here.

The principal relationships among program purposes and program constituencies can be summarized as follows. The first purpose has to do with the overall objective of rural development and is therefore most relevant to the RSP's first constituency, rural poor people. The second and third purposes deal with the issues of market justification and technological appropriateness and are particularly germane to telecommunications equipment and service providers. The fourth purpose concerns the benefits of rural telecommunications investments and is explicitly directed toward international lending and technical assistance organizations. And, finally, the fifth purpose is concerned with the development of national capacities to integrate telecommunications with rural development programs in different sectors and is therefore targeted toward user institutions and Ministries of Communications and Planning.

4.3 Types of Analysis

The third set of boxes in Exhibit 4-1 brings us to the specific types of analysis that will be performed in the evaluation of the RSP. There are a number of ways in which the analytical components of the

evaluation could be categorized. In our judgment, however, the most appropriate breakdown is the framework that AID uses in the design of development projects. As an AID project is developed, four different types of project analysis must be performed:

- Technical Analysis. A project must be technically sound on two counts. First, the project and its technological implications must be appropriate for the specific time and place for which the project is proposed. Second, the project must be reasonably priced and designed.

- Financial Analysis. A project must be financially viable. Among the major financial issues that must typically be addressed are whether there are sufficient financial resources to implement the project, whether cash flows are suitably timed, whether the ability to meet recurring costs is reasonably well assured, and, in the case of a revenue producing project, whether the project evidences an adequate financial rate of return.

- Economic Analysis. A project must be economically feasible. A typical economic analysis must provide the economic rationale for the selected project design over alternative designs. In general, one of two different approaches is used. For revenue-producing projects and projects whose outputs can be translated realistically into monetary equivalents, cost-benefit techniques are applied. Cost-effectiveness analysis, on the other hand, is normally used for projects that are not revenue producing but whose outputs can nevertheless be meaningfully quantified. In either case, an examination must be made of the possible divergence between the social and private returns resulting from the project.

- Social Analysis. A project must be socially sound. A typical social soundness analysis must address three distinct but related issues: the compatibility of the project with the sociocultural environment in which it is to be introduced; the likelihood that the new practices or institutions introduced among the initial project target population will be diffused among other groups; and the social impact on distribution of benefits and burdens among different groups, both within the initial project population and beyond.

In addition to these project analyses, each AID project must be shown to be institutionally viable. The major elements of such an institutional analysis, which is normally embedded in discussion of implementation arrangements, are several. They include the identification of the key organizations that are to implement the project, the role of each organization, and the interrelationships among them. Another element of institutional analysis is analysis of the management capability of implementing organizations, including an examination of proposed coordination mechanisms and administrative arrangements to reach and involve target populations. Finally, the operational responsibilities of each implementing organization must be specified and the appropriateness of the relationships among these responsibilities must be examined as part of the institutional analysis.

These five kinds of analysis -- technical, financial, economic, social, and institutional -- are couched here in terms of their applicability for pre-project justification and approval. The overall framework that these analyses provide is not only applicable before a project begins; it is also a useful tool for structuring the evaluation of the project during and after its implementation. In the context of the RSP evaluation, this framework also has two decided advantages:

- First, it allows us to organize our work in such a way as to be responsive to the varied needs of the RSP's different constituencies.

- Second, it is consistent with a division of contract labor that capitalizes on the diverse strengths of Abt Associates and its subcontractors.

4.3.1 Relationship of the Different Types of Analysis to the Different Constituencies of the RSP

Each type of analysis is not necessarily of major interest to each constituency of the RSP. In Exhibit 4-1, the arrows connecting "Constituencies of RSP" and "Types of Analysis" indicate which types of analysis are of major importance to the five RSP constituencies.[1] These relationships are also illustrated in matrix form in Exhibit 4-2. In this exhibit, the areas marked with an "X" indicate the types of analysis that are of major interest to the different constituencies; the remaining areas indicate the types of analysis that, although they may be of interest, are not of major importance to the constituencies in question.

In what follows, we elaborate briefly on Exhibit 4-2 and summarize how AID's project design framework will assist us in making the results of the evaluation directly responsive to the needs of the RSP's diverse reedership.

Rural Poor People

From the point of view of rural poor people, the use of a satellite is of considerably less importance than whether they benefit from the basic education, health, and agricultural services that such a system may facilitate. Thus, the technological components of the RSP evaluation are likely to be of only minor interest to the ultimate target groups of the program. Similarly, the questions of whether investments in satellite technology are profitable financially and whether they can be justified economically are not of major concern. What is of major concern is whether the way in which satellite-based services are delivered is compatible with these groups' sociocultural environment and whether the benefits of receiving services in this way are not outweighed by whatever burdens may also be associated with them. Often these questions are closely linked to institutional questions as well, particularly

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[1] Since the term, "technical," has a broader everyday meaning than "technological," Exhibit 4-1 uses the latter term to stress the technological focus of the first type of analysis. This more precise terminology is also adopted throughout the rest of this Program Evaluation Plan.

Exhibit 4-2

Types of Analysis that are of Major Interest to Different Constituencies

CONSTITUENCIES	TYPES OF ANALYSIS				
	Technological Analysis	Financial Analysis	Economic Analysis	Social Analysis	Institutional Analysis
Rural Poor People				X	X
User Institutions	X		X	X	X
Ministries of Communications and National Planning Ministries	X	X	X	X	X
Telecommunications Equipment and Service Providers, Including International Communications Carriers Such as INTELSAT	X	X			X
International Lending and Technical Assistance Organizations	X	X	X	X	X

concerning the organizations that deliver educational, health, and agricultural services and the kinds of relationships rural poor target groups have with these organizations.

In a nutshell, therefore, the kinds of concerns that are of most importance to rural poor people are social and institutional in nature. Although this constituency may often not be part of the RSP's readership in the literal sense, the findings of the RSP evaluation will be organized in such a way that its social and institutional analyses are clearly separable from the rest. Moreover, the key social and institutional findings that are of direct relevance to the program's ultimate target groups will be capsulized for possible presentation to rural poor people who may be affected by follow-on satellite communications investments beyond the RSP.

User Institutions

For Ministries of Education, Ministries of Health, Ministries of Agriculture, nutrition agencies, decentralized rural development institutions, etc., practically all the types of analysis that we do will be of importance. Before deciding to hook into satellite-based technology to deliver rural development services, these institutions need to know whether the technology itself is sound and appropriate, whether satellite and related communications systems are more cost-effective than conventional delivery systems, how target groups are likely to respond to their delivery of services in a new way, and whether suitable organizational relationships can be worked out with anticipated telecommunications service providers. The one kind of analysis that is not directly relevant to user institutions is financial analysis: since they are not actually responsible for investment in satellite technology, financial considerations are only a minor concern to them.

In the evaluation of the RSP, we propose to structure our technological, economic, social, and institutional analyses to be directly responsive to these needs of user institutions. In particular, these analyses will focus on the technological features of rural development service delivery systems, on the unit costs of delivery of satellite-based

and conventional delivery systems, on differences in rural poor target group reactions as between the two kinds of systems, and on implementation arrangements between user institutions and telecommunications service providers.

Ministries of Communications and Planning

These institutions make up the constituency that is responsible for investing in and operating national communications systems. Since these institutions need to be in a position to make informed choices among competing technological alternatives, information on the technological suitability of satellite-based systems is of major importance. In a similar vein, these institutions need to know whether the financial payoff from satellite technology is adequate to warrant public sector investment and whether appropriate and effective institutional arrangements are established for its operation. Of particular concern to Ministries of Planning is an assurance that the net economic benefits of a satellite-based communications system are positive and that the groups that are targeted for development programs in fact receive intended benefits.

Each type of analysis is therefore relevant to this third constituency of the RSP. In contrast to user institutions, however, Ministries of Communications and Planning generally take a less site-specific and more system-wide perspective. As a consequence, the types of analysis that are of concern to these two different constituencies will be organized to address micro-level and macro-level issues separately.

Telecommunications Equipment and Service Providers

For telecommunications equipment and service providers, technological appropriateness is naturally a key concern, as is the market potential for the goods and services they provide. Technological and financial analyses are therefore of first importance to this constituency. Institutional considerations are also a concern, inasmuch as they help to define expected market relationships and the conditions under which equipment and service providers must operate. Economic and social analysis are of much less importance, except to the extent that they may suggest the likelihood of long-term support by host country governments.

International Lending and Technical Assistance Organizations

This constituency is guided by a mixture of public and private sector orientation. On the one hand, institutions such as the World Bank exist to foster socially beneficial development. As a consequence, economic viability and social soundness are a precondition for their investments. On the other hand, these institutions also require assurances of financial feasibility and, as a corollary, of technological and institutional soundness as well.

As in the case of Ministries of Communications and Planning, therefore, all five types of analysis are of interest to international lending and technical assistance organizations. In contrast to national institutions, however, international organizations can be expected to assume a more global perspective and to be particularly concerned about the extrapolatability of satellite communications worldwide. In organizing the different types of analysis for the evaluation, therefore, we propose to give separate treatment to the extent to which RSP experiments have applicability elsewhere.

4.3.2 Relationship of the Different Types of Analysis to the Division of Contract Labor

The organization of the analytical components of the RSP along disciplinary lines allows for a division of operational responsibility that matches the diverse strengths of Abt Associates and its subcontractors. Although there will naturally be areas of overlapping responsibility (and we shall continue to encourage overlap), the lead responsibility for each analytical component of the evaluation will lie clearly with the organization that has predominant capability in the area in question.

Exhibit 4-3 lays out the operational division of labor that we propose to adopt. In accordance with this scheme, Abt Associates Inc. will assume the lead responsibility for social analysis and the integration of evaluation findings; MIT's Research Program on Communications policy will take the lead on the evaluation's technological and institutional analyses; Communications Studies and Planning International, Inc., will have principal responsibility for financial and economic analysis; and

Exhibit 4-3

Division of Operational Responsibility for RSP Evaluation

ANALYTICAL COMPONENT	LEAD RESPONSIBILITY	SECONDARY RESPONSIBILITY
Evaluation Design	Cook and Cook, Inc.	Abt Associates Inc.
Technological Analysis	Massachusetts Institute of Technology	Abt Associates Inc.
Financial Analysis	Communications Studies and Planning International, Inc.	Abt Associates Inc.
Economic Analysis	Communications Studies and Planning International, Inc.	Abt Associates Inc.
Social Analysis	Abt Associates Inc.	Cook and Cook, Inc.
Institutional Analysis	Massachusetts Institute of Technology	Abt Associates Inc.
Integration of Findings	Abt Associates Inc.	Massachusetts Institute of Technology; Communications Studies and Planning International, Inc.; Cook and Cook, Inc.

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Cook and Cook, Inc., will be primarily responsible for the integrity of the overall research design for the evaluation and will assist Abt Associates in performing the evaluation's social analysis.

4.4 Evaluation Methods

Since the key analytical components of the RSP evaluation will vary by discipline, evaluation methods will naturally vary by discipline as well. Although there are certain commonalities in evaluation methods across the different disciplines at issue here, these commonalities are not strong enough to allow for the imposition of a uniform methodological approach across the five different types of analysis that will be conducted. Rather, many important analytical approaches are largely discipline-specific. As a consequence, therefore, the evaluation of the RSP will be conducted in such a way that the advantages of each of these different approaches can be brought to bear.

The one-to-one correspondence between the third and fourth sets of boxes in Exhibit 4-1 highlights the discipline-specific relationship between evaluation methods and types of analysis. Moreover, in the fourth set of boxes, each box refers the reader to a specific subsection in Chapter 5, each of which is entitled, "Questions to Be Asked." Given the diversity in evaluation methods across the five different types of analysis, it is in Chapter 5, rather than here, that the particulars of each discipline-specific methodological approach are described in detail and that specific performance measures and evaluation criteria are discussed.

One danger in summarizing our evaluation methods in this discipline-specific way is that it may create the false impression that each type of analysis is so idiosyncratic that our evaluation methods will be utterly incomparable across disciplines and that it will be impossible to integrate the results of the evaluation in the end. This is not the case. As discussed in Section 4.7 and in Chapter 10, the results of the evaluation will be able to be, and will be, integrated in a way that will be responsive to the program's diverse readership. The evaluation will be united by adherence to five basic principles, that are discussed in succeeding paragraphs.

Principle 1: Discovery is at least as important as confirmation in the proposed evaluations. In a confirmatory evaluation, the intent is to reach a determination as to whether a certain hypothesis, or certain hypotheses, can be accepted. A precondition for the applicability of the confirmatory evaluation mode, therefore, is an ability to specify hypotheses beforehand -- which in turn suggests that there must be either an underlying theory or extant empirical evidence to guide hypothesis formulation. In the case of the RSP, a number of such hypotheses can be formulated readily. For example, location theory, together with empirical evidence, suggests that satelite-based communications technology is cost-effective in reaching isolated rural areas. Similarly, empirical evidence from India suggests that agricultural technology adoption rates are higher when farmers receive radio messages in organized groups then when they receive the messages as isolated individuals. Also, recent empirical work in Kenya by Communications Studies and Planning International, Inc., suggests that the commercial benefits of two-way communications exceed their associated costs.

In an exploratory evaluation, the objective is to describe, to discover, to learn. The exploratory evaluation mode is particularly appropriate when hypotheses do not readily suggest themselves and when a program is pioneering in nature, that is, when it is charting largely unknown seas of knowledge. Since the RSP is such an exploratory program, most elements of the RSP evaluation will be unabashedly exploratory in character. This is especially true for the evaluation's social and institutional analyses. Although the design of each of the RSP's component projects will specify the users who are expected to be the principal beneficiaries of satellite-based communications, as well as the major uses to which the satellite technology is expected to be put, there is very little certitude at this point as to exactly how expected users will react and whether actual uses will correspond faithfully to expected uses. (See

Section 5.4 below for further discussion of this point). Similarly, the degree to which existing institutions can harmoniously accommodate the introduction of satellite-based communications systems is largely an unknown at this time. In both these instances, therefore, the RSP evaluation will take on what is essentially a documentary role.

Much evaluation concerns discrete, localized entities (e.g., particular radio-based curricula) where prior research has indicated the planned and unplanned effects worth examining and where past experience has pointed to the major problems in implementing evaluations and has suggested some ways in which these might be overcome. None of these conditions pertains in the current case. There is no clearly delineated "treatment" in the discrete, localized sense. Although some possible effects can be listed, many cannot because of both the novelty of satellite telecommunications and the likelihood that the "services" provided will differ at any one site and from site to site as well as from country to country. Finally, it is presumptuous to maintain that experience, especially in social and institutional impact analysis in LDC's, is advanced, particularly in multi-sectoral contexts.

Any plan for evaluating impacts should have a considerable and delicate capacity to discover novel impacts and any events on which these might depend. This is not to rule out the capacity to confirm hypotheses; it is merely to affirm a priority that should not be overlooked. Also, the paucity of past evaluations suggests that evaluators will make mistakes in the first countries where they work, but that they will learn and that the work in countries studied later will be better than in countries studied earlier. This is not to deny that countries are very different and that the learning acquired in one country may not be totally relevant to another. It is merely to contend that some learning and consciousness-raising in both the applications and the evaluation staffs will occur as the planned evaluation progresses.

Principle 2: Existing theories of question formulation in evaluation are relevant to the RSP. The first task in any evaluation is to specify the domains in which one wants to ask or discover questions. One conceptual framework for doing this is provided by Cook and Leviton[1] They contend that most evaluation questions can be generated through attempts to describe the historical, political, social, and administrative context in which a project operates; the number and types of persons who are exposed to the project; and what is actually implemented at the site. They are also generated through attempts to consider what the planned and unplanned effects of the project are on those who directly receive its services; what its broader impacts are on other persons and on other institutions; what its costs, cost-effectiveness, and cost-benefit are; and what the results mean for policy, theory, and social values.

A presumption of this report is that the institutional analysis will provide rich data about the historical, social, administrative, and political context of the project, both by itself and in relation to central and regional governmental agencies. The second presumption is that the financial and economic analyses will deal with costs, although the social impact analysis will feed into the numerator in benefit-cost analyses. For these two reasons, the current report will deal with descriptions of who is and is not served by the RSP, what is actually implemented at each site, what effects the services have on recipients and what broader impacts the services have on the social systems of which recipients are a part. Our analyses of these few issues will then be related to the social impact questions of the compability of the RSP with the sociocultural context of each site; the diffusion of any knowledge and benefits it produces; and the distribution of impacts across various social groups.

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[1] Cook, T.D. and Leviton, L.C. Evaluation. In L. Lindzey and E. Aronson (eds.). Handbook of Social Pathology, 3rd Edition. Reading, Massachusetts: Addison-Wesley, 1981.

Principle 3: The entities being evaluated at a specific site are the RSP as a whole and specific important elements of the project. It is useful to evaluate each project as a whole for the insights this gives into the relationship of projects to their context. In addition, decisions may someday have to be taken about specific projects to be implemented at new sites. By itself, however, the present evaluation cannot promise high confidence about the transferability of projects because project effectiveness may be highly dependent on contextual factors. With only five projects, we shall not be in a good position to study a wide range of contexts. It is probably of greater immediate utility to evaluate constituent elements of projects. In the case of the hypothetical university-based Indonesia project, discussed in Chapter 6, such elements might include the use of teleconferencing, of radio broadcasting, and of whatever other hardware is used (e.g., individual telephones). Such elements may well be differentially effective, and elements may be more readily transferred to other future sites than would a global package of services.

Principle 4: All evaluation assumes a baseline for comparison purposes. Any RSP project can be compared against several baselines. We could examine it relative to the state of affairs prior to the availability of telecommunications. This would be useful if we wished to learn about changes caused by the particular constellation of telecommunication services available at that site. These services, however, may include many that could be delivered in ways other than by satellite. In the Indonesian university illustration, instruction by radio is an important component of the telecommunications package. Yet low-powered radio transmitters can be supplied with programming by means other than satellite, such as air mailed tapes. Similarly, real-time transmission can be obtained, at some extra cost, by land lines or direct microwave links.

We assume that RSP projects and project elements are to be evaluated relative to what went on before them. However, this assumption deserves to be challenged, at least for some of the contexts where satellite telecommunications might be used.

Principle 5: Program evaluation is more than the sum of individual project evaluation. The RSP is more than a project in the narrow sense. It is a program. Although five individual projects will be evaluated, the overall program is much more than the sum of its project parts.

In evaluating the Rural Satellite Program as a program, the intent is to go beyond the idiosyncrasies of the program's component projects and, ultimately, to answer a very straightforward question, namely, "Is satellite technology efficient and effective in facilitating two-way communications for rural development and in what ways, settings, and circumstances is or isn't it?" As a way of dramatizing the distinction between the program and its projects, consider that this question could be answered affirmatively even if each of the program's projects were assessed as failures. For example, it is conceivable (though admittedly not very likely) that each RSP project could turn out not to be financially viable but that improved technology available at the end of the life of the program would be inexpensive enough to make future applications quite competitive.

The overarching nature of the Rural Satellite Program relative to its projects has a number of important operational ramifications for the conduct of the program evaluation. Among these ramifications are the following:

- First, and most obviously, the evaluation of the RSP must avoid the shortcomings of much conventional project evaluation work. This is especially true of this work's common overemphasis on inputs and its corresponding relative lack of attention to outcomes. To use AID's "GPOI" terminology, much project evaluation work has only gone cursorily beyond the level of inputs to quantify outputs, purposes, and goals and to examine the linkages

that are hypothesized to exist among them. In the evaluation of the RSP, this will not be the case. The conceptual approach that we propose in this chapter is guided in the first instance by the purposes of the overall program. Moreover, Chapter 5 outlines in some detail the ways in which RSP outcomes can, and will, be quantified and assessed.

- Second, the RSP's component projects must be evaluated in the context of the broad purposes of the overall program. Examples of how this can be done are presented in the hypothetical project evaluation plans in Chapter 6.

- Third, whenever alternative project designs are feasible, the choice among them should be guided by program evaluation objectives. For example, if there is an opportunity to experiment with different technological or institutional configurations at different project sites, the decision should be made to do so. Even if sample sizes are small and formal statistical inference is impossible, a variation in applications would assist us in making more informed judgments as to the relative impacts of different program and project variables and in disentangling the impacts of these variables from the confounding impacts of other variables. In a similar vein, if budget constraints make it necessary to vary levels of evaluation effort across RSP projects, diversity of applications needs to be a key criterion in the resource allocation decision. These examples are illustrations of the general need for work by the Evaluation Management Contractor prior to the implementation of RSP projects, an issue that is discussed in greater detail in Chapters 7 and 9.

- Fourth, and perhaps most importantly, the broad purposes of the RSP imply the need for analysis that is independent of the program's component projects. For example, a demonstration of the market for communications services in the rural areas of developing countries cannot be performed on the basis of what is observed in the RSP's projects alone. Similarly, estimation of the extent to which earth station costs can be expected to drop with the advent

of large volume markets requires information on probable economies that can be achieved with mass production techniques. In the same vein, comparisons of satellite-based communications with conventional systems require information on the characteristics of conventional systems -- many of which may not be observed in the evaluations of the RSP's pilot applications. Each of the non-project analyses that must be performed to conduct the evaluation of the RSP falls under the rubric of technological, financial, economic, social, or institutional analysis and, thus, is described in its corresponding section in Chapter 5.

4.5 Data Requirements and Collection Mechanisms

Each evaluation method -- which, again, corresponds to a type of analysis -- will have a corresponding set of data requirements. A number of data collection mechanisms can be used to meet these requirements. These mechanisms can conveniently be classified as falling into four categories, namely:

- Interviews
- Logs and records
- Secondary data
- Observation

Although evaluation methods vary by discipline, we anticipate that there will be a certain degree of overlap in their data requirements. Even when data requirements are distinct, however, identical data collection mechanisms can often be used. As a result, economies can be realized in the process of data collection. In Exhibit 4-1, this is reflected by the convergence of the arrows from the fourth set of boxes, "Evaluation Methods," to the one box, "Data Requirements and Collection Mechanisms," and is also reflected in Exhibits 7-1a and 7-1b which show the types of data sources and the types of evaluation for which they are applicable. No attempt is made here to summarize the varied data requirements of the RSP evaluation. Rather, the requirements of each evaluation method are presented separately in Subsections 5.1.2, 5.2.2, 5.3.2, 5.4.2, and 5.5.2 below. Chapter 7 integrates these diverse requirements and catalogs the data that will be collected through each data collection mechanism. This integration and summary is then followed in Chapter 8 by a treatment of the field logistics issues associated with the evaluation approaches.

4.6 Analysis

The sixth set of boxes in Exhibit 4-1 corresponds to the analyses that will be performed with the data collected during the evaluation in accordance with the evaluation methods discussed above. The divergence of the arrows from the "Data Requirements and Collection Mechanisms" box to the five "Analysis" boxes reflects the fact that these analyses will, again, be discipline-specific. In light of this specificity, the peculiarities of these analyses are not discussed here but are presented separately in Subsections 5.1.3, 5.2.3, 5.3.3, 5.4.3, and 5.5.3 below.

4.7 Expected Results of the Program Evaluation

Upon completion of the five different types of discipline-specific analysis, the findings of these analyses will be integrated. The framework for this integration will be the set of seven results that AID has specified it expects from the RSP evaluation. These results, as stipulated in the RFP for the Evaluation Management Contract, are:

1. Development of decision-making guidance for LDCs on the range of demographic, technical, economic institutional, and social conditions for which satellite-based telecommunications approaches are cost beneficial.

2. Determination of the economic trade-offs (hardware, operational, cost, behavioral) of specific technological approaches for applications including delivery of training, administrative support, education, and rural development support.

3. Documentation of the socio-economic impact of two-way communications and, where relevant, broadcast radio on rural development, with particular emphasis on institutional effectiveness in service delivery. Three primary service areas are to be considered:

   (a) Health and Family Planning Services;

   (b) Agricultural Extension; and

   (c) Education (formal and non-formal).

4. Identification of the arrangements most conducive to effective application of communications in rural development planning and implementation, such as: institutional arrangements, software developments/ strategies, training methods, and other factors under the control of planners, project designers and project managers.

5. Investigation of market justification for investment in rural satellite communications for use in LDCs for such entities as:

   (a) International communication carriers such as INTELSAT.

   (b) Major investment sources, such as the World Bank and regional development banks.

   (c) Potential suppliers of low cost ground station equipment.

   (d) Telecommunications agencies and user organizations in LDCs.

6. Estimation of the resource requirements of LDCs for planning, implementing, operating, maintaining, and evaluating telecommunications-delivery systems compared with traditional means of achieving comparable results.

7. Estimation of the benefits of improved rural communications services among the targeted population groups/institutions, in the public and private sectors.

These seven expected results appear in abbreviated form as the last set of boxes in Exhibit 4-1. The seven boxes are included within one overall box to reflect the intent that these results stand as an integral whole. Similarly, the convergence of the arrows from the five "Analysis" boxes indicates that it is at this point that all discipline-specific analytical work will be brought together.

The manner in which our discipline-specific findings will be integrated is outlined in Chapter 10. So too is the relationship of the expected results of the evaluation to the five constituencies of the program.

5.0 ANALYTICAL COMPONENTS OF THE RSP EVALUATION

The purpose of this chapter is to flesh out the evaluation objectives discussed above by providing specific details (to the extent currently possible) of evaluation activities in each of the five major areas of project evaluation. Section 5.1 provides this discussion for the technological area, Section 5.2, for financial evaluation, Section 5.3, for economic analysis, and Sections 5.4 and 5.5, for the social and institutional evaluation areas, respectively. For each area, we have tried to address comprehensively the evaluation questions that would be asked, the data requirements for addressing those questions, along with the data collection mechanisms needed, and the analyses and outputs desired.

5.1 Technological Analysis

The technological area of evaluation focuses upon the communications hardware and software necessary for transmitting the project messages. It also investigates the interfaces both between the hardware and software and between the technology and the users.

The first step in specifying the research questions to be asked in the technological evaluation is to acknowledge that none of the pilot systems envisioned for the RSP can, by themselves, provide the kinds of data needed to demonstrate the technical and economic feasibility of the overall concept. This is true for two primary reasons. First, the pilot systems will simply be too small to achieve the economies of scale and the scale dependent communication effects which would be expected from a full-scale operation. Second, the pilot systems will use current technology, while the rapid rate of development in the satellite telecommunications area and in related digital areas ensures that full-scale systems built five years hence will have significantly different components and capabilities. The importance of scale factors in the economics of satellite systems needs little explanation. The price of small standardized earth stations exhibits the same precipitous decline with the number of stations bought as does that of most other manufactured products. The significance of scale-dependent communication effects, however, does require some explanation. As the number of earth stations in a satellite

network increases, the cost per earth station declines as noted above. Beyond that decline, the potential value of the communications services available to any given user of the network will increase as the number of connected nodes in the network increases simply because the number of possible communication paths is greater. Communications technology is not unique in exhibiting this kind of double edged economy of scale, but an appreciation of this effect will be essential in evaluating the technological suitability of a limited pilot project in a larger operational setting.

The question of the pace of technological development comes up in evaluating these satellite communication pilot projects because of the speed with which technology advances in this area. For example, PALAPA A-1 and A-2 were launched in 1976 and 1977, respectively. The second-generation Indonesian satellites, PALAPA B-1 and B-2, are scheduled for launch in 1983. The key parameters for determining the communications capacity of a spacecraft are its bandwidth and its power. The effective bandwidth of PALAPA B is twice that of PALAPA A, and the radiated power of the new satellite will be four times that of the old. In addition to a number of other significant improvements on the PALAPA B spacecraft, there are various major improvements in the design of earth station hardware and in the design of network architectures which have taken place in the period since the PALAPA system was first installed. The most dramatic of these improvements have been in the area of digital communications and in the digital implementation of communication subsystems. These trends are unlikely to abate in the next decade, so any pilot project which hopes to point the way to future operational use of satellites must attempt to lead the technology existing when the pilot system is implemented.

5.1.1 Questions to be Asked and Data Required

To take these above factors into account, the technological evaluation will address three versions of the system installed for each project. These are:

A. The system as actually installed;

B. A projected full-scale system, holding technology constant;

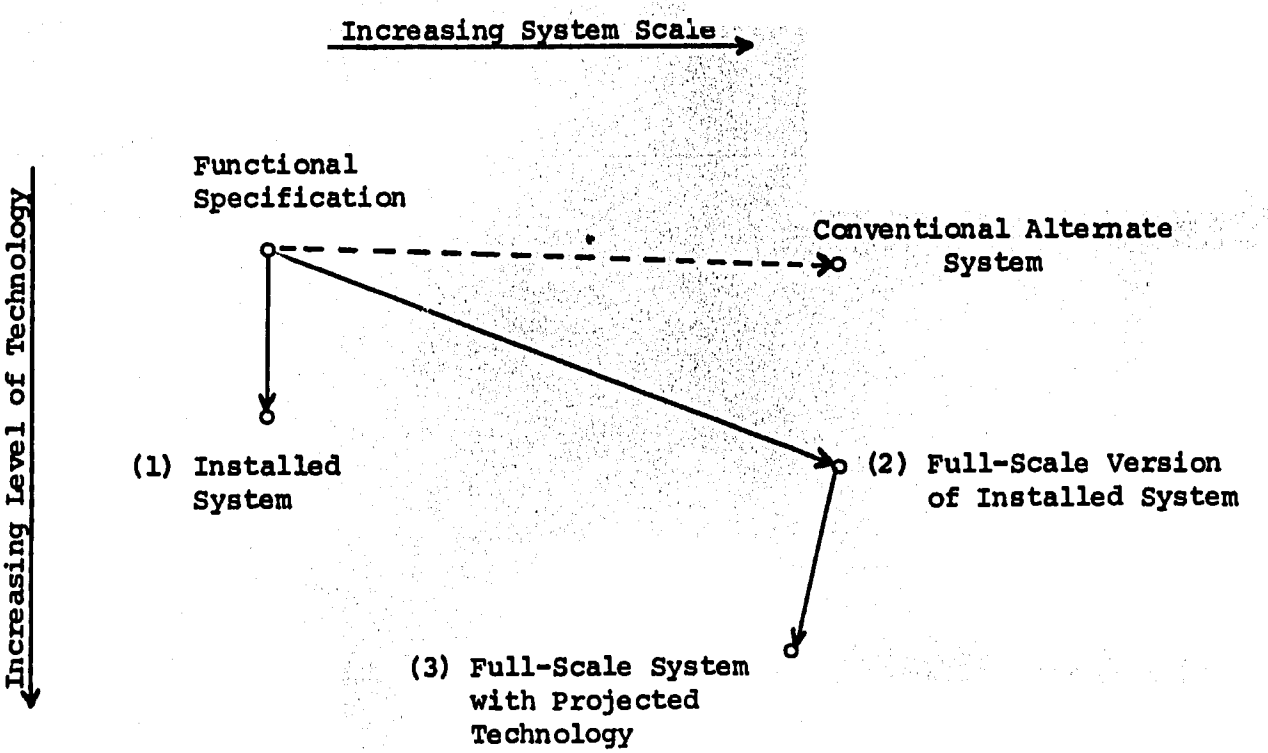
C. A projected full-scale system, incorporating forecasts of new high-technology capabilities.

Besides providing a "real-world" dimension to the otherwise limited pilot projects, this approach allows us to project technical and economic feasibility on a parametric basis, the parameter being the assumed scale of future operations and the rate of development of telecommunications technology.

A methodological concern which arises later in the economic and financial evaluation is a precise definition of the alternatives to the system(s) being evaluated. It is generally not sufficient to conclude that because the benefits of a given system exceed the costs it is worth building. One must also demonstrate that the excess of benefits over costs is greater for the candidate system than for any reasonable alternative design. Although this concern does not arise as an evaluation issue in the technological component of the study, some engineering analysis is necessary to provide the financial and economic phases with basic cost data. Accordingly, the technology segment will include as a "desk" exercise the design and costing of the most practical non-satellite-based alternative system (e.g., land lines or microwave links) which would perform the functions required in the actual project. In some instances, of course, the functions will not be able to be performed at all in the absence of a satellite. In those cases, the alternative system will simply be no system.

The systems we have described above are shown in Exhibit 5-1 according to their relative scales and levels of technological sophistication. This taxonomy provides a convenient framework for organizing the research questions to be asked in the technology evaluation, since some evaluation issues relate to the installed system and others pertain to the various alternative full-scale versions. The research questions that are to be asked, and the data required, are detailed below for each of

Exhibit 5-1
Scale and Technological Relationships Among Systems to be Considered in the Technology Evaluation



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three levels of scope and sophistication: for the system as installed for the pilot project, for the full-scale version of the installed system, and for a full-scale version incorporating advanced technology.

System as Installed for the Pilot Project (System A)

A1. Did it Work? The first piece of information desired is a simple qualitative indication of whether the components and the system as a whole operated according to, or close to, specifications. Failure of the system to work would turn the technological evaluation into a diagnostic or post-mortem session and would forestall consideration of most of the more interesting issues which follow.

A2. What was the quality of service? This question involves both quantitative measures, such as error rates and signal-to-noise ratios, and qualitative measures of user satisfaction.

A3. What was the reliability of the system and its components? Reliability of complex systems is a key determinant of their technical feasibility in any environment, especially in LDC's with their limited technical infrastructure. Classical measures of reliability are mean time between failures (MTBF) and percentage of time available. A distinction should be made in the analysis between failures of components and failures of the system, since a well-designed system may incorporate sufficient redundancy and interconnectivity to effectively compensate for individual hardware outages.

A4. What did the system cost to install and operate? The technological evaluation will consider actual out-of-pocket expenses incurred in building, running, and maintaining the system. Issues of indirect social costs, shadow pricing, and allocation of costs among multiple objectives will be dealt with not here but in the economic analysis. The cost factors developed here would be used as input to these latter phases.

A5. What was the distribution of traffic by system function, by type of user, and by end user? By measuring the above distribution, one can infer whether the mix of capabilities designed into the system was appropriate to the traffic. By recosting the distributions in terms of percentage of available capacity, one can estimate the demand (at a given price) for each function among various types of users. It is possible to design inexpensive hardware which can monitor traffic automatically, and consideration should be given to designing such hardware into the pilot project systems.

A6. What new or innovative services would better match users' needs? In addition to estimating usage for the system as it was actually installed, it is important to gauge the demand for other services which could be offered by future systems. This knowledge will allow designers to achieve more nearly optimal system designs and will increase overall usage.

A7. What personnel requirements and other burdens does the system place on the country's infrastructure? As was mentioned above, the need for specialized labor and materials often poses the major constraint on successful long-term operation of complex systems in third-world countries. Particularly important are the need for trained (or trainable) labor across a broad spectrum of operating, maintenance, and support skills; the availability of routine supplies such as coolants and lubricants; and the distribution network for ordering and receiving replacement parts.

A8. How well were human factors taken into account in the design of hardware and software? Usage can be enhanced or degraded depending on how well the system design takes into account the physical and cultural features of the users. Keyboard designs optimized for American hands may be awkward for Asian users; conventional "computerese" modes of address may offend or confuse people whose societies are strongly traditional or hierarchical. Avoidance of simple mistakes can greatly improve acceptance.

Full Scale Version of the Installed System (System B)

The demonstration systems as installed will necessarily be smaller than if they had been built with commercial operations in mind. The economic and communication scale factors mentioned in Section 5.1.1 above must therefore be taken into account. In addition, the demonstration system will have less of an impact (and pose less of a burden) on the surrounding economy and institutions than would a full-scale system. Furthermore, as experiments, the project will receive a level of attention and care which would not be accorded to an ongoing business. To correct for all of these effects, it is necessary to project the performance of a hypothetical system, similar in design to the one installed but of commercial size. The questions to be asked of this system are discussed below.

B1. What size should a representative commercial system be? It is necessary to pick a scale which does not exceed the reasonably identifiable demand but which is large enough to present a true test of the country's ability to support the operation. The hypothetical system will be sized by projecting to a national or regional scale the demand shown in the actual project for the services offered, plus judgmental estimates of additional traffic, both governmental and commercial, which would be attracted. The goal in this exercise is not to be accurate (since there is no "correct" size for a business enterprise) but to be reasonable

B2. What would be the resulting capacity requirements for the space segment, the ground stations, and the ground distribution networks? The traffic generated by the existence of the full-scale system may exceed the capacity of individual links. It is important to evaluate whether the system design used for the actual projects would be technically feasible on a full-scale basis, or whether the capacity of the hardware would have to be upgraded.

B3. What would a full-scale system cost to install, operate, and maintain? Just as the pilot projects will not be representative of the full-scale capacity needs, neither will they be representative of the full-scale cost structures. On the one hand, economies of scale may reduce the initial outlay; on the other, increased complexity in a hostile environment may escalate operating and maintenance expenses.

B4. What will be the burdens placed by the full-scale system on the host country infrastructure? The needs for skilled labor, local supplies, and spare parts from abroad must be gauged to ensure that they do not exceed the capacity of the host country to supply them. This is especially a problem because of the large-scale of the enterprises and the fact that the special attention accorded to the pilot projects will not be available to self-sustaining enterprises.

Full-Scale Version Incorporating Advanced Technology (System C)

C1. What are the foreseeable trends in satellite and communications technology? In a field which is developing as rapidly as is telecommunications, one must take into account future capabilities when evaluating today's systems. In particular, it is important to identify trends and technological advances which will alter the communication environment in general and the systems available to LDC's in particular. Two of these trends are readily identifiable and are addressed below.

C2. What will be the impacts of greater satellite power and digital transmission? It is likely that the trend toward increased power on the satellite will allow the LDC's to install small, inexpensive dishes in greater numbers than currently possible. Digital communications may offer special benefits to third-world countries because of the greater reliability of the equipment, ease of maintenance, and the ability to connect many distributed earth stations in two-way information transfers with such equipment.

C3. What problems will advanced technology pose for LDC systems with respect to compatibility? To the extent that advanced capacilities are not relevant to third-world needs, developing countries may choose not to invest in them. But it is probable that international communications standards would follow the leading edge of technology, regardless of the interests of LDC's. The possibility arises that the lower-capability systems may become incompatible with the overall international network as coding schemes, bandwidths, data rates and other properties evolve in response to "technology push." This is partly an institutional issue as well, since it may call for exceptions to, or variances from, international standards.

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C4. What is the potential for using "appropriate" technology? This question may be approached from two sides. First, what functions can be simplified or otherwise be made feasible by locally available machinery and labor? And second, what recent innovations in other LDC's have proved successful and have shown promise for transplantation to similar environments? Three areas in which innovations may be available are the manufacture of dishes, the development of power supply, and local generation of system software (both of the programming and the digital variety).

C5. What are the opportunities for domestic production of "appropriate" components? Making components within LDC's has two advantages. First, it avoids the diversion of scarce foreign currency. Second, it stimulates the local economy by promoting development of the manufacturing sector, which can then use its new capabilities to make other necessities besides those related to communications.

C6. What are the cost benefits of using "appropriate" technology? Besides the savings in foreign currency mentioned above, the replacement of complex components with simple ones can be expected to reduce the system's installation and maintenance costs. There may be regions and applications where the use of local materials and labor may make the difference between financial success and failure.

C7. Can "appropriate" technology improve the fit between the system and its cultural setting? Cultural unacceptability can be a major barrier to system use. For example, the division of labor needed to operate and maintain sophisticated equipment may conflict with established patterns of social interaction. Using "appropriate" technology may give designers the chance to incorporate cultural factors into the plans, thereby improving the system's acceptance. This is particularly important in the area of programming.

5.1.2 Analyses and Outputs

The technological evaluation requires no complex analyses or algorithms. The computations will mostly involve calculation of various performance indexes and figures of merit using simple algebra or elementary statistics.

5.2 Financial Analysis

The purpose of the financial component of the overall evaluation plan is to indicate the financial viability of providing satellite communications services for the applications under study. The principal constituencies to which this analysis is of concern are: international carriers, international development agencies, the bond and money market, and equipment suppliers.

With the exception of the development agencies, these constituencies are concerned with the financial performance only of the telecommunications segment of the applications in question; any monetary benefits which are not reflected directly in telecommunications revenues do not affect the viability of the application from the standpoint of these institutions. Consequently, it is necessary in this section to focus quite narrowly on the financial characteristics of the telecommunications component of the overall application. All costs and benefits other than those borne by, or accruing to, the telecommunications authority (for instance, costs and benefits to the users of the satellite system) will be covered in the economic rather than in the financial section of this evaluation plan.

5.2.1 Questions to be Asked

A financial project appraisal is designed to answer two broad questions, the first concerned primarily with the project's profitability, and the second with its liquidity:

- How does the financial return yielded by the project compare with that of alternative means of investing the capital required?
- What are the cash flow implications of implementing the project?

The customary profitability measures are the following:

1. Net Present Value (NPV) -- This is the sum of all revenues generated by the project, net of all cost outlays, over the planned life of the project. The revenues and costs are adjusted by a "discount factor", which is designed to reflect the opportunity costs of the capital tied up in the project -- capital which could normally be put to alternative profitable uses.

2. Internal Rate of Return (IRR) -- This is the rate of return (in percentage points per annum) earned by the capital invested in the project If the project is financially viable, the IRR should be higher than commercial interest rates.

The project's cash flow requirements are indicated by a discounted cash flow chart (DCF), which summarizes the net cash flows into and out of the project during each accounting period. Among the financial measures derived from this chart is the:

3. Payback period--the period of time required to recover the initial capital invested in the project.

The quantities (1), (2), and (3) above are three figures which summarize the projects' financial performance.

The selection of the "discount rate" is an important element in the financial appraisal. It is based on a number of criteria which differ according to whether the project is in the public or private sector. In the private sector, the rate is intended to reflect the "opportunity cost" of the capital invested, that is, the interest it would earn if invested in capital markets at an equivalent level of risk. In the public sector, the rate is designed to provide a measure of the "opportunity cost" of public capital funds; in principle, the figure should reflect the contribution which the funds could make to the economy in their best alternative use.

The assessment of the riskiness of the project, and of the value to the economy of alternative public investments, is necessarily a matter of judgment rather than precise calculation. We believe that the figure of 8% as a real discount rate (net of inflation) is compatible with the criteria customarily applied in both the private and public sectors. It is widely accepted by governments and international agencies as a realistic figure for the opportunity costs of public funds. If inflation is running, at, say, 10%, this is equivalent to a nominal discount rate of 18%.

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A financial appraisal of a proposed project always relies on several assumptions or estimates of key parameters, such as demand for the service and future costs. In order to test the sensitivity of the financial performance measures to errors in these assumptions, the analysis is repeated for a number of different parameter values. Typically the following sets of measures are derived:

- A "lower bound" set of estimates, in which all revenues are fixed at the lowest reasonable level and all costs at the highest.
- A "principal" set of estimates, in which all revenues and costs are fixed at the expected level.
- An "upper bound" set of estmates, in which all revenues are fixed at the highest reasonable level and all costs at the lowest.

A particular feature of the financial appraisals required in this evaluation scheme is that the analysis will be partly based on actual or historic performance and partly on forecast performance. It is unlikely that the telecommunications segment of each proposed application will achieve a positive financial return (NPV) during the evaluation period itself, even if the applications are financially sound when viewed over a more conventional timespan of, say, ten years. It will therefore be essential to develop forecasts of the costs and revenues attributable to the proposed applications beyond the period of the Evaluation Management Contract. This raises a procedural problem since there may be a number of ways in which the applications could reasonably be extended, each with very different cost and revenue flows. It may be necessary to develop a number of alternative financial projections, each corresponding to a clearly defined alternative plan for extension of the experiment beyond the initially planned period.

5.2.2 Data Requirements and Data Collection Procedures

Quarterly data on three types of costs will be collected during the period of project evaluation. We label these direct costs, shared costs, and hidden costs:

- Direct costs include all expenses that are directly incurred in providing the telecommunications facilities, such as equipment purchase, maintenance, operation, and administration.

- Shared costs are the costs of facilities that are used jointly by the application under study and by other services, such as shared equipment, buildings, circuits, or administrative facilities.

- Hidden costs are expenses which would ordinarily be charged to a project but, in the case of this particular application, are borne or subsidized by the government or other parties.

The relevant measure of revenue for the financial appraisal is the total of all tariffs collected by the telecommunications authority which are attributable to use of the satellite system. In many cases, this revenue will be collected separately from any other telecommunications tariffs and will therefore be clearly identifiable. Some revenues may be attributable both to the satellite system and to use of other parts of the telecommunications network, however. In these cases, the share of income which is attributable to the satellite segment will have to be calculated. These data will also be collected quarterly during the period of project evaluation.

In addition, annual forecasts of all costs and revenues will be required from the end of the evaluation period to ten years from the starting date on the project. The evaluation team will make extrapolations from previously collected cost data and adjust for changing costs of ground equipment and satellite circuits, and changing overhead and administrative costs that result from changes in general economic conditions. Similar extrapolations will be required of all revenues. In this case, account will have to be taken of changing levels of usage and forecasted tariff changes.

Data collection methods will range from direct examination of actual business records to interviews with users and managers involved in the application under study. The accounts of the applications management team and the telecommunications authorities will be inspected to determine, when possible, direct and shared costs and revenues. Interviews with the

ıpplications management team and telecommunications authorities are ›xpected to help determine the appropriate proportions in the case of ›hared costs, and to determine direct costs and revenues that are not ›asily ascertained from the accounts. General economic data on national ıncome, investment levels, and financial conditions will be examined both :o assist in the forecasting of changes in economic conditions over the :en-year appraisal period and to determine the appropriate discount rate 'or the discounted cash flow analysis. Discussions will be held with user .nstitutions and project management to help establish likely configuration› ›f the system for the period following completion of the applications ıanagement contract.

›.2.3 Analyses and Outputs

The starting point of the analysis stage is the compilation of a ›iscounted Cash Flow (DCF) chart for each set of financial forecasts. 'here will be three forecasts (lower bound, principal, and upper bound) or each alternative configuration of the satellite application in question. he cash flows corresponding to the initial period of evaluation will be ommon to all charts since they will be based on historical, rather than orecast, data.

The DCF charts will contain quarterly data for the initial evaluaion period and annual data for the forecast period. Major categories of ost, such as equipment, salaries, and circuit charges, will be identified eparately. This will facilitate subsequent manipulation of the data in esponse to changed technical or economic parameters.

Then, summary measures of financial performance will be calculated or each alternative system configuration, as follows:

- Net Present Value (lower bound, principal, and upper bound),
- Internal Rate of Return (lower bound, principal, and upper bound), and
- Payback Period (upper bound, principal, and lower bound).

5.3 Economic Analysis

The purpose of this component of the overall evaluation plan is to describe and assess the economic impacts of providing satellite communications services for the selected applications. The class of impacts which can be described as economic is very broad; it includes all aspects of the application which bring about change in the allocation and use of economic resources. Because the range of effects is so wide and the methods by which they are analyzed so varied, it is important to specify clearly our basic model of the economic interrelationships under study. The impact of introducing satellite services will be analyzed by reference to this basic underlying model.

The satellite program will be used by certain selected user institutions, such as health ministries, universities, and commercial establishments. The relationship between these institutions and the economy as a whole is illustrated in Exhibit 5-2. The institutions absorb input resources, such as personnel, capital funds, and materials, from the economy. They supply to the economy a range of services, such as health care, education, or commercial products and services. Both the inputs and outputs can, in principle, be measured and can sometimes be valued in monetary terms. Input resource flows can usually be valued directly as they are purchased on the market. Output flows can sometimes be measured in financial units, especially if the service is sold to the beneficiaries, but are often more easily expressed in other units. Appropriate units of educational output may be number of student class hours, number of students graduating (perhaps weighted by grade obtained); units of health care delivery may be number of patients treated (perhaps weighted by the severity of the complaint), number of person days of inpatient care, or the number of inoculations given.

Given this framework of input and output flows, we distinguish between two categories of economic effect, direct and indirect.

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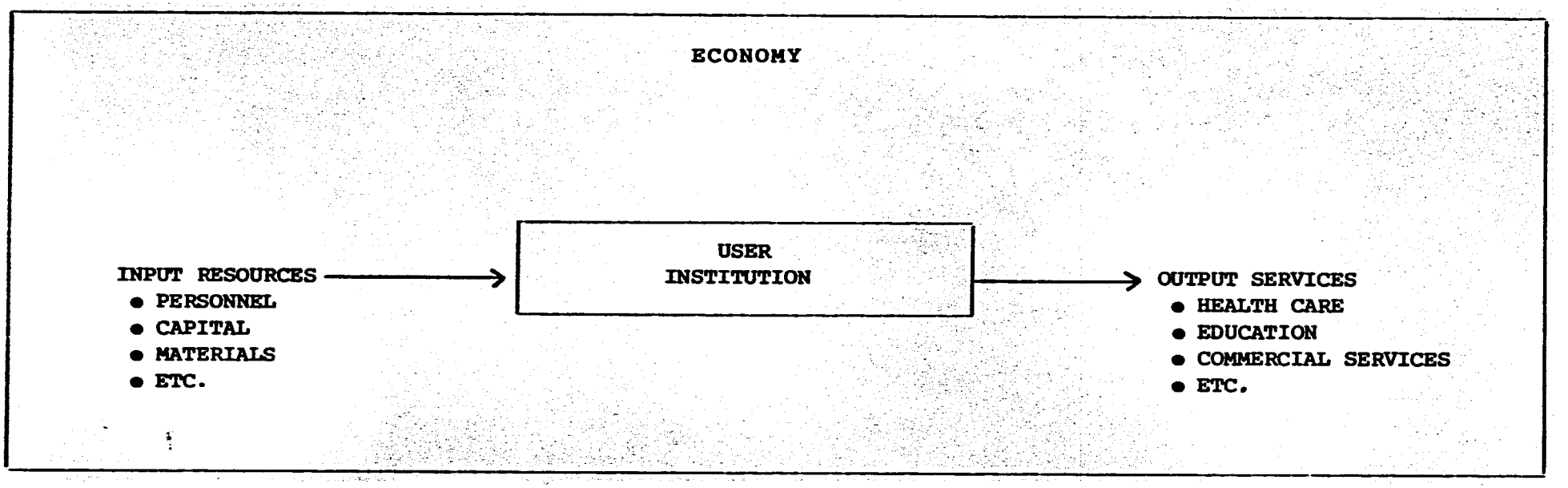
Exhibit 5-2

Relationship Between the User Institution and the Economy in An Application of Satellite Services



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- The direct effect is the effect on the efficiency with which the user institution converts input resources (personnel, capital, materials, etc.) into output resources (health care services, educational services, commercial products, etc.)

- The indirect effects are the effects on welfare and resource allocation throughout the remainder of the economy; we distinguish between macroeconomic effects at the national level (such as impacts on the balance of trade, capital availability, and national employment), and socioeconomic effects at the local level (such as impacts on health and welfare in the region affected by the application).

These two categories require the application of quite distinct modes of study. In the case of direct impacts, the conceptual structure is quite straightforward and typically consists of a cost-effectiveness analysis of the delivery of services by the user institutions in question. (In some cases the cost-effectiveness analysis will be replaced by a benefit-cost measurement approach; the circumstances in which this is appropriate are discussed in Section 5.3.2.) Before and after the introduction of the satellite system, an assessment is made of the ratio between the volume of services delivered and the volume of input resources consumed -- for example, the number of patients treated per unit resource cost, or the number of classes delivered per unit cost. In the model illustrated in Exhibit 5-2, this is the ratio between the magnitudes of resource flows represented by the input arrow and output arrow, respectively. A separate measure may be required for each major type of service provided by the institution (for a health care program, services may include inoculation, pre-natal care, and surgery); in this case, input costs will have to be apportioned appropriately. The changes in these ratios -- the cost effectiveness ratios -- resulting from the implementation of the satellite project are the relevant measure of direct economic impact. Clearly, in practice the measurement problems may be more severe than this simple description suggests, but the framework of analysis is based in principle on the comparison of cost-effectiveness measures.

The assessment of indirect impacts is conceptually much more complex because the variety of potential effects of any project on resource allocation is wide. Nonetheless, the approach we will adopt in this part of the analysis can be explained in broad terms by reference again to Exhibit 5-2. The input and output arrows in the exhibit represent linkages to the remainder of the economy. In both cases, the economic impact of the linkage will reach beyond the immediate supplier or service user and affect other economic variables. In the case of outputs, there may be effects on such quantities as the level of productivity of workers in the region (due to improved health care), or the quality of agricultural methods employed in the region (due to improved agricultural education). In the case of inputs, there may be impacts on the balance of trade (due to the use of imported supplies), unemployment levels (due to the engagement of local staff), or investment capital availability (due to the use of investment resources by the institution).

Various techniques of measurement and economic analysis, some quantitative and others qualitative, are available to address these indirect linkages. The specific methods recommended are described subsequently in this chapter.

5.3.1 Questions to be Asked

Six research questions will be addressed in analyzing direct and indirect economic impacts of satellite based telecommunication applications.

1. How and for what purpose is the satellite used?

2. What are the alternatives to the satellite based application?

3. What are the benefits/costs of a basic unit of output/input before and after the satellite service is introduced?

4. What are the macroeconomic impacts of the system?

5. What are the intersectoral impacts arising from use of the system?

6. What are the socio-economic impacts of the system?

5.3.2 Data Requirements and Data Collection

The economic analysis will draw upon a wide variety of data sources. The analysis of direct impacts (impacts on the economic efficiency of the user institutions) will require data in the following broad areas:

(i) Patterns of usage of the satellite system.

(ii) The cost structure of the user institution(s) in areas relevant to satellite usage.

(iii) The value of resources used by the user institution(s).

(iv) The types, the quantities, and, where applicable, the value, of services provided by the user institution(s).

Each of items (ii), (iii), and (iv) should be assessed both before and after the satellite system is introduced. The analysis of indirect impacts (impacts on the economy as a whole) will require data in the following areas:

(i) The input-output structure of the economy.

(ii) The state of the local labor market.

(iii) The values of major national economic indicators (balance of trade, currency reserves, interest rates, demand levels, investment levels, etc.).

(iv) Demographic data for the region affected by the aplication.

A more detailed list of data requirements and sources is contained in Exhibits 7-1a and 7-1b, which brings together the data requirements in all the areas of evaluation.

5.3.3 Analyses and Outputs

As discussed in the introduction to this section, we shall distinguish between two levels of economic impacts:

- Impacts on the efficiency of the user institutions ("direct effects"), and
- Other economic impacts ("indirect effects").

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In each case, different techniques of analysis will be adopted. The evaluation procedures to be applied are described in more detail in this subsection.

Impacts on User Institutions

The two modes of evaluation which will be applied to assess the impact of satellite services on user institutions are cost-effectiveness analysis and benefit-cost analysis. Over and above the method of analysis used, the question of attribution of effects in the economic analysis lingers. With an economic analysis of this nature, no control or comparison group is usually possible. It is not particularly fruitful to use as the sole metric the changes in cost (or benefit) of an activity or unit from before the satellite program is made available to after, for other factors in the country, unrelated to the RSP, may have influenced change. There is no ready solution to this problem for the economic analysis. Qualitative analysis of a case-study nature will have to be engaged in in order to round out the picture of economic changes that might emerge, or non-RSP regions of the country may be examined in order to have a rudimentary basis of comparison for the economic effects tentatively attributed to the RSP project. The economic effects are likely to be subtle, and the economic analysis will have to be supplemented by close observation of process and sensitivity to all potential causal elements.

To the extent that user institutions substitute satellite based communications for traditional methods, cost-effectiveness measures will be utilized as the preferred method of analysis. Cost-effectiveness measures essentially look at the ratio of net monetary effects over net program effects. The basic concern of such an approach is the cost of a basic unit (for example, the cost of a semester hour of agronomy instruction) before and after the satellite is made available. The cost of delivering a unit of output using a satellite-based versus a traditional approach to a given project or activity determines the cost-effectiveness

of the two modes of delivery. For example, in the case of teacher training, cost-effectiveness may be measured as the cost of training each teacher using teleconferencing as opposed to traditional classroom methods. Alternative measurement units may also prove useful. For example, program effectiveness may be measured by the student-teacher ratio achieved in the institution. The appropriateness of any of these measures depends upon the relevance of the output measures to policy makers and institutional constituencies.

The situations in which the cost-effectiveness methodology cannot be applied are when the satellite system generates completely new services or programs, or when the satellite system affects more than one service, and the overall costs of the institution cannot be apportioned among the services.

If either of the above conditions apply, cost-effectiveness ratios cannot be developed, and a benefit-cost measurement approach must be applied. The reason for preferring the cost-effectiveness methodology, where it is applicable, is that it allows us to leave unvalued one type of impact for each application; this unvalued impact may be the most important (such as the provision of extra university courses, or health care services). The need to value such services in monetary terms may often make the results of the evaluation highly controversial.

The requirements of the benefit-cost and cost-effectiveness approaches are compared in Exhibit 5-3. Given the range of applications we may encounter in the satellite applications, we cannot predetermine the extent to which cost-effectiveness or benefit cost analysis will be more appropriate, although it is believed that cost-effectiveness will be the predominant mode of analysis for the direct impacts on user institutions. Each project and situation will be individually assessed, and the appropriate form of analysis will be adopted.

Exhibit 5-3

The Benefit/Cost and Cost-Effectiveness Process Compared

ANALYSIS STEP	BENEFIT/COST	COST-EFFECTIVENESS
1. identifying the decision-maker and his values	the B/C analyst must value all dimensions	the C/E analyst can leave unvalued one dimension of effect (typically the most important effect)
2. identifying alternatives	same	same
3. identifying benefits and costs	same	same
4. valuing effects	relatively difficult	relatively easier
5. discounting effects	same	same
6. determining distributional effects	same	same
7. aggregating and interpreting the valued effects	B/C presents either a measure of net benefits or the B/C ratio	C/E presents the ratio

Other Economic Impacts

In assessing indirect economic impacts, we make a distinction between macroeconomic impacts at the national level (such as influences on the balance of trade, capital availability, and national employment), and socioeconomic effects at the local level (such as impacts on health and other aspects of individual welfare in the region convered by the satellite application).

Certain types of macroeconomic impacts are amenable to a relatively well-developed set of measurement procedures. These impacts include:

Balance of payments implications. Telecommunications projects usually involve the purchase of substantial quantities of imported equipment. Since most developing countries experience severe balance of payments problems, the effect on the national economy of the consequent increase in the import bill should be taken into account. Economists adopt a technique known as "shadow pricing" for this purpose. In the evaluation process, the true cost to the country of buying one dollar's worth of imports is deemed to be more than one dollar; it is assessed at some higher level (the shadow price), which reflects the scarcity of foreign exchange funds. A similar adjustment is made to overseas revenues to take account of their effect, this time beneficial, on the balance of payments.

Skilled personnel requirements. The telecommunications sector has a high requirement for skilled technical personnel which, like foreign exhange, is a scarce resource in most developing countries. Again the technique of shadow pricing is used to take account of this scarcity in the evaluation of projects. The cost of employing skilled staff is adjusted upwards to reflect the fact that the project is employing personnel sought by other sectors.

Impact on employment of unskilled labor. Conversely, the employment of unskilled labor in telecommunications projects must be counted as a benefit to the economy. Throughout the developing world, the presence of widespread unemployment constitutes a major social and economic problem. The beneficial effect of a project on local employment conditions can be quantified, at least roughly, and taken account of in the project's evaluation. (Again, the quantitative technique employed is based on shadow pricing.)

Capital requirements. Telecommunications investments tend to be highly capital-intensive by the standards of industrial patterns in developing countries. As there is intense competition for capital investment funds among sectors, an integrated approach to national planning requires methods of determining the capital allocation appropriate for each sector. Such methods are available to economic planners. An effective approach is to apply a higher interest rate than that charged by commercial banks when discounting.

Cash flows in the evaluation of projects. Such an adjustment to the discount or interest rate, applied to investment projects in all sectors, including telecommunications, helps to compensate for capital scarcity and to achieve a rational allocation of funds to each project. The same procedures can also be used to evaluate the performance of a project once it is implemented.

Consumer surplus. It is widely thought that the benefit that an average telephone user derives from the use of service is very much greater than the price he or she pays for it. Evidence of this is found in the large sums users are willing to pay, unofficially, to obtain telephone service in the face of long waiting lists. For example, the unofficial price at which private transfers of telephone lines take place in African countries is often many times higher than the official price. This difference between user benefits and revenues, which is termed consumer surplus, has important implications for the evaluation of telecommunications investments. If it can be shown that consumer surplus is larger in the communications sector than in other areas of national investment, an allocation of funds to the sector larger than that indicated on purely financial criteria can be justified.

Socioeconomic impacts, and certain other macroeconomic effects, such as intersectoral linkages, cannot be accounted for using standardized techniques of the kind described above. The proposed satellite applications are likely to have effects at the local and community level which, while very important, are difficult to quantify. For example, it is unlikely that the effects of telecommunications on the rate of morbidity

can be effectively isolated from that of other major influencing variables. In addition, the number of countries receiving the satellite system and the number of in-country evaluation sites may render more rigorous statistical and econometric techniques meaningless. For these reasons, we will blend a case study approach with more traditional economic analysis methods to determine socioeconomic impacts. It is hoped that this approach will both capture the uniqueness of each project and allow, to the extent possible, some generalization of project findings. Our suggested approach to the socioeconomic case study methodology is described below.

As used here, the term "case study" refers to research which is intensive in its exploration of a large number of factors bearing upon an outcome of interest, in an attempt to describe a phenomenon in detail; makes use of participants' own accounts of causality in a situation as a means of relating study variables to one another; and supplements such subjective data with the maximum feasible amount of objective data collection, in order to substantiate subjective findings. Case study methods also rely heavily on the professional experience and judgments of the investigator to qualify data for analysis. Case study research, which relies on observation to help develop theory, can often be contrasted with survey research, in which measurements for items of interest are given in advance and are then taken to the field for extensive data collection. An important benefit of case study research is that it can help specify the policy implications that survey research can only summarize. This is because case study research is not restricted in its scope to a prescribed set of variables. Thus, when discussing policy implications, the case study researcher can draw upon other considerations or variables which have emerged from the case investigation and which may critically affect the design or implementation of proposed policies. A summary comparison of the distinctive characteristics of traditional economic and case study research is given in Exhibit 5-4.

Exhibit 5-4

Summary Comparison of the Characteristics of Case Study and Traditional Economic Approaches

Case Study		Traditional Economic
intensive	vs.	extensive
open-ended observation with specific measurement categories emerging from field work	vs.	closed-ended measurement in predefined categories
professional judgment and interpretation	vs.	statistical formulation
participants' accounts of causality	vs.	theory-based measurement and modelling
theory building	vs.	theory testing

Case study data collection will proceed using the types of on-site observers discussed more fully in Section 5.5 and in Chapter 8 below. The evaluation of each impact will begin with a detailed study of the individual case findings. Statistical or econometric analysis will proceed only after careful review of the variables and patterns of interest which emerge through the case studies. Where possible, more rigorous analytic methods will be used to test the significance and generalizability of the case study findings.

5.4 Social Analysis

Each project evaluation plan has to be tailored to the unique characteristics of the setting studied and to the specific questions that are presumed to have greatest leverage for policy.[1] In the present instance, the settings where data collection is to take place are not yet determined, and though the substantive issues are more highly developed, they are not yet cast in stone. Consequently, while we can present here a general outline of the considerations to be borne in mind in planning any site-specific evaluation of satellite-based telecommunications, we cannot offer a blueprint. Rather, this section illustrates our general approach to evaluating social impacts.

5.4.1 Questions to be Asked

The social impact questions are grouped below in terms of their focus: questions about users of services, implementation of services, effects on target groups, impacts, and issues of compatibility, distribution, and diffusion.

Questions About Users of Services. For each project and each project element that is to be evaluated we would want to probe issues concerned with:

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[1] Cronbach, L.S. and Associates, Towards Reform in Program Evaluation. San Francisco: Jossey-Bass, 1980.

- The Target Population

  --Who are the services designed to reach?

  --Who is it hoped that the services might also reach?

  --Who is supposed to implement the services?

  --Who is supposed to administer them?

  --Who is supposed to maintain them?

- The Groups Reached

  --Who actually uses the services at least once

  --What characterizes those who use and never use the services?

  --Which non-target groups use the service?

  --Who actually implements, administers, and maintains the services?

- Questions About Improving Outreach

  -What are the obstacles to various groups using/implementing/administering/maintaining the services, including structural and motivational obstacles?

  --How can these obstacles be removed?

Questions about the Implementation of Services. This area o inquiry asks the following:

- Questions about Frequency of System Use[1]

  --How often is it used?

  --What characterizes the persons who use it more often?

  --How do usage patterns change over time, in general and for specific subpopulations?

  --For what purposes is the system used in general and by specific subgroups?

  --How do these purposes change over time in general and for specific subgroups?

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[1]These questions are asked of each of the target groups, but with a special emphasis on students in the educational context and small farmers in the context of agricultural development projects.

- Questions about the "Appropriateness" of Usage.

  --Can appropriate usages be defined for each target group?

  --If so, how much appropriate usage occurs?

  --How does the appropriateness of usage change over time?

- Questions about Improving Usage.

  --What are the non-technological reasons for any disappointingly low levels of usage?

  --How can these be dealt with?

  --What are non-technological reasons for any inappropriate usage?

  --How can these be dealt with?

- Questions about Discovery.

  --What novel uses is the telecommunications equipment put to?

  --Who develops such uses?

  --By which mechanisms are they sustained or not sustained?

Questions about Effects on Target Groups. The questions we ask about effects on the planned target groups are necessarily even more general than the questions we would ask about which groups received particular telecommunication services. This is because the effects to be examined depend so heavily on the particular package of telecommunications being implemented, on the socio-cultural context, and on the uses to which they are being put. Thus, the discussion of effectiveness is centered more on the framework from which questions will be derived than on the questions themselves.

- Explicating Intended Target Groups. In the period after the AMC, AID, and a host nation have agreed upon a project, but before telecommunications have been introduced at the specific site, it is critical to explicate who are the target groups the services should impact upon. It may also be useful to prioritize these audiences. In the Indonesian university example, the target groups would probably include students, teachers, administrators, researchers, and technicians, and of these, the students would probably be the major target group.

- Explicating the Intended Effects on Each Target Group. Interviews with AMC, host nation, and local officials may be required to list specific intended effects for each target group. In the Indonesian case, for example, we might learn that effects are intended on students' achievement, attitudes towards learning and new technology, and the career possibilities they see for themselves. For faculty members, the intended effects might include changes in the curriculum and the style of teaching (to make it more two-way or individualized). For administrators, the intended effects may include exposure to new ideas and a willingness to try them out, plus more time spent on local campus administration because coordination with the other campuses is made easier.

- Explicating Possible Unintended Effects on Each Target Group. Interviews, literature reviews, and a reanalysis of the theory behind the specific form of telecommunications used at a site should be used to develop a list of possible unintended effects, both beneficial and otherwise. This list should, of course, be more refined when evaluations take place at the later sites, for the discoveries from the earlier sites should by then give a more reality-based perception of the unintended events that are occurring. Such unintended effects will follow from private uses of the telecommunications facilities, novel usages, differences between groups in usage patterns, usage by non-target groups, and any activities that intended service recipients might have to forego in order to use the telecommunication facilities.

- Explicating Causal Mediating Mechanisms for Each Effect. When elucidating intended effects, it is useful to probe why these effects came about. Such knowledge serves to improve effectiveness by highlighting some of the necessary and sufficient conditions for effectiveness. Such knowledge makes it possible to incorporate these conditions into projects that are already ongoing or are about to be implemented. They, common sense, and the experience of persons who have used satellite-based telecommunications are all useful for detailing the processes that are presumed to mediate particular expected effects. So, too, is cumulative evaluation and, compared to the early-studied sites, we can expect study at the later sites to be more sophisticated about possible causal mediation.

Questions about Impact. In the present context, we understand impact in terms of effects on the social systems of which target recipient groups are a part. Impact analysis differs from analyses of effects in either of two ways: (a) the unit of analysis is at a higher level of aggregation -- e.g., a whole university as opposed to the classes having access to telecommunication services; or a whole village as opposed to those within it who have access to services; or (b) the units being studied are not part of the target group -- e.g., when students in classes without access are studied to examine diffusion, or when individual farmers without direct access are studied for the same ends. The study of effects and impacts are closely related. The distinction is made here solely because effects are presumably easier to bring about and are more obviously linked to the provision of services. Yet impacts are of greater utility, implying both the multiplication of effects and a greater likelihood of changes in the broader social system.

As in the study of effects, the impacts to be examined depend heavily on the particular site chosen for study, on the particular mix of telecommunication services there, and on the purposes to which the services are put. Hence, we shall again concentrate on a framework for question-generation rather than on the questions themselves.

- Explicating Non-Target Groups and Higher Order Aggregates that Might be Affected. Theory and formative research on local communication patterns should lead one to guess the social groups most likely to hear of the telecommunication services or -- as is more likely -- the "advice" available through them. This should make it possible to generate provisional sociograms of the transmission of knowledge and influence, and such sociograms will help determine the groups on whom impact might be asssessed. Each student (as in the Indonesia example to be presented in Chapter 6) and each village resident (as in the Philippines example) exists in numerous social systems. For the latter, these include, but are not limited to, the immediate family, kinship groups, friendship circles, and perhaps a cooperative, village or barangay.

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It is not unreasonable to expect that telecommunication facilities could impact on each of these, even if many of the members of these groups are not themselves as directly exposed to the facilities. In generating impact questions, one has to identify these higher-order groups prior to estimating whether it is useful to assess whether they have been impacted by the RSP

- Explicating Possible Patterns of Impact. For each non-target group and each higher order aggregate, it is useful to use past theory and present experience to suggest ways in which telecommunications might influence them. From such an analysis follows the specific research questions to be asked. These might include, for example, questions about the percentage of farmers in a village who use knowledge of market conditions (arrived at by phone) to help decide when and where to market produce; or it might in some contexts include questions about the progress made towards using new seed types or irrigation possibilities, or towards controlling surface water. The list of possible impacts is endless, the more obviously so once one is in a multi-sectoral framework and begins to speculate on long-term impacts that follow from prior impacts.

- Explaining Possible Patterns of Impact. The more knowledge is available about processes that bring about impact, the easier it will be to recreate these impacts. Hence, in considering possible impacts, it is desirable to be specific about why it is thought they may come about. Then, decisions can be made about how much of the evaluation resources one wants to devote to studying the micro-mediation of impact.

Relating these Questions and Frameworks to Questions of Compatibility, Diffusion, and Distribution. The social impact evaluation might ask about (a) the compatibility of the implemented telecommunication system with the socio-cultural context of the site where implementation took place; (b) the diffusion of knowledge and practices caused by having telecommunications system in place; and (c) the distribution of impacts across social groups and even, in some circumstances, across sectors.

Though it may seem to be a circular argument, compatibility is best inferred when a system is heavily used. Such usage does not suppose optimal compatibility. This is why, even when usage is high and appropriate, it is useful to analyze any barriers to even more extensive or more appropriate use. Thus, issues of compatibility are implicated in the questions about who uses the telecommunication system, how often, for what purposes, and with what temporal pattern. Improvements in compatibility can come about once one learns about the obstacles to better usage and reasons why usage patterns are as they are.

Answers to questions about the diffusion of knowledge of telecommunication facilities and of the practices they promote can be gained from probes of the structure and content of local communication patterns, and from analyses of the usage of telecommunication facilities by non-target individuals. By these means, we should be able to chart who speaks to whom about what. Should the diffusion issue be assigned a high priority, we can go a step further to ask whether individuals who learn about novel practices from persons with access to phones, teleconferencing, and the like implement these practices and, if they do, with what success.

The general question about the distribution of benefits requires three kinds of information: identification of the types of persons who use telecommunications more or less frequently, analyses of those who benefit more when access is held constant, and analyses of the groups that gain more or less when access and the gain per unit of access are left free to vary. The last analysis is in many ways the most important since groups with lower average exposure but higher gains per unit of exposure can benefit more in the aggregate than groups with higher exposure but lesser gains per unit of exposure. Of course, analyses of the distribution of benefits depend on a prior analysis of, or a rationale for, selecting the group to be compared. Like so much else, this rationale will be project-specific.

Finally, we shall be faced with the difficult task of aggregating all of the sources of benefit -- which could well be of very different types -- in order to arrive at benefit scores for use in cost-benefit analyses Of necessity, some benefits cannot be easily expressed in money terms; others we will be unsure of because they have emerged from the evaluation process and were not initially planned for or because sensitive numerical estimates are just not possible. Consequently, it is only realistic to expect that out of the analyses of effectiveness and impact will come a restricted array of possible benefits that, if many assumptions are accepted, can then be tentatively translated into a common monetary metric. But since the viability of cost-benefit analysis rests so heavily on a comprehensive universe of possible benefits, it is crucial that the site-specific process of evaluation planning be used to generate a wide array of potential benefits that are subsequently assessed.

5.4.2 Data Requirements and Data Collection Mechanisms

When research questions have been listed, it is relatively easy to outline data requirements and data collection plans that are fitted to the evaluation budget. However, when an evaluation is largely exploratory, the data requirements are not so obvious, and a greater emphasis must be placed on the development of data collection methods that promote open-ended inquiry. This observation conditions the discussion that follows. It will seem heavily weighted to more confirmatory research tasks, but only because these can be more readily related to data requirements in an explicit and comprehensive way than is possible with more exploratory tasks.

Describing System Users and Non-users

In many specific evaluation contexts, several different user populations will be defined. For each of them, we need to know, at a minimum, the percentage of persons who use the system or its components of interest and the reasons why usage seems high or low. Ascertaining the percentage of persons who are users requires the simplest kind of usage data; but since more sophisticated questions about changes in usage over time require more elaborate data, it would be useful to collect all usage data by means of one of three methods:

- physical monitors, attached to the telecommunication system, that are ethical, reliable, unobtrusive, and validly linked to individual users;
- time-sampled direct observation; or
- retrospective accounts of usage by individuals who keep logs on a periodic basis, probably monthly.

These methods are ordered in terms of supposed validity. The first possibility may not be expensive, but much formative work is needed before mechanical devices can be used with assurance. If no such assurance is forthcoming, monthly logs are to be preferred, despite their obtrusiveness, on grounds that they generate data on more individuals than might be possible by direct observation.

Data on the characteristics of individual users may sometimes be available in archives (e.g., in school settings). But such archives are less likely in other settings, and even in the school context it is an empirical issue whether information is available for the specific variables that evaluation planning suggests are worth measuring. Thus, some interviewing of individuals is going to be likely. If mechanical recording devices are also to be used, the data from them will have to be linked to such interview data. If linking proves difficult, the case for using logs to measure usage is all the more compelling.

For many purposes, the user profiles that emerge will have to be compared with the characteristics of persons in the target groups who failed to use the telecommunication facilities. Describing the target population(s) is extremely difficult in many contexts, logically requiring censuses or sampling with known probabilities within well-defined catchment areas. Neither of these is likely to be feasible. Instead, existing archives or comparisons of obtained profiles with what individuals sensitive to local conditions <u>reliably</u> believe is the local profile will have to be used. Since probing reasons for non-use must include some persons eligible for telecommunications who failed to use them, purposive sampling of non-users for purposes of interviewing them will be required. The exact number of such persons depends on budgets, the importance ascribed to reasons for non-participation, field logistics, and other site specifics.

The data generation mechanisms suggested for the social impact evaluation are, therefore:

- Mechanical devices or monthly logs for recording usage.

- An interview with users to determine their characteristics and the nature of their reasons for exposure. A fallback option here would be to use records in those settings where they are available.

- An interview with a purposive sample of unknown size consisting of eligible persons who were not exposed to the communication system. The reasons for these interviews are to assess background characteristics and to probe reasons for non-use.

Describing the Extent and Nature of Usage

The data generation techniques above can also be used for related questions about the extent and type of usage. Thus, logs or mechanical devices could be used to plot the mean level of frequency of usage and any changes in this level, and the same interview data or -- where available -- institutional records could be used to describe individual characteristics. Conclusions about the nature of use depend, of course, on the nature of the category schemes built into log books or mechanical devices or on the category schemes developed for use by coders who examine open-ended logs. In an evaluation area as new as this, it is very desirable indeed to leave respondents plenty of room for recording uses that have not been categorized in advance. Discovery may not be facilitated by initial category schemes that are too rigid.

If it is deemed desirable to rate usage in terms of its appropriateness, this will be difficult to achieve well. One reason for this is the difficulty of defining so normative a concept as "appropriate", for even obvious "playing around" with the telecommunications system may involve learning how to handle the system physically or developing feelings of mastery with it. A second reason is that each usage then has to be coded as appropriate or not or has to be coded for the degree of appropriateness. Quantification of appropriate usage may not, then, be feasible, and it may be more desirable to resort to judgments of appropriateness in interviews with system developers, monitors, and administrators.

Neither logs, mechanical recording devices, nor on-site interviews permit much discovery to take place concerning who uses the telecommunication services, how well they use them, and how usage can be improved. To achieve this requires an extended on-site observational capacity. The crucial issues are: By whom? When? and For how long?

Budget constraints seem to dictate that most of the periodic on-site observation be conducted by host-country nationals with occasional monitoring visits by members of the EMC team or their subcontractors. While such observation may, for example, be supervised by host country academics (in the university setting) or local teachers (in the rural development context), they may not always be the actual recorders of data. In the university setting, for instance, the actual observation will probably be carried out by students associated with the faculty members who are using the system. While financially the most feasible, such data collection mechanisms are of little known validity and utility when the concern is to uncover unique patterns of usage, unique user groups, and unique effects and impacts.

Considerable training prior to data collection may well facilitate more responsive open-ended data collection, as may the periodic interchanging of information among observers and between observers and their local supervisors. So, too, may supervision by EMC representatives at an early stage in data collection when it is still possible to detect problems of open-ended data collection that can be corrected. But it is not clear yet that these steps will or will not lead to the collection of high quality data. Thus, in some settings (e.g., the decentralized campuses in the Indonesian context) it may be possible to devise a small validation substudy in which American trained social scientists who speak the local language are used, and the analyses they provide are impressionistically compared to those provided by the more numerous, less trained, less senior, and less expensive indigenous observers. Such a substudy will provide evidence on the validity of open-ended data collection by persons with little social science training and knowledge of substantive issues associated with telecommunications or social development

When new services are provided, a "shakedown period" of unanticipatable duration typically ensues. Evaluation can be helpful at this time in providing diagnostic feedback. But to spend one's evaluation resources heavily at this time means that less is available when -- and if -- the system attains a more representative level and style of functioning. Our provisional estimate is, however, that we should expend resources for monitoring of on-site data collection during the initial months of implementation, to give feedback, to train observers, to make inevitable mistakes from which it is hoped learning occurs, and to communicate to local staffs at an early date the symbolic message that AID is committed to the evaluation activities. If visits by EMC staff are left until way after implementation has begun, serious problems of motivation and data quality could ensue.

Although a continuous on-site capacity is desirable to record and perhaps handle unexpected events, such a presence is not budgetarily feasible. It is therefore probably most useful to have three waves of implementation measures of presumed high quality. These would occur early in the shakedown period, midway between the pretest and posttest (so that there is no differential regression from the pretest to the posttest and vice-versa if implementation measures are to reclassify individuals by their degree of treatement exposure[1]) and at the end. Each of these more intensive observational periods could be of two or three weeks duration and perhaps conducted when EMC representatives are present for some part of each period.

The data collected from the open-ended study of implementation is likely to uncover aspects of the telecommunications package that seem more important when seen from the field than from the planner's armchair. As a result, one consequence of the data collection effort could be a reformulation of the "independent variables" (the constituent elements of the package) or a sense of new variables that need to be measured because "treatment" effectiveness may depend on them.

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[1] Cook, T.D. and Campbell, D.T. Quasi-Experimentation: Design and Analysis Issues for Field Settings. Chicago: Rand-McNally, 1979.

Inferring Causal Effects

Until possible effects have been developed and prioritized for individual RSP projects, it will not be easy to specify sampling, design, measurement, data collection, and data quality control options. So, the first point to be made is that sampling, design, measurement, data collection, and data quality control issues are involved in attempts to infer causal effects, together with the treatment specification issues that have been dealt with and the data analysis concerns that are discussed subsequently.

Persons, settings, and times usually have to be sampled, with sample sizes depending on budgets and the precision of desired estimates. Rarely will random sampling of settings and times be possible. Even sampling persons at random will be difficult, and purposive samples are more likely. The type of sampling is obviously site-specific and has to be probed afresh at each site in terms of the possibilities that emerge in the crucial formative period before the telecommunication system is implemented. It is important in this regard to note that different sampling methods and ratios can be used with different populations -- students, researchers, technicians, administrators, etc.; and that the unit sampled need not be the individual. In the rural development context it might be households, villages, or neighborhoods; and in the university context it might be classrooms.

We make the assumption that pretest data will be collected for their utility in describing change and inferring its causal nature; also because the time interval between agreeing to implement telecommunications and their actual implementation may be many months, perhaps a year. However, evidence of change does not by itself invariably (or even often) constitute evidence of the causal influence of a presumed agent of change.

Causal inference is only warranted when plausible alternative interpretations of the change can be ruled out. In the abstract, many alternative causes are possible (see Cook & Campbell's threats to internal validity[1]). In the concrete case of a particular study, there may be

[1] Cook T.D. and Campbell, D.T. Quasi-Experimentation: Design and Analysis Issues for Field Settings. Chicago: Rand McNally, 1979.

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few or many alternative causes. Campbell has discussed the rare case (other than a randomized experiment) where no control groups are needed for estimating the degree of change that would have taken place in the treatment group had there been no treatment.[1] This is when the treatment is so unique in its presumed effects that these effects could not have been caused by any other known causal forces. Some medical research is like this where the constellation of symptoms is so "signed" that they can only be due to one known disease. The viability of this strategy in our case is questionable, since many of the desired effects of telecommunications could presumably be multiply determined. Perhaps the only way the no-control-group strategy could be used in our context is by having the telecommunication system promote practices that have never independently occurred locally and do not occur nearby. Unless this can be done, an independent "no cause baseline" is needed that only a control group can provide.

Choosing such a group is not easy and is, once again, setting-specific. We would look for groups that meet three requirements: (a) they are as similar as possible to the treatment groups in background characteristics; (b) they are exposed to similar forces that might influence posttest performance after the pretest has been measured; and (c) there is little or no communication between the units receiving and not receiving the treatment. In the hypothetical Indonesian case, for example, other classes in the same colleges may serve as controls, or maybe a different college can so serve. It is conceivable that we may be forced back on internal analysis within classes of individuals who spontaneously differ in their degree of exposure to ascertain control subjects (i.e., those who received no or minimum exposure). Creating one's own control group by partitioning respondents according to the level of reported exposure, though useful, presents many special con-

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[1] Campbell, D.T. "Degrees of Freedom" and the case study. Comparative Political Studies. September 1975, 178-193.

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ceptual problems,[1] and the use of independent control groups has much to recommend it where it is feasible. Only intimate knowledge of local conditions will allow sensitive probing of what is logistically (and financially) possible.

The choice of a control group is also driven by a consideration mentioned above, the analysis of policy options. We have assumed that the telecommunications package and its components are to be examined against a no-cause baseline, viz., that which would have happened in the absence of telecommunications. But in some cases, more appropriate comparisons may be available, as in the example above of evaluating telecommunications used for teaching in an agricultural college with battery-operated radios used for that same purpose.

In contexts where multiple local sites are eventually to be served by the same telecommunication service, it might be possible to create control groups by staging implementation. That is, if sufficient software exists for only a subset of sites, then these can serve as the treatment group and others, that are to receive the treatment later, can be the temporary controls. The difficulty with such a strategy is that no study of long term effects may be possible. In the same multi-site context, resources can sometimes be husbanded by studying some sites with pretest-posttest methods and others using retrospective pretest data (i.e., recollections at the posttest of how things were when the pretest would have been collected). Retrospective pretests are rarely to be recommended by themselves, but in the context where pretest-posttest measures at some sites confer validation, their use can be readily justified.

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[1] Campbell, D.T., and Boruch, R.F. Making the case for randomized assignment to treatments by considering the alternatives: Six ways in which quasi-experimental evaluations tend to underestimate effects. In C.A. Bennett & A.A. Lumsdaine (Eds.), Evaluation and experience: Some critical issues in assessing social programs. New York: Academic Press, 1975.

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It is impossible to say how we would measure outcomes when none are clearly known yet. But the measurement of outcome variables and all important, presumed moderator variables is called for. The more the measures of each construct, the better. Otherwise, one works within a mono-operationalist framework that makes difficult the analysis of causal mediation.[1]

Where pretest and posttest observations are appropriate, many of the data needed from individuals would be collected by interviews and questionnaires administered by the local collectors. In the university context, literacy should not be a problem, but it will be in the rual development context where less dependence can be placed on certain forms of questionnaire administration. Among other things, these interviews are used to assess learning, attitudes, perceived changes attributed to the system, perceived benefits, perceived drawbacks, ways to improve the system, as well as any new communication patterns that are useful in their own right but also help measure diffusion.

Sometimes, records may be available that, after probing for validity, seem useful. These could involve, for example, grades or types or weights of farm produce. If one wants to move to behavioral outcomes, and archives are not suitable, direct observation will be required. This can be expensive, and so much probing of local data collection possibilities will have to be carried out before a telecommunication system is implemented.

Data quality will be increased by training (including mock interviewing), feedback among data collectors, supervision by host country residents, and by EMC staff visits. Reliability checks can also be conducted between observers. While reliability is only one component of validity, it is a useful diagnostic tool for pointing to situations where invalidity is likely. Separate validation substudies may be useful at the very first sites studied, just to be sure. Invalid data will, of course, prejudice any evaluation.

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[1] Joreskog, K.G. and Sorbum, A. LISREL IV: Analysis of Linear Structural Relationships by the Method of Maximum Likelihood: User's Guide. Chicago: International Educational Services, 1978.

In summary, the social impact evaluation effects and impacts we have outlined will require data collection efforts that take place at different times:

- A formative period between when a site is chosen and telecommunication facilities are set up. At this time:

  -- local staff are recruited and trained,

  -- the purposes of the project are assessed as one major means for specifying possible effects and impacts,

  -- local administration, history, and social relations are explored in their own right and to specify factors that may condition the effectiveness of the treatment,

  -- control group possibilities are assessed, and

  -- "independent variables" are provisionally decided upon.

- A pretest is carried out. This taps into the knowledge, attitude, reported behavior, and behavioral issues that emerge as possible social outcomes, and may itself suggest new issues.

- A monitoring capacity is implemented when the telecommunications system is set up. This is to provide rapid feedback on users and use patterns for the local systems' personnel during the initial shakedown period. It will also serve to "green" on-site data collectors.

- Extensive measures of implementation are made, at the minimum, at two other times. Local data collectors are responsible for the quality of records logs which are useful for many purposes, including the description of usage patterns over time, clues as to why usage fluctuates, and as fallback experimental design options should the control groups not be secured or maintained for the duration of the study.

- Regular meetings are held between data collectors, host country professionals, and, sometimes, involving EMC staff. The purposes of this are data quality control.

- Posttest measurement is carried out. This is done by interview and questionnaire on all (or a sample) of the members of target groups.

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- Records and archives are checked to see what extent they meet data requirements for some of the study's specific purposes once these have been analyzed and agreed upon.

- Data collectors at all levels of authority will provide logs, and be interviewed about, novel uses and effects that they have observed. This will be done at three times so as to raise their consciousness to methods and issues and so as to impress upon them the importance of watching for the unexepected.

5.4.3 Analyses and Outputs

This discussion is in two sections: descriptive and inferential. It pertains only to inferences about individual projects and not about commonalities between projects or about the program as a whole.

Descriptive Analyses of Users

Multiple regression techniques will be used to characterize telecommunication users and to differentiate them from non-users. Factor-analytic techniques are appropriate, probably discriminant analysis.

Simple counts will be made of each of the reasons for non-usage, and these will be aggregated into whatever categories make sense.

Descriptive Analyses of Usage Patterns

Multiple regression techniques will also be used to characterize users by the frequency and patterns of usage of both the system as a whole and any components. Special attention will be paid to the time changes in user groups, including unplanned users. The latter are important for examining part of the diffusion issue.

Simple counts will be made of the different purposes to which telecommunications are put, and graphs will be drawn to illustate any temporal shifts in purpose. Such graphs may be disaggregated by characteristics of students or farmers. Individuals will be assigned usage scores, if possible, based on some composite of the frequency and appropriateness of usage. In practice, only the former may be possible.

Anecdotes and counts of unplanned usage will be collected, and analyses of the reasons for these will be offered.

Analyses of Effects and Impacts

The preliminary descriptive data analysis will give sample sizes and attrition rates. Also, the outcome variables will be factor-analyzed to determine which items behave abnormally and which deserve to be retained and added to particular scales. Pretest-posttest correlations will be computed within treatment groups, and treatment and control groups means, standard deviations, and reliabilities will be inspected. The more similar these are, the more confident causal inference will generally be.

The inferential analyses are likely to take the form either of reliability-adjusted analyses of covariance (ANCOVA) or structural equation modeling (LISREL). Which of these related techniques is used depends on many factors not yet known, including the degree of knowledge of selection processes, the availability of proxy measures, etc. These analyses will provide best estimates of the form: "The effect of X on Y was . . . ." The X's will be telecommunications variables, and the Y's, effects and impacts of importance. The outputs of such analyses feed into the benefits component of cost-benefit analyses.

Since effects may be conditional on characteristics of individuals and settings, it is useful to explore the personological and situational conditions under which telecommunication possibilities are successful. This means that, in the initial planning period once the sites are known, a list of measurable personal and situational constructs should be developed. Once measured, these can be entered into the analysis as stratification variables in ANCOVA analyses or as interaction factors in multiple regression. Such analyses will, for instance, indicate any differences in the distribution of benefits. If the experimental-control contrast breaks down, internal analyses will be conducted constrasting the effects on high- and low-level users of the system. This will probably also be in the form of reliability-adjusted covariance or treatment-effect correlations.

Since effects may be discovered by observers and not planned for at any of the sites, including later ones, such possible effect can, however, be discussed in terms of the qualitative evidence that is in favor of the proposition and helps rule out alternatives. Often such evidence will involve syntheses of field notes, reports from interviews with respondents, and so forth.

5.5 Institutional Analysis

The purpose of this part of the evaluation of the RSP is to examine the effects of the program on the operations primarily of participating institutions. The institutional analysis will examine two major effects: 1) the effects of the RSP on the relevant institutions and their stability, effectiveness, and role in development, and 2) the effects of institutions and their behavior on the success or failure of the RSP. Each ministry or other national institution in most LDC's typically is composed of numerous services, divisions, and bureaus, and extends from the national level downwards via regional, provincial, and district levels to the village. At the village level, the ministries are represented in other forms, such as by rural health clinics in the case of the Ministry of Health and agricultural extension offices or university campuses in the case of the Ministry of Agriculture. Also at the village level (and other levels), each agency performs a variety of service activities, most of which contain educational components. One way of visualizing these relationships is shown in Exhibit 5-5.

The aim of the institutional analysis will be to obtain a solid understanding of the organization of each user institution, its mission or goals, its service activities, the principal actor, and the flows of information and resources within and among the institutions. Three types of institutions will be observed:

1. Local on-site institutions, e.g., village clinic, or school.
2. National institutions, e.g., Ministry.
3. International satellite institutions, e.g., INTELSAT.

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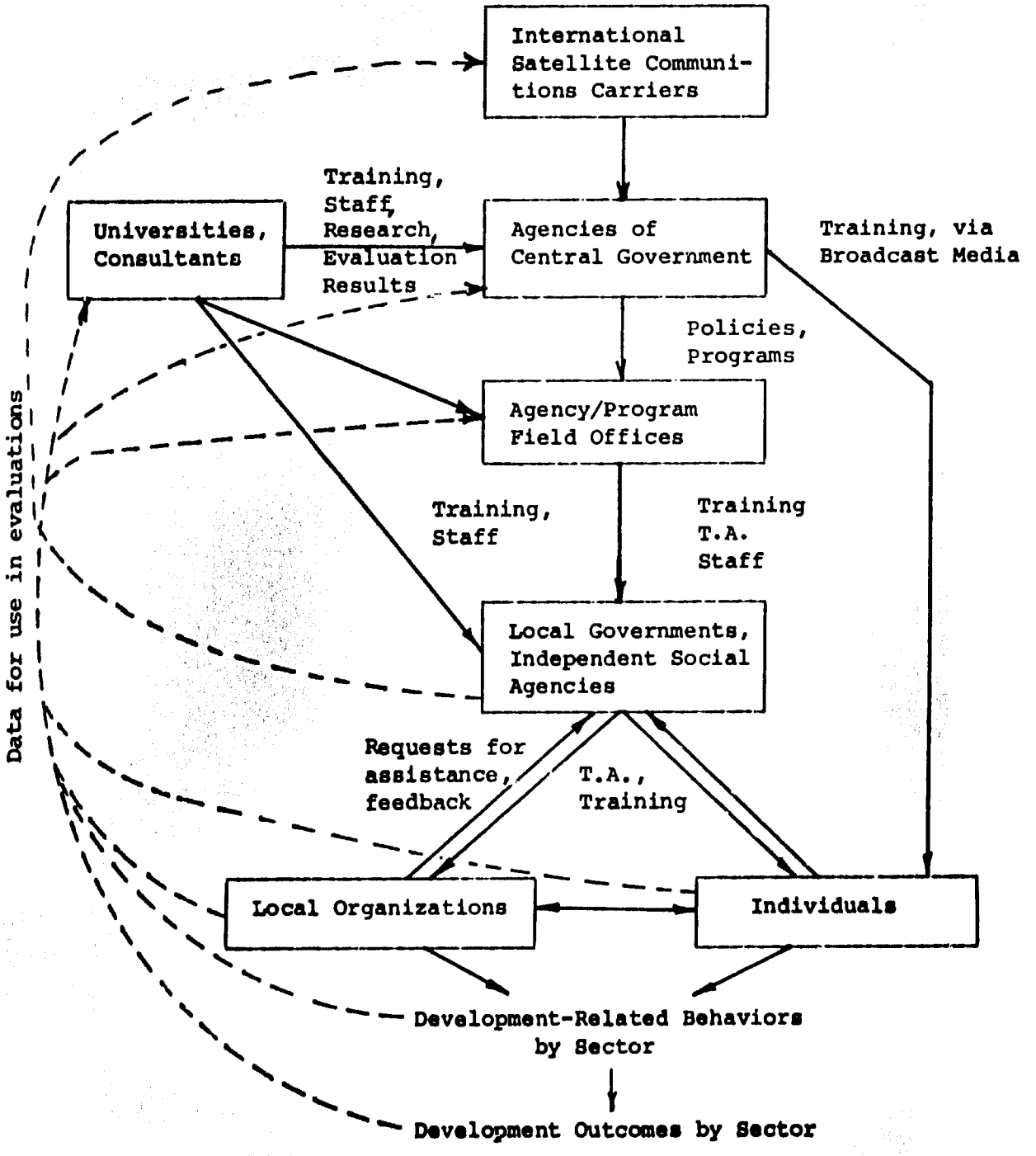
Exhibit 5-5

Flow of Information in LDC Development Programs



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Additionally, as indicated in Chapter 3 above, we shall be sensitive to insitutions that may not be directly impacted by the RSP but which, just the same, may receive indirect impacts.

In what follows, we attempt a fairly comprehensive list of the kinds of questions that have to be answered to deal with the two major areas of institutional analysis indicated above for the RSP. In any given project evaluation, only some of the questions that follow would be relevant or worth exploring. The selection of the particular questions that are of high priority can only be done with any degree of confidence after the pilot project site is chosen and the basic implementation plan made. For example, one set of institutions listed above is international satellite institutions. That would be an important topic in an area where the satellite used was from INTELSAT, but might be totally skipped or dealt with in a cursory way in a project where a domestic satellite is used, such as in Indonesia. Similarly, a multi-functional integrated development project, such as is under consideration for the Philippines, would require attention to international co-ordination and relations, while a purely educational project, such as is being considered for Indonesia, would not require as much attention to that topic.

In general, when a project has been identified, Abt Associates, in consultation with AED, will seek to identify those particular institutional arrangements involved which are likely to be important to project success, or sensitive, or troublesome, and also those institutions which the project is seeking to develop. We shall then select the subset of questions that need to be systematically answered by data collection. Other questions, which at first glance may not seem relevant, will be kept in mind, using the full list as a kind of mnemonic, in case they turn up as important.

For the program evaluation, those questions will be dealt with which have turned out to be parts of recurrent patterns in the project evaluations. Another distinctive feature of the institutional program evaluation, in contrast to the project evaluations, is that the questions need to be dealt with not just in the form of reporting what

happened, but also in the form of evaluating what institutional arrangements seem likely to be effective in future satellite programs in developing countries. We shall attempt to generalize about such matters as what kinds of arrangements between the telecommunications authorities and the substantive ministries work or create problems, what kinds of on-site staffing and organization are necessary, and so forth.

5.5.1 Questions to be Asked

The questions to be asked as part of the institutional analysis are all cross-cut by three overarching questions which arise out of the general theoretical literature on institutional research are:

- Did the institutional effects occur because of the project that was implemented or because of the novelty of the situation itself?
- When in the process of project implementation did certain institutional effects occur?
- Why did observed institutional effects occur?

One of the recurrent problems in institutional studies is the frequent dominance of what is known as the Hawthorne effect, i.e., the fact that the conduct of an experiment itself represents such a motivational perturbation in the situation that it, rather than the specific contents of the project, makes the measurable differences. It is, therefore, essential to consider whether the observed effects of the project, or the effects on the project, were effects relating to the satellite communications activity itself or effects relating to the fact that this was a novel or pioneering activity.

Institutional changes evolve. In any change, there is an initial period of resistance. Over time, the change may become institutionalized and perhaps also routinized. For this kind of process to be recognized, it is essential that events be tracked in their chronological context.

Every question should be treated as an open-ended question to which the query, "why" should be appended. Because of the complexity of institutional interaction, the institutional analysis will require probing of the particulars of each case.

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Questions About Effects of the RSP on the Institution

Acceptance of the RSP. A priority question in every project concerns how the institutions being studied came to accept the RSP. Was there resistance to the RSP? If so, we need to know of what nature, how attitudes changed over time, and what events accounted for the change of attitudes. What did the institution expect of the RSP? Later on, we will wish to take note of whether those expectations were met, disappointed, or changed.

Effects on organizational behavior. One of the measures of success of a project will be the extent to which it improves the functioning of the organizations involved in it. One of the respects in which a change could occur is in the degree of decentralization of initiative that takes place and, conversely, in the extent to which the center is able to exercise leadership. Satellite communication could change the balance either way, and in so doing could be either positive or negative in its consequences. We therefore will want to know such things as whether the RSP was accepted actively or passively (i.e., ordered from above.) To understand the process of change, we need to take account of what the original structure was: Was it vertical-authoritarian, cooperative, or decentralized? In what direction did it change? What proportion of RSP descisions were made on the site and what proportion centrally?

In many projects, one of the purposes will be to change the goals of the organization. In others, such a change may occur even if unintended. Thus, we need to ascertain what the original goals of the institution were, whether they changed under the impact of the RSP, and how.

Institutional learning. Demonstration projects are not ends in themselves. They are significant only to the extent that they lead to learning and immitation by the institutions to which they are addressed. For example, does the telecommunications administration (outside of the personnel directly involved) pay much attention to the project? Do they come to see it as a new type of service to be offered to other possible

customers? Do they learn to use the system? The same question would be asked for other relevant ministries in the government. We will also want to ascertain whether, among the system users themselves, new patterns of collective problem solving developed.

Institutional change. New organizations may develop as a result of the project in a country, in which case we would wish to describe the objectives, structure, and events in the new organizations. After a time, the new organization may remain more or less permanently, it may be absorbed by other units, or it may disappear. Also, existing organizational units may grow or decline in size. To track these developments, we will wish to have information about the changes in the numbers of personnel in the different units and also about shifts in the budget. These matters are discussed below in relation to data collection methods.

New skills may develop as a result of the RSP. As a result, there may be changes in the balance of power between technologists, substantive specialists, and administrative personnel. This, in turn, implies change in the balance of recruitment and in training among kinds of personnel. These are matters to be studied whenever there are major changes in institutions as a result of the RSP.

Furthermore, the satellite project may have important effects on the institution's self-confidence and prestige. We would also want to examine how the satellite service changes or improves the functioning of the institution.

In all instances, it will be important to keep track of how often the institution uses satellite communications. Sometimes, these uses will be substitutions for communications that used to be made in other modes, e.g., travel, mail, messenger, or phone. It will be important to track these substitutes, just as it will be important to ascertain the extent to which the satellite project represents a new function for the organization.

The use of the satellite may well reflect advantages and disadvantages perceived by the users and user institutions of the satellite communication over the method previously used. These advantages and disadvantages may include time savings, money savings, and changes in work style or work environment. The satellite project may produce changes in levels of effort and discipline. Perhaps self-regulating systems develop. If so, how? If not, what is the pattern, e.g., passive dependency?

Organizational Change. We might productively examine the effects of a project in a site on the structure of the relevant organizations. We shall examine the table of organization from before and after the project's inception and ask: Did a parallel organization develop (such as one which separates satellite users from "traditionals")? How? What changes occur in who works with whom, and in the influence structure of the organization?

Reporting Practices. Changes in reporting practices as a result of implementation of a satellite system also are of importance in our institutional analysis. Frequently, such changes go hand-in-hand with organizational change while other reporting changes may occur informally, regardless of organizational stability or change. We shall examine the change in who reports what to whom with what frequency.

Organizational conflict. In looking into whichever of the above issues are important in any given project, it is important not to neglect the fact that there can be negative as well as positive outcomes. Much of the literature of evaluation of institutional change is concerned with the identification of unanticipated consequences. What follows is a list of questions about some of the more common such consequences.

- Did the increment in communications create overloads or bottlenecks because of incremental exigencies for which the organization was not prepared?
- Were units or persons bypassed or reduced in status?
- What conflicts occur as a result of the satellite activity?

- Were informal or latent functions of the previous communication system lost with the use of the more advanced system?

- To what extent do the injured persons react and express their discontent in:

  -- Non-cooperation,
  -- Lowered performance,
  -- Factionalism,
  -- Sabotage of the system,
  -- Diversion to other activities, and
  -- Adverse opinions?

- What kinds of resistance to change are observed?

- Was it necessary to develop new bureaucratic methods in order to achieve successful results, or did the existing protocols work well?

Questions About the Effects of the Institutions on the RSP

We have discussed above one of the two main topics of institutional analysis, namely, the effect of the RSP on the institutions involved and those indirectly affected by it. We turn now to the effects in the other direction, namely the ways in wich the institutions involved in the project help or hinder the successful conduct of the RSP.

One of the major questions is whether an adequate infrastructure is provided by the local government to allow for the introduction of needed changes. In all cases, we will be concerned with the ways in which the institution helped in the conduct of the experiment and what individuals or units in the institution were supportive. Where they the ones directly involved? What was the attitude of superiors on site, at district level, in the capital?

In this regard, we shall also examine how conscious the central agencies of the operation were of the project in the field. Did they keep track of the project? How did they learn about the project's status? Through what channels? Did they feel it to be a threat in any way? If so, how?

There are various ways in which organizations can be supportive. They can manifest interest and enthusiasm. They can engage in actual work or participate in activities. An activity of particular importance in some projects for which preprepared software is needed is software production. What software planning and development was thought about or done by the central institutions? If they had such responsibilities, did they meet them? If not, why not? How far did the experience of the RSP make these institutions feel that there is such a need or role for themselves?

Another critical requirement for support of the RSP from local and central institutions is money. We will, of course, need to ascertain whether the money needed during the project and planned for was actually provided on schedule. In addition, we shall examine how far the relevant organizations assumed responsibility for planning for funding after the term of the pilot project. How conscious were the authorities of this from the beginning? What happens when they have to face up to the issue?

Another kind of support which the institutions have to give for the future, in some instances, is technical planning for future satellite configurations. How far are the lessons and possibilities found in the RSP taken into account in national and international planning for future satellite development?

Institutional support of the RSP will not come out of sheer altruism. There will always be some institutional need that generates whatever support is given. We shall attempt to ascertain what institutional needs led to support.

Just as we noted above that negative consequences of the RSP had to be taken into account in parallel to the positive ones, so here too, we emphasize that institutional obstructions to the RSP have to be noted, along with ways in which institutions helped. We will, of course, in each instance seek to identify what units or individuals were obstructive, and, regarding them, answer questions in parallel to those above about support. Obstruction, of course, can come from persons and

units engaged in the satellite project in-country, or ones engaged in similar activities and resentful at not being included in the project activities, or ones not engaged in the project and seeing it as threatening to their related activity. Opposition can also come from those included in the experiment but in a lesser role than in the previous mode of organization. In each case where we are observing opposition or obstruction, we will wish to know how individuals were obstructive, what negative attitudes were expressed, whether there was factionalism or failure to perform, and what institutional needs led to obstruction.

5.5.2 Data Requirements and Data Collection Mechanisms

Data on institutions are more complex and less systematic than data on individuals. It is not irrelevant that the most historical and least formal kind of economics is called "institutional economics." A survey of individuals can proceed on the assumption that each individual counts as one, and so each is asked the same questions, and the answers are then tabulated. In a study of institutions, there is no such uniform unit, as organizations are very different from one another. Thus, fewer institutional data are collected by routine repetitive observations, and much more depends on sensitive observation by a person who understands what is going on. It is in that sense more anthropological or historical than most of the other data required in this evaluation.

Since the questions to be asked differ with the content of each project, so do the data requirements. However, following the same procedure as above, we list the full range of data requirements, some of which would apply to virtually every case, but some of which would be relevant only in some instances.

Time Series Logs

There are two types of regularly logged data which will be of considerable value to the institutional analysis, financial books and records of use of the system.

Financial books. We assume that it will not be possible to obtain access to the regular books of the agencies involved in the experiment. For one thing, in rural developing areas it is unlikely that usable books will be kept. Many activities will be conducted on unrelated accounts. Thus, if the local village chief, nurse, or school

teacher does something for the experiment, there is likely to be no regular accounting of segments of his or her salary. Furthermore, many of the books will be kept in the district headquarters and will aggregate many activities with those of the project. Therefore, it will be necessary to keep a simulated set of books in which records are kept of time put in and equipment used, and then estimates made of the likely cost of these.

To do that across the board would be far beyond the possible scope of this project. However, where it becomes relevant to our needs to estimate the costs being incurred, we can do so by calculating the cost of equipment and estimating the labor used in sampling periods (multiplying that by the average payment received by persons of the different skills.)

Activity logs. Records will be kept of activities in sample periods. These will include the number and characteristics of the persons involved and also what they do and how it is carried out. The specific content of the logs has to be specified in connection with the particular activities in any given project, but the following are some of the kinds of data that may be collected. (For this illustration we use the word "session" to describe an event in which a number of persons are telecommunicating; the word necessarily suggests only one of the kinds of activities that may take place.)

- Attendance at each session,
- Social composition of the attendees, by age, sex, social status, location of origin, etc.,
- Identity of the persons conducting the session,
- Duration of the session,
- Deviations of the session from the work plan,
- Technical difficulties encountered, and
- Attention by the participants.

Maximum use should be made of administrative records that are kept in the normal course of things, e.g., clinic treatment records or class attendance records. This would be both less obtrusive and less costly than special data collection efforts instigated by the RSP itself.

Organization Charts

To track the changes that take place in the structure under the impact of the RSP, organization charts should be prepared at times that there is a major change, as well as at the beginning and end of each project. Numbers of personnel at different boxes on the organization chart will need to be recorded.

Observation and Interviews

The most important institutional data will arise from observations and interviews by observers who are on the spot throughout the period of the project, particularly at the local level. At the local level, this means having persons collecting the data who are close to what is going on in the field. We discuss the problems of their recruitment, selection, and training below. Here we discuss the data they should be collecting.

Periodic interviews with key people and small samples of user populations will provide much useful data. The pacing of interview waves would depend on the pacing of the project itself. A typical pattern might be to have interviews at the beginning, at periods of about every six months, and at the end. In an educational experiment, for example, the primary user groups would be students and faculty. In an agricultural experiment, the primary user groups would be farmers.

In the best of all possible worlds, there would be an observer present all the time at each location where there is a satellite project. That is obviously impossible given the nature of the program and budgetary constraints on this contract. For example, some projects may take place in many scattered locations. Others may involve use of the telephone at random times as the user desires. What is possible is to arrange for part time observation in a sample of locations. Some of the project observers will be "stringers" on a continuing arrangement with the project. Some will be project participants who will collect data as part of their normal duties. Some may travel into particular locations on a few

occasions, but that is expensive and cannot be done often. The exact pattern will depend on the specific project, its location, and the nature of the available on-site observers. The observer's role will be to keep his eyes open at all times and, as occasion offers, talk to persons involved in the RSP. Systematic records will be kept of these occasional conversations and observations as well.

At a field site, a local person (or if the experiment involves quite distinct activities--such as agriculture and health--more than one) will be hired as a part time interviewer/observer. Such a person should have more than average education and may be a school teacher, a social worker, or an extension agent. Literacy is essential, as is integrity. Local observers will be selected cooperatively by both EMC representatives and a host country supervisor, such as a senior social researcher from the project country. For the sake of local level cooperation, local leaders will also be asked for advice on the selection of on-site observers. This is necessary to assure that the observer has both the necessary reportorial skills and acceptability in his community. Given language and cultural sensitivity problems, choice of local observers by both EMC and in-country social researchers will go a long way to assuring that data collection is carried out wisely and well.

On site, the interviewer/observer may hire additional observers to collect routine observational data. These persons may collect data as an adjunct to their normal job. For example, an admitting nurse may, for a small fee, keep a running tabulation of the number of patients who come in with a certain type of problem.

The training of observers is critical and will be done at the time that Abt Associates representatives are in country. Given language and cultural problems, the actual training will be done by bilingual (where required) personnel, either a senior in-country researcher or a U.S.-based expert on the country and its language and culture.

Manual for Interviewer/Observers

An extremely simple manual will be prepared explaining to the interviewer/observers the nature of the study, the importance of honesty and accuracy in reporting, lack of any judgment as to what is a right answer, the techniques of non-directive interviewing and observation, and the details of each instrument they are to fill out. The manual will be translated into the working language. A skeletal manual will be developed in English early in the course of the EMC which will then be amenable to amplification rapidly when specific projects and project countries are decided on.

Use of the Satellite System for Monitoring Observers

Even with the best possible recruitment and training, there will be a difficult problem keeping isolated on-site observers motivated and informed about what is expected of them. Also, there is the problem of obtaining timely, reliable reporting. These problems can be vastly ameliorated by the very nature of the program being evaluated. The satellite communication system can be used for teleconferencing among the interviewer/observers. Obviously the teleconferences cannot be used for eliciting sensitive information, since the communications will be overhearable. However, simple factual reporting can be obtained by interviewing the interviewers over the satellite, and those who have failed to report on time can be put under some pressure by querying in the teleconference.

Debriefing of Observers

Some kinds of information will be too subtle to be effectively reported by interviewer/observers. Their writing skills may also be inadequate for these purposes. However, they will frequently know the answers. Consequently, these observers will be carefully and periodically debriefed in order to obtain the full benefit of their on-site experience.

Unobtrusive Observation

Fairly standard off-the-shelf hardware, like the equipment used in corporations to keep track of phone traffic and billings, is readily available and will provide a wealth of easily collectible information about system utilization, such as what locations called other locations, how often, and for how long. Without intruding in any way into the privacy of communications, a great deal can be learned about institutional change by looking at the patterns of flows from these unobtrusively obtained data.

5.5.3 Analyses and Outputs

The purpose of the institutional analysis is threefold: 1) to provide periodic feedback of RSP performance and acceptance to AID, the AMC, and the user institutions; 2) to support explanations for the relative successes and failures of the RSP; and 3) to suggest ways in which future RSP's might be implemented more smoothly. Essentially this task is performed by drawing unbiased conclusions from the available data pertaining to the institutional process, applied to each user institution. Most likely, the AMC would perform some ongoing process analysis of the RSP as well, but only by combining the efforts of both contractors in a cooperative arrangement which maximizes in-country presence can a useful process analysis be conducted. The success of the institutional process analysis also hinges on the quantity and quality of information provided by the in-country observers and host country counterparts.

The analyes will be geared to answer the questions raised in Section 5.5.1 above, and, therefore, they need not be discussed in great detail here. In brief, the analyses can be summarized as taking two predominant approaches, qualitative and quantitative. While the methodology associated with the institutional process analysis will be be largely exploratory, it need not be strictly qualitative. Careful network analyses, and tracking of resource and information flows, for example, are analytical activities that can be carried out.

The task of drawing overall conclusions regarding the impacts of the RSP on the user institutions and vice versa will involve quantitative analyses of data pertaining to the institutional impact questions discussed above, as applied to each user institution. Perhaps the most difficult impact questions to answer will deal with identifying RSP impacts among institutions as opposed to within each institution. In many developing countries, there is a considerable amount of communication and cooperation among agencies dealing with health, educational, or agricultural programs. While impacts among direct user institutions should be discernable from the data, indirect impacts of the RSP on institutions only remotely connected with it will be more difficult to discern (as will identification of the institutions themselves) and will have to rely heavily on qualitative observer-supplied information.

The two basic analytical methods to be employed in the institutional impact analysis are a time series analysis of monthly administrative and service penetration data and a nonrandomized control group comparison between changes in service delivery levels in RSP units and non-RSP units.

6.0 TWO HYPOTHETICAL PROJECT EVALUATIONS

The purpose of this chapter is to provide illustrations of how the evaluation plans discussed in Chapter 5 will be applied. The illustrations are based upon hypothetical rural satellite communications projects in two developing countries, Indonesia and the Philippines. The hypothetical applications are not entirely fictitious: at one time or another AID and the AMC have discussed the possibility of implementing RSP pilot projects in each country, and the descriptions below are based as much as possible on those discussions. At the same time, we have added considerable detail, drawn mostly from descriptions of actual, similar projects conducted elsewhere. The hypothetical applications, therefore, are realistic enough to serve as a basis for illustrating how our evaluation plan in each of the five areas of concern -- technological, financial, economic, social, and institutional -- might be played out if they were put into operation. The background descriptions of the countries and their communications systems are accurate.

6.1 Indonesia: A Hypothetical Project Evaluation

The Indonesian archipelago extends across across the equator for a distance of 3,200 miles, or one eighth of the earth's circumference, from a point just north of Australia on the east to its western extremity, west of southern Thailand. The country is composed of 13,677 islands, of which over 7,600 are unnamed, and of which only about 1,000 are inhabited. The largest islands are Kalimantan, Sumatra, Irian Jaya, Sulawesi, and Java. Indonesia's population in 1980 was about 150,000,000 people, making it the fifth most populous nation in the world and the most populous nation in Southeast Asia. Most of this population is concentrated in Java, the fifth largest island (about 85 million population) and Sumatra (about 23.5 million population). Indonesia is an important member of OPEC, with a total crude production of 1.5 million barrels/day of which about 1.0 million barrels/day are exported. Indonesia's recent rapid economic growth is based primarily on the export of raw materials, mostly oil and timber. Problems persist in the distribution of this economic growth.

Indonesian Telecommunications

The national telephone system is operated by Perusahaan Umum Telekomunikasi (PERUMTEL), a government agency. Indonesia was an early member of the INTELSAT organization. In September, 1969 its international earth station in Jatiluhur was put into operation with the Indian Ocean Region INTELSAT III. The Indonesian domestic satellite system -- PALAPA -- was put into operation in August, 1976, shortly after the successful launch of the first PALAPA spacecraft in July 1976. A second spacecraft was launched to provide backup and additional capacity in 1977. Two new and improved PALAPA satellites are now being built by Hughes Aircraft for launch in 1983 and 1984. The initial set of 40 earth stations for use with PALAPA went into operation in August 1976 -- a master control station at Cibinong, near Jakarta; 18 main traffic stations; and 21 light traffic stations, distributed throughout the country. Shortly after the system began operating, ten small user-located earth stations were added to the system, and additional 5 meter diameter stations have been added to the system so that the total number of earth stations operating with PALAPA in Indonesia had reached about 200 by the middle of 1981. Seventy-five of these stations were manufactured for the Indonesian military by three separate Indonesian telecommunications companies. Additional small earth stations are used by Indonesian's neighbors for domestic communications by means of leased PALAPA transponders.

The INTELSAT organization has approved the use of the next generation of PALAPA spacecraft for international regional communications under certain conditions.

The PERUMTEL telephone network is undergoing a period of rapid expansion due to the stimulus of PALAPA. As of January 1979, the number of telephones in Indonesia is reported as 392,563; and of these, 129,174, or 33%, were in Jakarta. The total investment in ground distribution facilities in recent years dwarfs the investment in PALAPA and its earth stations. Nevertheless, the availability and quality of voice communications outside of Jakarta (and sometimes in Jakarta also) is limited. This problem, common to all developing countries, has encouraged the addition of small user located earth stations to the system.

In 1980, PERUMTEL, in cooperation with the UNDP and ITU, began an experimental satellite data network project to provide public data services to the business and government sectors of the economy. The system now being implemented involves large numbers of small user located earth stations and an electronic mail message service.

Indonesian RSP Project[1]

The planned Indonesia Rural Satellite Project will take place within the framework of two sets of institutions of higher education: The Indonesian teacher training colleges, IKIPs (especially the two at Ujang Pandang and Manado) and the eight member campuses of the Indonesian Eastern Islands University Association (EIUA) in Ujang Pandang, Manado, Banjarmasin, Sarinda, Jayapura, Ambon, and Manokwari. The Association was created in 1976 to foster cooperation among the institutions and generally to improve postsecondary education in the region.

The member campuses are of very different size (ranging from 10,000 students at Ujang Pandang's Hasanuddin University to less than 2,000 at some of the remote campuses) and have different specialties and strengths. In addition to its educational mandate, the college system has a major role to fulfill as a resource center for the region's other development programs, especially those pertaining to agriculture. Because of the scattered campuses, the lack of other communications infrastructure among the islands, and the presence of the Indonesia-owned PALAPA satellite, a satellite-based system is seen as offering major benefits to the higher education system for the Eastern Islands.

The concept for using the satellite system involves four spheres of activity: (1) the external classroom, which includes both courses conducted for credit and tutorial assistance; (2) curriculum development; (3) continuing education; and (4) administrative/information exchange. In the external classroom, students at all campuses will take credit

[1]This case description is a hypothetical composite project formed from information obtained from AED on the actual Indonesia project as it is now evolving, plus descriptions of other ongoing, university-based satellite communications projects.

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courses by satellite, registering with the center for courses such as land tenure, sociology, agronomy, etc., and meeting via satellite with the course lecturer and other students at scheduled times. Special individual tutorial sessions with the instructor may be scheduled through the regional center. The continuing education experiment will focus on teacher training but will also include community course offerings in contemporary problems, nutrition, and home economics. The administrative/information exchange experiment will include regional administrative meetings, staff meetings, and administration of finances, and will expedite requests for information on course enrollment, equipment availability textbook ordering, and the like.

The capabilities of the system will include two-way voice transmission between terminals located at the various campuses; teleconferencing among groups of terminals; a rudimentary message system with two terminals (one for backup) at each earth station using an experimental PERUMTEL electronic mail system; and a radio transmitter linked to each ground station to allow broadcasting of lectures to conventinal VHF receivers.

6.1.1 Technological Analysis

The technology evaluation portion of this project does not differ substantially from the evaluation guidelines provided in Secion 5.1 above. An interesting feature of the Indonesian situation, however, is the presence of firms capable of manufacturing ground station hardware. This capability may substantially reduce the project's dependence on imported equipment and may also imply the existence of a pool of trained (or trainable) operating and maintenance personnel. Special emphasis, therefore, can be given to those parts of the evaluation (especially Questions A7, B4, and C5) which deal with the interaction between the project and the national infrastructure.

The use of satellites in the RSP projects, in Indonesia and elsewhere, makes possible a powerful data gathering tool not ordinarily available to a project evaluation. Satellite communications by its very nature provides a broadcast capability not present in conventional communication systems. That is, since a satellite transponder will broadcast down any signal transmitted to it in its active frequency band, that signal may be received by any earth station(s) to which the signal is sent. Thus, a major portion of this evaluation program will be planned around a central monitoring satellite earth station which will listen to all transmissions in the band assigned to the RSP project and which will record and analyze these transmissions. In the case of the Indonesian project, it is likely that the monitoring station can be the existing PALAPA master control station at Cibinong. But one immediate activity of the evaluation project should be to determine the availability and suitability of the Cibinong station for this activity.

Such a monitoring activity inevitably brings up the question of privacy and information security. We note here that this concern is a factor of much less importance in the Indonesian culture (in terms of electronic communication) than it is in our own; it is not felt that the privacy issue will be a major problem in the implementation of a project monitoring earth station for educational purposes in Indonesia. In addition, the use of fairly simple and secure crypotographic techniques could be employed by users with special or sensitive data. We do not expect that such users will be part of this project.

The only aspect of the data analysis for the Indonesia project not dealt with in section 5.1.3 above is the efficient processing of the data recorded by the earth station monitor. Since we expect a large amount of such data, it is important that an efficient data reduction procedure be employed as soon in the analysis sequence as possible. To this end, we plan to investigate whether the information can be reduced at the Cibinong station or whether it will be necessary to transport the tapes to another

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center and process them there. The extent of data reduction will also be investigated early in the evaluation planning process. It will be fairly simple to use a digital system to keep track of transmission times and information types (voice or digital). More sophisticated processing with today's general purpose small computers may also be feasible. Among the possibilities to be investigated are automatic transmitter identification automatic speaker identification, and perhaps even some rudimentary content analysis. This latter option will depend upon the resources which can sensibly be devoted to this aspect of the evaluation.

6.1.2 Financial Analysis

The financial analysis of satellite use by the Eastern Islands University Association will seek to determine whether the application of satellite communications to a university's needs is financially viable from the standpoint of the telecommunications authority. The Eastern Islands University Association plans to use the satellite for external classrooms, curriculum development, continuing education, and administrative and information exchange. The financial appraisal will determine whether the revenues obtained from the University for these uses are sufficient to cover the costs of the telecommunications facilities and to provide a reasonable return on investment.

Quarterly data on three types of costs will be collected during the period of project evaluation. We label these direct costs, shared costs, and hidden costs:

- Direct costs will include the initial and maintenance costs of equipment and facilities on each island, the salaries of all personnel who are hired explicitly for the purpose of working with the system, and any other expenditures that are necessary only for satellite use.

- Shared costs will include the salaries of employees who devote part of their time to the satellite project, or rent for the buildings that house the satellite system equipment.

- Hidden costs are expenses which would ordinarily be charged to the project but in the case of this particular application, are borne or subsidized by the government or other parties.

The relevant measure of revenue for the financial appraisal is the total of all tariffs collected by the telecommunications authority which are attributable to use of the satellite system. In many cases, this revenue will be collected separately from any other telecommunications network. Sometimes, however, only a part of a revenue stream will be attributable to the satellite segment. These data will also be collected quarterly during the period of project evaluation.

In addition, annual forecasts of all costs and revenues will be required from the end of the evaluation period to ten years from the starting date of the project. The evaluation team will make extrapolations from previously collected cost data and adjust for changing costs of ground equipment and satellite circuits, and changing overhead and administrative costs that result from changes in general economic conditions. Similar extrapolations will be required of all revenues. In this case, account will have to be taken of changing levels of usage due to different potential applications within the university system, and changes in the size or composition of the university system.

Data collection methods will range from direct examination of business records to interviews with users and managers involved in the application. The accounts of the Applications Management team and the telecommunications authorities will be inspected to determine, when possible, direct and shared costs and revenues. Interviews with the applications management team and telecommunications authorities are expected to help determine the appropriate proportions in the case of shared costs, and to determine direct costs and revenues that are not easily ascertained from the accounts. General economic data on national income, investment levels, and financial conditions will be examined both to assist in the forecasting of changes in economic conditions over the ten-year appraisal period and to determine the appropriate discount rate for the discounted cash flow analysis. Discussions will be held with university administration and project management to help establish likely configurations of the system for the period following completion of the applications management contract. These data will be analyzed as described in Section 5.2 to yield:

(1) Discounted Cash Flow (DCF) chart,
(2) Net Present Value (NPV),
(3) Internal Rate of Return (IRR), and
(4) Payback Period

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6.1.3 Economic Analysis

The analysis of the economic impacts of the proposed satellite project in Indonesia will be divided, following the principles explained in Section 5.3, into two parts. The first will examine the effect of the satellite system on the efficiency with which the university system fulfills its educational, research, and administrative functions (the direct impact). The second will examine the influences of the project on the remainder of the local and national economy.

The most important application of the satellite within the university system is likely to be in the delivery of simultaneous lectures to several campuses. The evaluation team will therefore seek to measure the change in the total resource cost (of personnel, materials, and capital funds) of delivering one hour of effective lecture time with and without the satellite facility. The term "effective" is used to emphasize the need to account for any differences in the quality (as well as the cost) of conducting classes in the two alternative ways. A more extensive discussion of the methods of collecting and processing data for such a cost/benefit analysis is given in Section 5.3. Similar measurements of impact and effective output will be applied, where possible, to the research and administrative functions of the university system.

The indirect effects of the university application, such as the economy-wide impacts of improved continuing education, are far more difficult to measure. The extent to which courses in areas such as nutrition and home economics contribute to higher productivity or to a higher quality of life or health is not well established and cannot be measured in a straightforward fashion. Similarly, the effect of agricultural education on the level of agricultural output in the region is difficult to estimate. Case study interviews with university and community persons may help uncover some of the more significant, and perhaps quantifiable, results. Surveys may allow us to determine which of the persons taking part in the continuing education program would not have

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had access to such courses without the satellite system. The characteristics of such persons can be mapped against the types of media used so as to assess which type of media application is likely to target certain segments of the population or canvass the largest number of persons in a given area. For example, it may be found that certain persons are far more receptive to teleconferencing in small groups than to two-way voice transmission.

In the long run, it is possible that observable macroeconomic effects might result from a university based program. In the time period encompassed by this project, however, there is little chance that any measurable changes could be attributed to the project. The economic evaluation, therefore, will not deal with the project's effect on Indonesian economic sectors.

6.1.4 Social Analysis

The social analysis will follow the broad outines delineated in Section 5.4 above. We shall collect information on users, on the implementation of the program, on the effects of the RSP on the target groups, and on the impacts of the RSP, i.e., the effects on the larger social systems such as the local campus, the university system, or perhaps the entire province.

We shall begin by ascertaining which undergraduate students are participating in the program, i.e., which students are taking courses via satellite. We shall then define the comparison group, namely other students who are taking the same course or a similar course but are doing so face-to-face rather than by satellite. Since the universities will have records on each student, we shall be able to define a comparison group that is very similar to the group receiving the "treatment," in terms of size, age, prior schooling, and socio-economic background. Since the universe of undergraduate students tends to be fairly uniform and large, it is likely that two similar groups can readily be found.

It will be slightly more difficult to identify users and a comparison group of non-users for the continuing education program. Again, the university will have records on who has signed up for the course, thereby identifying potential users. However, not everyone who has signed up for a course will in fact either take it or follow through to completion. This is in the nature of continuing education. Many of those who desire to take a course encounter conflicts arising from their job or other responsibilities so that they either cannot take the course at all or are forced to drop out. The comparison group of non-users will have to be similar in the sense that they have signed up for the same course or a similar course as the users, but they expect to receive instruction not via satellite but directly from an instructor.[1]

For the administrative or information exchange use of the program, the users will be readily identifiable, as will non-users that can constitute a comparison group. Both groups are likely to be small.

Among the data to be collected will be the number of students who take satellite-supported courses (both undergraduate and continuing education courses). If there is a significant increase or decrease in the enrollment compared with previous offerings of the course, this will indicate whether or not the target groups are being reached. One will look particularly for increases in enrollment, as well as changes in the drop-out rate, compared with times when the course was offered in a non-satellite mode. One will also examine these enrollment trends over time, expecting to see greater effects of satellite courses as they are

[1]We shall decide, on the basis of locally available information, whether the comparison groups ought to be students who take the same course as that offered via satellite or a different, though similar, course. First, it may not be the case that the same course is offered in both the satellite-supported and the direct mode. Second, even if a course is offered in both modes, the differences between instructors may be so great that these differences may override any discernible differences arising from the mode of instruction. In this case, students taking a different course will have to constitute the comparison group.

presented more often. Another effect that will be examined is whether the satellite-supported course appears to draw students from other courses (as reflected in declining enrollments). This would certainly be interesting, although the interpretation of the phenomenon may be difficult. It may be considered a desirable effect, in that additional students are attracted to the course (perhaps because the instructor chosen to give the "satellite" course will be a well known and excellent instructor). However, an unintended side-effect would be the decrease in enrollment in other courses. This of course could be due simply to the Hawthorne effect of the novel way in which the course is being taught, and so data collection must continue long enough for any such effect to wear off, for sensible inferences to be made.

We will also collect data on the effectiveness of the course. This will be done by comparing test scores of students on the final examination in the treatment and the comparison groups, perhaps aggregating over time so as to achieve better measurement stability.

Data will also be collected on how many courses are taught via satellite and whether any courses originally taught by satellite were dropped because someone -- the instructor, the students, or the administration -- found the satellite mode inappropriate to the course.

The data elements on student users and on implementation in course presentation can be summarized as follows:

- number of students in "RSP" course;
- number of students in "comparison" course;
- demographic and socio-economic characterstics of both groups;
- change in test scores before and after taking course (may not be available); and
- change in course enrollments (longitudinal data needed)

These are quantifiable data and will be obtained three times: before the program becomes operative (obviously only some data -- data on all students who subsequently take the RSP course cannot be obtained); several times after the program becomes operative[1], and once after the program has ended.

In addition to these data, some subjective data must also be obtained, particularly as regards social effects and impacts of the program. Although some effects can be captured through test scores, others will be obtained through interviews with a sample of students. We would attempt to obtain information on changes relating to:

- motivation of the students;
- sense of accomplishment;
- self-image relative to ability to compete outside of the university;
- ease of learning:
- quantity of learning;
- ability to understand the teacher; and
- ability to have special problems dealt with.

In addition, the interview will seek information on students' perceptions of how they operate in the larger society (i.e., possible impacts of the RSP), such as changes in:

- perceived role of student in his/her family;
- perceived role in his/her town/village/community;
- perceived role on campus and/or university; and
- behavior of others toward self.

Furthermore, data must be obtained on the "administrative" use of the RSP, i.e., on the extent to which the system is used in order to exchange data between campuses about such things as enrollements, payments received, payrolls, accounts payable, utility costs, and the like. This can be done by asking administrative personnel, particularly those that deal with financial matters, to keep logs for a stated period of time indicating their use of the RSP for these purposes. Again, logs

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[1]The advantage of obtaining data shortly after the program begins is that some effects will be most apparent then. Even though some effects may be due to Hawthorne effect and should be discounted, this can readily be done by means of the later data collection. The early data collection avoids missing effects that soon become routine, such as changes in course enrollment.

should be kept at sampling periods before the implementation of the system, through initiation of the system, and to the end of the project. In order to make the logs useful in the "before" period, a determination of likely uses of the RSP for administrative purposes must be made before the system is installed. Otherwise, the administrators will not know what to enter on their logs. This is somewhat undesirable in that it cues the administrators to possible future uses and applications and therefore may bias the response. A possible alternative would be to forego the log-keeping in the "before" period and simply note the use of the RSP for administrative information exchange purposes in the "during" period. Since we are basically interested in use and not in other derived effects, data on use may suffice. Through interviews with a few administrators, it may be possible to obtain anecdotal data indicating whether or not the RSP has promoted efficiency, cost-effectiveness, or other desirable effects.

6.1.5 Institutional Analysis

Many different kinds of institutions and agencies are to be involved in the Indonesian Rural Satellite Project besides the nine campuses of the Association of Universities of East Indonesia. The project will also involve organs of the national government, from PERUMTEL to the Ministry of Education, local development agencies (and other ministries involved in development), and the U.S. Agency for International Development, its contractors, and subcontractors.

Indeed, the first step in the evaluation will be to enumerate all of the organizations with significant involvement in the project and to determine what their role and status in the endeavor will be. Key organizational questions are: What are the agencies playing a role in the Indonesian project? Who are the decision makers and how are the decisions reached in their agencies? What is the history behind the formation of the Association? What are the Association's main objectives? How successful has it been to date? What are the strategic missions of each of the campuses in terms of overall higher education programs in Indonesia?

Once we understand who the players are, we will need to examine the relationshps among them. In particular, we will want to examine influence structures, flows of information, flows of money, and flows of other material and human resources. The objective of this analysis is to be able to specify the initial state of a dynamic institutional system, comprising a "snapshot" which can serve as a benchmark for reference and comparison.

An early item on the evaluation agenda will be to ascertain what participating agencies hope for and expect from the RSP. These goals and objectives cannot be understood as given or self evident; indeed, it is reasonable to expect that different organizations -- even different individuals or units within the same organization -- will hold differing views on what is reasonable and appropriate to want (or to expect) from an interactive telecommunications system. We can identify two important classes of organizations, the goals of both of which should be ascertained. First are the organizations and individuals who will actually use the system, including the Universities and IKIPs themselves and their students (departments, research centers, etc.); the Association; the university students and their organizations; the faculties of the various campuses; development agencies (both local and national, along with local development cadres); and the Ministry of Education. The second class of organization that will have goals and objectives for the project includes PERUMTEL, other interested ministries (e.g., agriculture, health), USAID, and other organs of national and local government which are tangentially involved in the project.

This first part of our institutional analysis will require very little in-country data collection. Library research on Indonesia as well as consultation with area specialists should provide necessary background information on the RSP in the Indonesian context. The outputs from this first step in the institutional evaluation will be:

- A descriptive, historical sketch of the background to the RSP project in terms of Indonesia's satellite involvement and its institutional arrangements;

- A list of institutions describing the roles, responsibilities, and goals of the various institutions in the project; and

- An initial model of information and resource flows and structures of authority, reporting, and tasks.

This initial state "snapshot" will help us to model the dynamics of institutional change either occasioned by, or parallel with, the implementation of the Rural Satellite Project.

The next part of the institutional evaluation will identify the agency activities most likely to be affected by the satellite system and postulate the types of impacts to be anticipated. This can best be approached through the examination of specific events and activities. Therefore, before asking what impact the satellite had on the institutions involved in the Indonesian RSP, we want to consider just what these organizations did with the capability provided by the satellite. The set of activities below is not intended to be either exhaustive or final; rather, it suggests the kinds of use that may take place and the kinds of questions that might shed some light on those uses.

Teaching

We include here all uses of the satellite for the direct instruction of learners, in the classroom or through distance learning in the villages. In this regard, past research has shown effective distance teaching requires very important institutional changes, even more perhaps than changes in communications technology. Is the RSP used to teach courses from one campus to another? Which campuses are the senders and which the receivers? Does the flow tend to be one way or do the campuses reciprocate? Are certain disciplines or departments particularly eager to hold or receive "telecourses"? To what extent are the instructors and students satisfied (or dissatisfied) with the telecourses? Do the

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institutions provide adequate support systems for the off-site (i.e., on another campus) learner? What can we learn from the social analysis component of the evaluation that will help us to understand the institutional uses of the satellite system for instruction? What changes in attitudes and perceptions are there as the project progresses? To what can we attribute these changes?

Institutional Support

In addition to direct teaching, the satellite system can be of great value in support of instruction as, for example, in the rapid distribution of text or audio-visual materials from one campus to another. Do the campuses employ the satellite system to support institutional activities through the sharing of instructional materials, guest lectures, data processing resources, etc.? What mechanisms are established to facilitate this kind of resource sharing and what institutional arrangements tend to impede it? (For example, do the librarians hold electronic meetings via the satellite to discuss and coordinate resource sharing?).

Faculty Development

In isolated campuses cut off from colleagues and perhaps from the metropolitan mainstream of research and scholarship, faculty members, especially those in the smaller, more rural, campuses, may welcome the opportunity to interact with experts in their fields of endeavor. Do faculty members use the system in this way? Do some see it as an unwanted intrusion, and how do they deal with it? Are there demographic or other factors which can account for the various responses of individual faculty members or are these responses campus-specific? What kinds of uses of the satellite system do the faculty members find most (or least) beneficial? To what extent is the system (both the technical system and the administrative structures) able to handle the traffic generated by faculty demand?

Administrative

The RSP system will be able to handle large volumes of routine administrative traffic between the campuses. Until the fairly recent advent of the Association, the campuses (except for the one or two "branch" campuses of larger institutions) had very little opportunity for administrative communication since each was an autonomous entity. What levels of administrative communications are necessary to support the goals and activities of the Association? To what extent does the provision of a satellite channel stimulate the flow of administrative communications? How much of this traffic can be seen as "productive" and how much is unproductive housekeeping "overhead"? Is the communication system perceived as a boon to greater cooperation and coordination among the campuses or as a tool for greater centralized control?

Development Support

One potentially valuable application of the telecommunications system will be to help bring to bear the resources of the various university campuses in support of rural development efforts. To what extent are the campuses already involved in rural development projects? Do local development agencies avail themselves of the new communications capacities of the campuses to further their own efforts? Does the system enhance or retard cooperative efforts in development? Do the faculty use the system for "teleconsultation" to reach out to distant projects either in lieu of travel or to enhance the impact of periodic trips?

Feedback and Evaluation

One particularly propitious use of the satellite system will be in support of the RSP and its evaluation. Do project staff and consultants avail themselves of the satellite system? Do other government agencies use the system to monitor field workers and to collect feedback and evaluation at a distance? To what extent are these uses seen as welcome help, or on the other hand, unnecessary intrusions? Is there a systematically different view of this issue in the capitol and in the hinterland?

We expect to employ a number of tools and methods to help answer questions of the kind posed above. First, the technical capacity of modern computerized switching equipment to maintain records of the destination and origin of narrow band traffic will provide inexpensively and unobtrusively collected data. This will let us know what departments (assuming a department telephone rather than phones in each office) on one campus are in touch with which ones on another campus. For teleconferencing or teaching, system activity logs associated with the terminal equipment will provide valuable data on the changing patterns of teleconferencing utilization. Diaries or personal logs are rich sources of information but difficult to maintain and analyze. Nevertheless, they would provide some valuable information, especially if on-site personnel are able to explain how the diaries are to be maintained. Short feedback questionnaires administered and collected by on-site personnel (probably faculty members) will offer insights into user satisfaction. Treating the results of a series of such questionnaires as time series data, we will be able to track changes in user attitudes over time. On-site observation, either by outsiders or by trained local people, will be very useful since people may see things which are not reflected in written questionnaires. Of course, informal interviews with users -- faculty, students, administrators, politicians, development workers, and so on -- will be conducted at all levels. Unfortunately, structured interviews by trained professionals are expensive. Given the difficulty of travel in the Eastern Islands, it may be that telephone interviews or teleconference group sessions will be substituted for personal interviews.

A chronology of events will serve as the skeleton of a narrative project history. The "history" will offer a tool for ongoing formative evaluation and will eventually chart the course followed by the users and other key actors in the Indonesian RSP. Interview and questionnaire data will also be useful in improving the quality of services provided by clarifying precisely what factors led to the acceptance or rejection of the system. Specific analytical techniques, such as network analysis and control-group studies of service delivery levels, have already been discussed in Section 5.5.3 above.

In conjunction with the university goals and activities described above, the institutional analysis will allow us to understand how the articulated goals impinged on the day-to-day project activities and how the activities informed a changing set of goals.

6.2. The Philippines: A Hypothetical Project Evaluation

The Republic of the Philippines consists of an archipelago of some 7,100 islands about 500 miles off the Southeast coast of Asia, near the equator. The islands extend north and south about 1,152 miles, and east and west about 688 miles. The combined surface area of the 7,100 islands which make up the Philippines amounts to 115,831 square miles. The two largest islands, Luzon in the north (40,420 square miles) and Mindanao in the south (36,537 square miles) account for 66.4 percent of its territory. With an estimated population of 48,252,800 at mid-1979, the Philippines had an average density of over 412 per square mile. Despite the existence of about 75 linguistic groups in the Philippines, considerable progress has been made recently in developing Tagalog, the language of central Luzon, as a national language. English is, however, widely used also. Other than the Christian Filipinos, the Muslim Moros comprise the only large indigenous group, inhabiting the southern and southwestern peripheries of the country and forming about 5 percent of the total population.

Apart from its agricultural potential, the country's main natural resources lie in its extensive reserves of timber and a fairly wide range of metallic minerals, including copper, gold, iron, manganese, molybdenum, lead, and silver. Not only is the relatively poor infrastructure of the Philippines a serious constraint to economic and social development, but also it aggravates the uneven distribution of income within the country, particularly between rural and urban areas. Development spending on infrastructure has been subsidized in recent years. Nevertheless, the World Bank estimates that annual public investment in infrastructure would have needed to be increased by about U.S. $1,000 million by 1980 (at 1974 prices).

The Philippines is geographically divided for economic and political purposes into 13 regions, subdivided into 73 provinces, which in turn are subdivided into nearly 1500 municipal districts containing roughly 40,000 barangays (villages or neighborhoods). Each ministry or other national institution is composed of numerous services, divisions and bureaus and typically maintains administrative offices at the national, regional, provincial, and municipal levels. Exhibit 6-1 shows this organization for one Philippines ministry, the Ministry of Social Services and Development. The Ministry of Agriculture is similarly organized into Bureaus of Plant Industry, Animal Industry, Social Industry, Agricultural Economics, and Agricultural Extension. At the Municipal level, the ministries are represented in various forms, such as by Rural Health Units, in the case of the Ministry of Health and agricultural extension offices or university campuses, in the case of the Ministry of Agriculture. At the municipal level (and other levels), each agency performs a variety of service activities; for example, the Rural Health Units provide family planning, nutrition education, and preventive health services in addition to diagnostic health treatment of inpatients and outpatients.

Philippines Telecommunications

Despite the joint efforts of the Philippines Government and several private communications firms, demands for telecommunications in the country are not being fully met. For example, it is estimated that only 32 percent of populated areas are adequately served by telephone, telegraph, and related services. There are 593,127 telephones, representing an average of 1.2 telephones per 100 persons.[1] The service is, however, highly concentrated in urban areas: 93.8 percent of the total telephones are installed in the most important cities of the country, which account only for 19.2 percent of the total population. For example, 70 percent of the total telphones are installed in Manila.

Rural areas are in many cases isolated: two-thirds of the population does not have access to a public telephone. With only 2,463 coin box telephones and no public telephone stations, the service does not reach 23 cities and provincial capitals.

[1] Statistics are as of January 1979, provided by A.T. & T.

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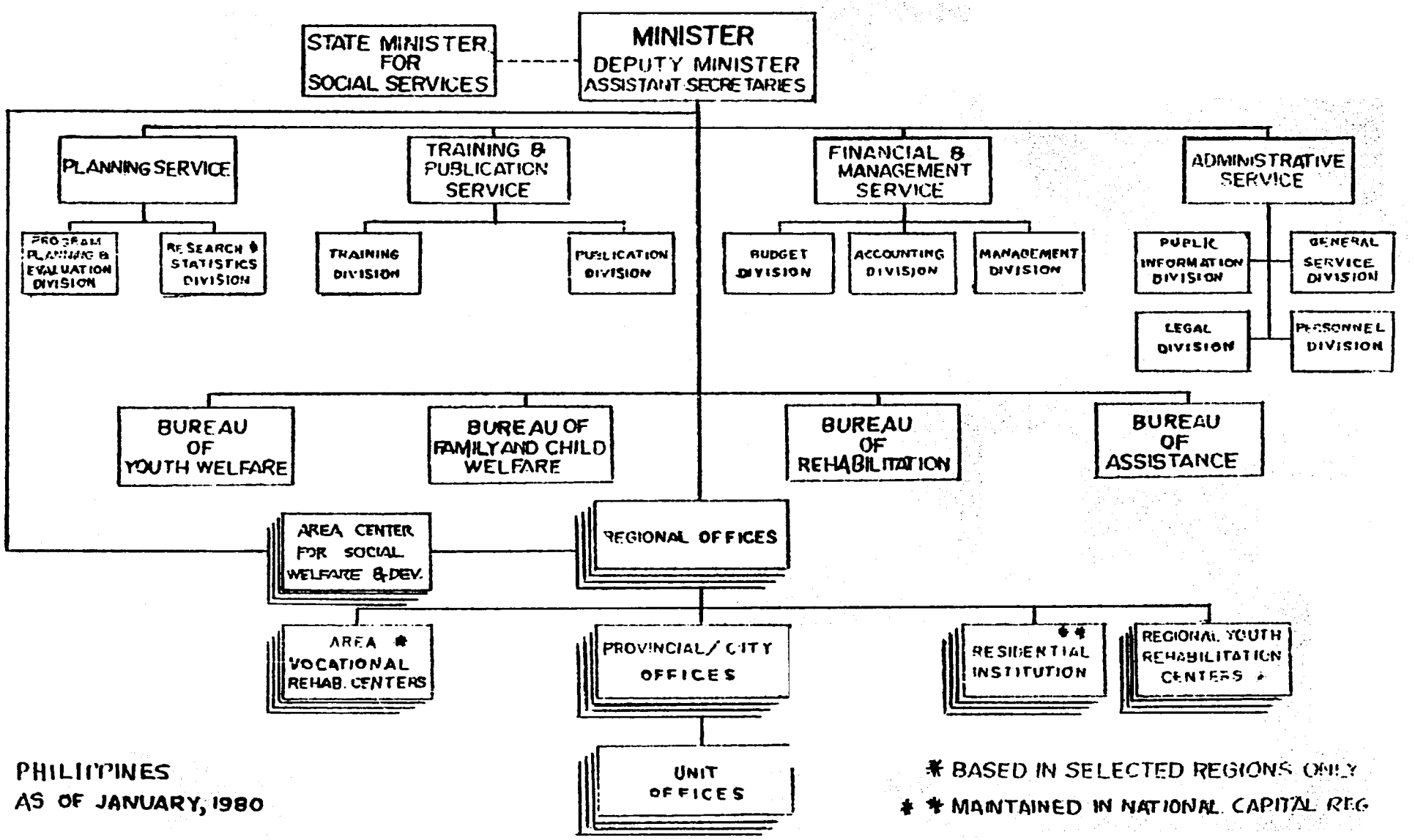
Exhibit 6-1

Organizationl Chart
Ministry of Social Services and Development



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The telecommunications industry is characterized by a number of private and public operators. The privately owned Philippines Long Distance Telephone Company provides telephone services. Radio Communications of the Philippines Inc. provides telegraph services. The Philippines Telegraph and Telephone Corp provides both services, and the government-owned Bureau of Telecommunications (BUTEL) also operates telephone and telegraph services throughout the country. The three private companies operate 95% of the telephone services and maintain some 600 telegraph stations. BUTEL has the most extensive telegraph network with 1,320 offices, most of them in rural areas, but it operates only 4.2 percent of the telephones in the country. There are also state-owned and municipality-owned entities which operate 0.8 percent and 1.0 percent of the Philippines telephones, respectively.

Overseas telecommunications facilities include two standard A earth stations linked to the INTELSAT system: Pinugay 1 linked to the Pacific Region Intelsat satellite and Pinugay 2 linked to the Indian Ocean Region Intelsat III. Both stations are operated by the Philippines Communication Satellite Corporation (PHILCOMSAT).

Three coaxial cables provide connection to the US, Japan, and Hong Kong respectively. All these facilities, earth stations, and cables provide telephone, telegraph, and telex links with the rest of the world. Overseas service from Manila is extremely good: the speed of connection and voice quality of overseas calls are superior to those of intracity calls.

On the basis of an agreement with members of the Association of Southeast Asian Nations, or ASEAN (Malaysia, Philippines, Singapore, and Thailand), the Indonesian government telecommunications agency, PERUMTEL, leases satellite transponder services for domestic use to each member country. The PALAPA Indonesian satellite provides complete coverage of Indonesia as well as the rest of the countries of the ASEAN. Three 36 MHz transponders are available for lease by any country of the ASEAN. Each transponder operating in the FDM/FM mode with a single carrier has a capacity of 840 channels and in the SCPC mode a capacity of 1000 channels.

Philippines RSP Project[1]

The island province of Palawan is located on the western edge of the Philippines, lying between the South China and Sulu Seas. It is long, narrow, mountainous, and poorly developed. With its poor road system, Palawan has virtually no communications system except telegraph. In fact, it was only in 1980 that the Philippines Bureau of Telecommunications began leasing channels on the Indonesian Domestic Satellite for telegraph service. The Bureau of Telecommunications and the Radio Corporation of the Philippine Islands both maintain municipal telegraph offices on Palawan. There are no cable links from Palawan to Manila, however: only DOMSAT and radio links exist at the present time.

The island of Palawan is considered a first priority "in-need" area by the government of the Philippines with regard to its educational development. Education on the island has lagged behind the general advances made in neighboring regions of the country. Likewise, the island is a third priority "in-need" area with regard to health development. In general, the island lacks the needed infrastructure and health personnel to adequately disseminate primary health care information to large segments of its population. These population groups could also benefit from infusions of technology and advances stemming from the "Green Revolution" which has penetrated Asia and much of the Philippines. Isolated by its lack of good communication networks, however, the island suffers from inadequate dissemination of such information to its farmers. The International Rice Research Institute in Los Banos, a key agency for research and dissemination of new rice technologies, has no direct way to facilitate the diffusion of information on the island. Any new agricultural initiatives undertaken on Palawan, such as the development of agricultural support facilities or production entities, would likewise suffer from a lack of adequate networks to relay information to outlying areas and villages.

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[1] As with the Indonesia RSP project description, this description is a hypothetical composite.

In short, the sparse telecommunications network within the Province of Palawan and the limited number of links to other islands limit its potential for growth relative to that of more highly developed telecommunications areas. These limitations thwart attempts to establish outreach programs for the target "in-need" populations in all sectors.

The RSP project in Palawan involves four main areas of activity: 1) administration of development projects, 2) private telecommunications facilities, 3) education, and 4) health. The objectives in each of these areas will be the following: 1) the Palawan Integrated Area Development Project and Ministry of Agriculture will increase effective supervision of development field personnel, facilitate collection of data, and support the training of agriculture extension agents and the dissemination of agricultural information; 2) telephone traffic will be provided to private and commercial entities; 3) the Palawan National Agricultural College will strengthen its teacher training and curriculum enrichment program for remote agricultural high schools as well as develop an effort in non-formal education; and 4) the Ministry of Health will support its public health and nutrition programs.

Given these pilot project goals, the following functions have to be conveyed: educational and training programs, administrative staff meetings, private telephone traffic, and data transmission.

The system will use small-aperture earth stations and high-frequency radio equipment to interconnect "likely" project sites at Puerto Princesa, Abolan, Narra, Quezon, Condawag, Quinlogan, Brookes Point, and Bataraza. Each point will be capable of transmitting two-way voice signals, teleconferencing with a group of terminals, and servicing electronic mail messages. Each point will also provide public telephone service upon demand.

Each site will be able to communicate with the others, as well as with Manila. Puerto Princesa will be specially equipped with radio equipment to be used in broadcasting educational and training programs. Facsimile transmission facilities will also be installed in Puerto Princesa.

6.2.1 Technological Analysis

An alternative to the pilot system will be "desk" designed and cost evaluated. It will include microwave links between the project sites, an earth station at Puerto Princesa that would link Palawan with Manila and a broadcasting station at Puerto Princesa, and receivers in project sites. The alternative system will enable us better to evaluate the pilot system in terms of costs and benefits.

The evaluation guidelines of the Philippines project will closely follow the recommendations provided in Section 5.1 above. There are some aspects of the data requirements and data collection mechanisms which are specific to this project, however. The Philippines pilot project system presents the combination of point-to-point communications with a broadcasting network.

The technology evaluation will be organized in six parts: maintenance, reliability, flexibility, usage, operating personnel, and management features. Each part will include the following points:

- Maintenance:

  -- Downtime history and nature of problem for each system component,
  -- Average time for diagnosis and repair,
  -- Supply of spare parts (delay, cost, etc.),
  -- Cost of labor,
  -- Routine maintenance.

- Reliability:

  -- Reception quality,
  -- Reaction to specific climatic conditions.

- Flexibility:

  -- Capability of the system to allow diverse uses such as education, training, and private and commercial communications.

- Usage:

  -- Traffic statistics collection process will consist of a usage log, containing a descriptive record of each call. The information in each call record will include the city of origin, the city destination, and the duration of the call. Subsequent processing might provide us with evaluation statistics such as total network point-to-point busy hour traffic and circuit utilization. Data will be gathered either in written form by providing every customer with forms, or by a computer control system.

  -- Radio broadcast collection process will consist of a permanent recording unit linked to the sytem by a receive-only earth station.

- Personnel:

  -- Recruitment, training and turnover rates of operators, technicians and engineers.

- Management Features:

  -- Information concerning the way the system is managed.

6.2.2 Financial Analysis

The procedures described in the methodological section on financial analysis (Section 5.2) and in the description of the Indonesian case study (Section 6.2.1), apply to the Philippines case study as well and need not be repeated here. An issue specific to this case illustration, however, is the organization of the Filipino telecommunications system. Unlike most developing countries, which centralize their activities under a ministry or public corporation, the Philippines has largely adopted the U.S. free-enterprise model. Thus, three private telephone companies operate 95% of the telephone services, and the two standard A earth stations linked to INTELSAT are operated by a separate company which fills no other function. The implication of this situation is to place greater importance on positive financial findings since a fragmented private sector is less likely to invest in risky but socially beneficial projects than is a government ministry. This further implies that a major condition for the financial success of the project may be the degree to which commercial enterprises "piggyback" their own communications on top of the development-related traffic. The financial evaluation, therefore, will pay considerable attention to the system's commercial usage.

6.2.3 Economic Analysis

The economic analysis of the Philippines satellite-based telecommunications system will begin with an examination of the direct impacts on the user institutions. In the Philippines case, the user institutions consist initially of the Ministry of Health, the Palawan Integrated Area Development Project (PIADP), and the Ministry of Agriculture, as well as a number of commercial and private users. The first three of these have ongoing social and economic development projects in the area. It is hoped that the establishment of the telecommunications-based system will assist in the promotion and distribution of the agencies' activities and also allow for the creation of new programs. We will therefore begin the analysis with an assessment of the inputs and outputs of the agencies as they are currently pursued in the absence of the satellite. Thus we will establish the number of units of staff, capital, and material that are required for a unit of service output in a given area of Palawan. We can also assess a unit of input that would be needed for a unit of output in areas that are now out of the reach of the servicing agencies. We can then proceed to estimate the efficiency with which these same services are provided with the establishment of the satellite system. We would ask, for example, what are the net monetary effects (in terms of staff time, capital, and equipment used) to field a unit of health services to Puerto Princesa before and after the satellite system is installed. The cost effectiveness measures suggested in the basic model described in Section 5.3 are directly applicable to the direct effects on all three public sector user institutions under consideration in this instance.

More extensive analysis is required to assess the indirect economic impacts. It is essential to develop analytical approaches which will capture the more significant of these indirect user impacts, given their importance in the Philippines case. Survey data, as well as secondary records and on-site observation, will be required in order to trace the effect on the local economy and community of, for example, an increase in the level of health care service.

In the Philippines case, an attempt will be made to apply statistical techniques to analyze, where possible, the major indirect secondary socio-economic effects. Recipient characteristics will be matched against various program offerings, by type of media used, across the three user agencies. For example, it may be found that farmers institute more agricultural changes when the ministry uses interactive communication than when it uses radio broadcasts. The latter may reach more farmers and relay the messages more frequently, but the radio medium may not elicit the desired change in behavior. Issues such as these may be discovered through the use of the case study and analytical approaches we would use.

The proposed satellite applications are likely to impact many important macroeconomic variables in the Philippines. For example, the training component of the program is expected to affect the amount of local skilled labor used on the project; the local market for unskilled labor is also likely to be affected. Furthermore, as the project is developed, over time, several import substitution mechanisms may come into play. For example, commercial use of the system may encourage local production of previously imported goods, or of exportable goods. We will use the technique of shadow pricing to examine the "true" costs of labor and capital in this changing balance of foreign versus local supply of goods and services. We will also use realistic discount rates to reflect the relative scarcity of capital in the region and its potential uses in other sectors of the economy.

Estimates of consumer surplus will be made in the case of commercial uses of the satellite system. Direct and indirect evidence of the value of the telecommunication services to those users will be solicited. Imputations will be made as to the perceived versus real value of the system to the private and commercial sector.

6.2.4 Social Analysis

The evaluation will follow the guidelines presented in Section 5.4 above. Since Palawan is such an isolated province and is at present so poorly provided with telecommunications services, the emphasis in the evaluation will fall on the users and on the implementation of services. That is, the emphasis will be on determining whom the new services were supposed to reach and whether those groups were in fact the ones who used the services. Furthermore, emphasis will be on determining how frequently the service was used, because in this case frequency of use constitutes an excellent indicator of benefits derived from the service.

It will also be important to look at appropriateness of usage in some detail. The reason for this is that the RSP project in Palawan involves so many different kinds of activity, some of which may be more important in the eyes of the project sponsors than others. For example, the service may be used very frequently, but mostly for private use, with use for educational or health-promoting purposes being limited. While the service will still be providing benefits to the private users, these benefits may be considered inappropriate by AID or the host country.

Also of interest will be the determination of the intention of use, which is closely related to the appropriateness of use, as well as to issues of unintended target groups and unintended effects. It may well be that the intended use (according to those who sponsor the service) is for such things as training farmers in better crop management or health care of livestock. If there is a group that was not included in the original target, such as a certain group of merchants, that begins to use the service heavily (to promote and sell their products), this use can be considered unintended. It may not be considered inappropriate, however, since one of the objectives of the RSP program (see Chapter 3) is to facilitate commercial activity.

Finally, the impacts of the service will be looked at. Are there detectable changes in patterns of social behavior which may be due to the increased and improved communication capabilities that the island has? This would be of special interest here, since communication at present is so primitive that the RSP project respresents a large improvement. It may well be that there will be large social impacts -- increased awareness of the outside world, which in turn could lead to political restlessness; changes in family size due to better family planning capabilities, with consequent impacts on family life style; increased literacy with consequent greater expectations from the state; and so forth.

In order to obtain information on these points, data collection will proceed along several lines. Frequency of use data can probably be obtained from records that will be kept at the several earth stations. This will give an indication of how many calls or messages are transmitted in a 24-hour period. Records should be examined for "typical" time periods, i.e., ones that do not have excessive holidays, unusually severe weather, or similar factors that might bias the data. The measurement periods should not follow immediately upon implementation but rather should be scheduled when the use of the RSP links has become more or less "routine".

We are assuming that automatic recording of origin and destination for both incoming and outgoing calls is made for billing purposes. If this cannot be done by automatic means, then the operator at each earth station will be instructed to note these data, and we shall attempt to gain access to these origin/destination records.[1] These records will provide information on <u>users</u> -- who used the service for outgoing calls and who received calls.

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[1] It is assumed that privacy of communications is not an issue here, since the origins and destinations of calls are recorded for billing purposes. It is not likely that there would be any objection to recording sender and receiver for any messages over the RSP system.

Appropriateness of use requires additional data collection, since to a certain extent it is a judgmental matter. While the data collection effort that we have mentioned so far can tell us who sends messages, who receives them, how frequently these messages are sent, and how long they are, the effort cannot tell us the content of the messages.[1] In order to know for what purposes messages were transmitted, we will interview a sample of those persons who sent messages. Both private and institutional users will be interviewed, since it may also turn out that "official" or institutional use is inappropriate. The interviews will probably be able to detect not only inappropriate uses but also possibly suggest unintended uses. For example, as a result of being in touch with Manila, a farmer or group of farmers may decide to keep rice or another crop off the market until prices are more favorable, thereby ultimately enriching them. This usage and its impact may be unintended, although not necessarily inappropriate.

Three of the purposes for which the Philippines RSP is instituted involve governmental institutions: development projects, education services, and health services. We will want to interview the officials at each of the institutions on Palawan who use or have used the RSP. While data on their frequency of use (and the direction of the calls) will already have been collected, we need to determine how useful these officials feel that the system has been, whether they would plan to

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[1] Nor should it. Even granted that privacy of communications is not a large issue, neither AID, the AMC, Abt Associates as the EMC, nor the government of the Philippines, ought to be in the position of listening in to all telecommunication messages transmitted via the RSP.

continue using it without strong pressure from above, and whether they feel that the system benefits the ultimate users, i.e., the residents of Palawan, because their economic, educational, or health status is improved. An instrument will be devised that asks about perceived utility of the information received, about cost-effectiveness, and about the ease with which the farmers, etc. were able to use the information.

Where some of the information reaches the ultimate consumer (the residents) directly, i.e., via radio broadcast from Puerto Princesa, a sample of listeners will also be interviewed. They will be asked directly (again, via an instrument to be designed) questions such as these:

- Did they listen to one of the broadcasts in question?
- Over the last month, how many of these broadcasts did they listen to?
- Did they find the information easy to understand?
- Did they learn something new from the broadcast?
- Did they use the information received:

  -- in their farm practice?
  -- in their health care procedures (either personal or of livestock)?
  -- with their chidren?

- Did they believe that use of the information did in fact benefit them (by increasing their crops, avoiding disease, etc.)?

Since obtaining data by interviews face-to-face is both costly and time-consuming, one way of conducting these interviews might be by use of the RSP itself, assuming that the logistics could be worked out.

6.2.5 Institutional Analysis

The first task in the Philippines institutional evaluation will be to obtain a solid understanding of the organization of each user institution, its mission or goals, its service activities, its principal actors, and the flows of information and resources within and among the institutions. This task will also provide a profile of the initial baseline conditions which exist on Palawan regarding institutional services and administration of the institutions discussed in Section 6.2 above.

Annual institutional reports and planning papers are abundant in the Philippines and these, together with RSP project papers, should be sufficient for preparing profiles of institutional structure, goals, and activities as related to the RSP. Such documents are not sufficient, however, to gain an understanding of initial conditions and the communication flows within and among the user groups, and uses by and impacts or "non-user" institutions. For this, informal interviews and on-site observation (e.g., at a Palawan Rural Health Unit) most likely will be required.

The next step in the analysis is to lay out the research questions pertaining to institutional impacts we seek to address for each user institution, group them by topic (e.g., administrative support functions), and prioritize them according to their importance to the overall evaluation (e.g., high, medium, and low). Exhibit 6-2 lists potential process and impact evaluation questions for institutional analysis as applied to one institution, the Ministry of Health, for the Philippines RSP.

Exhibit 6-2

Institutional Analysis of the Philippines RSP:
Potential Ministry of Health Research Questions

PROCESS QUESTIONS

To what extent are baseline conditions satisfactory or unsatisfactory regarding the [efficiency of/capabilities of] the [administrative support/instruction support/service delivery] functions of the Ministry of Health in the area of [diagnostic health care/health and nutrition education/family planning] on Palawan?

How has the Ministry of Health been affected by the RSP at the National, Regional, Provincial, or Municipal levels in terms of [flows of information/patterns of adoption/centralization or decentralization of authority/total number and mix of staff/dependence on the RSP network/use of alternative communication methods/staff satisfaction with and perceptions of the RSP]?

IMPACT QUESTIONS

To what extent has the RSP increased the [efficiency of/capabilities of] the [administrative support/instructional support/service delivery] functions of the Ministry of Health in the area of [diagnostic health care/health and nutrition education/family planning] on Palawan?

To what extent has the RSP increased the [efficiency of/capabilities of] information flows relating to [administrative support/instruction support/service delivery] between the Ministry of Health and the [Ministry of Agriculture/Ministry of Education and Culture/Rural Development Council/Bureau of Telecommunications]?

With respect to data collection, Exhibit 6-3 summarizes the most likely uses of each type of method and category of personnel for evaluating the impacts of the RSP on the Ministry of Health. Similar approaches would be implemented for other user institutions, and similar (although much less intensive) approaches would be implemented to explore use by unintended institutions. These applications may be reallocated across methods and personnel types depending upon the operational constraints associated with baseline conditions in Palawan. Interviewers and on-site observers will be drawn from qualified consulting firms with whom Abt Associates has worked on earlier AID projects in the Philippines.

The data analysis will be organized according to the institutional process and impact questions shown in Exhibit 6-2 above. The process-related analysis will be largely qualitative, involving an examination of patterns of interaction among institutions and probable causal relationships as revealed in the various project logs. The impact analysis will be predominantly quantitative. The two analysis methods most likely to be employed are a time series analysis of monthly administrative and service penetration data and a nonrandomized control group comparison of changes in service delivery levels, in RSP municipalities on Palawan with non-RSP municipalities on the island.

Exhibit 6-3

Institutional Analysis of the Philippines RSP:
Ministry of Health (MOH) Data Collection Applications

DATA COLLECTION METHODS

- Existing reports and records: Municipal health indicators relating to morbidity, mortality, health and nutrition attitudes/practices, family planning attitudes/practices; Ministry of Health monthly reports relating to administration and program penetration.
- Program activity logs: RSP frequency and duration of usage by function (administrative support, instructional support, service delivery) and activity (diagnostic health care, health and nutrition education, family planning) at all MOH levels.
- Mail questionnaires: Administered to primary health care workers at the Provincial, Municipal, and Barangay levels to measure satisfaction with and perceived advantages and disadvantages of the RSP by MOH function.
- Personal interviews: Administered to MOH administrators and instructors at the National, Regional, and Provincial levels to measure satisfaction with baseline conditions versus RSP conditions in terms of efficiency, reliability, and capabilities.
- Group sessions: Held with Rural Health Unit physicians, nurses, and assistants to discuss progress, problems, and potential applications associated with the RSP. Also held with National level MOH administrators.

DATA COLLECTION PERSONNEL

- In-country observer: Identify sources of Municipal health indicators and verify data quality and accessibility; monitor completeness of program activity logs; conduct informal interviews and observation at Provinical, Municipal, and Barangay levels.
- Institutional counterpart: Implement and maintain system description logs; report changes in staffing levels, flows of information, patterns of nonusage and adoption; provide MOH monthly reports; arrange meetings.
- In-country subcontractor: Conduct structured interviews with MOH administrators and instructors at National, Regional, and Provincial levels; conduct mail survey of primary health care workers at Provincial, Municipal, and Barangay levels.
- AMC staff: Maintain system performance/ repair logs and system usage frequency/duration logs; conduct planner/user group sessions; participate in formative evaluation process.
- EMC staff: Design data collection forms; conduct training of in-country personnel; conduct informal interviews with and observation of MOH and AED staff at national and municipal levels; participate in group sessions.

7.0 INTEGRATION OF DATA COLLECTION MECHANISMS

The technical discussion provided above has been segregated into individual topic areas. All of the analytical phases, however, will share a common data collection effort, which, although centralized, will be tailored to the needs of each area. In this way, the efficiency of the data collection effort will be maximized, and the analytical areas will benefit from using an integrated data base.

The data items to be collected are shown in Exhibits 7-1a and 7-1b, representing primary and secondary data, respectively. The items represent broad categories of variables; actual variables to be collected will have to be specified in more detail as the work progresses. Also shown in the exhibits, for each data item, are the analytical areas to which it pertains and the stage of the project during which data collection first becomes possible.

The data items are grouped by ultimate source, as follows:

Primary data:	Usage logs for each system.
	Surveys of users/operators/beneficiaries at each site.
	Observations of system use and effects at each site.
	Observations of institutional behavior in the host country capital.
Secondary data:	Host country capital or regional center.
	U.S.-based organizations: U.S. government, industry, offices of international organizations.
	Applications Management Contractor and hardware subcontractor.

These data sources will form the basis for the collection effort. Appropriate teams will be assigned to each source, and they will be responsible for collecting all data from that source regardless of which analytical areas the data is intended for. Of course, the collection teams will be thoroughly briefed on the ultimate uses of the data so that they will know how to interpret what they receive and to initiate appropriate follow-up activities. By organizing the data collection in this fashion, considerable labor and travel costs will be saved.

Exhibit 7-1a

Primary Data Items

Data Sources	Data Items	Applicability: Technical	Financial	Economic	Social	Institutional	Collection Period: Evaluation Contract Startup	Project Identification	Project Startup	Project Completion
Usage Log	• For each use:									
	--function(s) used	X	X	X	X	X				X
	--type(s) and location(s) of users	X	X	X	X	X				X
	--nature of message				X					X
	--user comments and reactions	X			X	X				X
	• For each system component:									
	--downtime history, and nature of problem	X			X	X				X
	--failure maintenance: costs of parts and labor, lead times for diagnosis and repair	X								X
	--routine maintenance: cost of parts and labor, frequency of activities	X								X
	--attempted uses during downtime	X			X					X
On-Site Surveys	• User reactions to and benefits from existing services:									
	--time saved in doing traditional activities		X	X						X
	--new activities not previously possible		X	X	X	X				X
	• User demand for new services	X	X		X	X				X
	• Changes in development-related attitudes, knowledge, behaviors (project-specific)				X					X
	• Changes in material indexes of development: education, nutrition, etc. (project-specific)			X						X
	• Interactions of commercial sector with satelite system: --direct uses --indirect benefits	X	X	X						X
	• Groups not reached by services				X					X
On-site Observation	• Patterns of communications, work relationships: --before system installation --during/after operations	X			X	X				X
	• Nature and quality of users' interactions with system	X			X					X
	• Social/institutional obstacles to, or opportunities for, system use				X	X				X
Observation in Host Country Capital	• Intended effects of communications				X			X		
	• Communication and relations among interested groups: ministries, PTT's, AID Mission --before installation --during/after operation	X			X	X		X	X	

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Exhibit 7-1b

Secondary Data Items

Data Sources	Data Items	Applicability: Technical	Financial	Economic	Social	Institutional	Collection Period: Evaluation Contract Startup	Project Identification	Project Startup	Project Completion
Host Country Capital or Regional Center	• Network for ordering, distributing spare parts and supplies	X				X		X		
	• Infrastructure for recruiting, training operators and services	X				X		X		
	• Wage and benefit structures for relevant occupations	X		X				X		
	• Historical and projected baseline figures on health, nutrition, etc. for affected region (project-specific)			X					X	
	• Fees paid to satellite operators, carriers, etc.		X					X		
	• Revenues received from users		X	X					X	
	• Subsidies provided by government to users/operators		X	X					X	
	• Financial/economic parameters:									
	--shadow price of currency			X					X	
	--import duty provisions			X					X	
	--capital recovery provisions			X					X	
	--specific import/export restrictions			X					X	
U.S. Government; International Organization; U.S. Industry	• Projections of component costs and capabilities: --conventional satellite systems --"appropriate" satellite subsystems --competing alternative systems	X	X				X			
	• Financial criteria of lending/granting institutions		X							
	• ITU and carriers' standards/compatibility requirements	X	X				X			
	• Potential unintended effects				X			X		
Applications Management Contractor and Hardware Subcontractor	• Costs of system purchase, installation and operation: --individual subsystems --direct vs. indirect costs	X	X				X	X		

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The right-hand columns in Exhibits 7-1a and 7-1b represent the earliest phase of each project in which collection of a particular data item becomes feasible. The phases are: between startup of the evaluation contract and identification of a project (the present phase); between project identification and project initiation; and during the project's operation. Most of the work -- particularly the observation of behaviors and the measurement of impacts -- must be done during project operations. A significant amount of data collection can take place, however, during the two earlier phases. This is especially true of the items to be collected in the U S., and much of the information to be collected in host country capitals. In order to avoid the inefficiency of trying to obtain all of the items from all of the sources while each project is in operation, we recommend that data collection proceed in advance of project startup wherever possible.

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8.0 FIELD LOGISTICS: ISSUES AND OPTIONS

In this chapter, we identify a series of operational issues and constraints which may be anticipated in evaluating any of the rural satellite projects, suggest cost-effective data collection strategies for dealing with these constraints, and describe in general terms our plans for recruiting, training, and managing in-country personnel for data collection and site observation.

8.1 Operational Issues and Constraints

Operational constraints operate in any evaluation effort. Frequently, evaluators must make tradeoffs between obtaining the kinds and quantity of data required, when required, and external limitations that operate on obtaining the desired data. In the RSP evaluation, the following operational constraints will most likely apply:

- Budgetary limitations. The processes of setting up meetings, locating and obtaining data, and most importantly, gaining an understanding of the project flow within each country necessarily take time. Our ability to maintain an in-country presence, however, is constrained by budgetary limitations.

- Language barrier. In remote areas of developing countries, the language barrier will hinder our ability to observe unobtrusively project activity and perceive local community interests and concerns. Even if we have a bilingual observer or interpreter interfacing between project activity and the EMC staff, perceptions and ideas can frequently get "lost in translation."

- Data access delays. Locating and gaining access to important data sets inevitably will involve frustrating delays (especially from nonparticipating institutions or comparison communities) and the data, once obtained, may be unreliable, incomplete, or out-of-date.

- Local skepticism. Local field staff and service providers typically will be ill-informed regarding who we are and why we are there. This becomes most problematic when their assistance is needed in keeping diaries, logs, or records for evaluation purposes.

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- Dispersion of activity. In-country project activities are likely to be occurring at several different geographic locations, complicating the task of monitoring them.

- Need for early involvement. Early involvement of the evaluation team in each project is crucial to the collection of baseline data for either impact or process evaluation purposes, yet this may not be perceived as equally crucial by AID, the AMC, or the host-country institutions.

- Multiple masters. Since project responsibilities and authorities will be shared among the user ministries, the local AID mission, AID-Washington, the AMC, the evaluation team is likely to encounter conflicting institutional needs and/or desires which must be dealt with diplomatically.

- Institutional Recordkeeping Revisions. Changes in methods of providing health, agricultural, or educational services brought about by telecommunications might also include changes in methods of recordkeeping or measuring outcomes which could produce incompatibilities with baseline data ("instrumentation effects").

While some of these potential problems may be inescapable, none are insurmountable as far as accomplishing the objectives of this evaluation is concerned, and many may be minimized through the data collection devices proposed below.

8.2 Strategies for Cost-Effective Data Collection

The importance of each of the following support mechanisms for gathering evaluation data in a cost-effective manner became clear during the two-day evaluation planning conference held at Abt Associates:

- In-country observers. These individuals would be employed part-time by Abt Associates to observe the RSP implementation process, identify and validate secondary data sets, conduct informal or in-depth user interviews, compile system usage logs, and prepare monthly status reports on RSP progress and problems. They should be indigenous individuals, fluent in the local language(s), interested in and knowledgeable about development communications

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and/or program evaluation, and skillful in dealing with and observing others. By employing one or perhaps two in-country observers per project, potential problems relating to budgetary limitations, the language barrier, data access delays, and local skepticism may be minimized.

- Institutional counterparts. Within each user institution, it is essential that we identify one or two counterparts to the in-country observer who appreciate the purpose and importance of the evaluation and are willing to provide assistance to the evaluation team at little or no cost to the study. These middle-level staff could serve as liaison between the user institution and the RSP evaluation team and could provide vital assistance in monitoring system usage and acceptance, accessing institutional data, arranging meetings or interviews, and reducing local skepticism regarding evaluation. The tasks of the in-country observers can be simplified through collaboration with, and feedback from, their institutional counterparts, although the observers should take pains to recognize a certain amount of institutional bias on the part of the latter.

- In-country subcontractors. For purpose of in-country survey data collection, the establishment of subcontracting agreements with local market research firms can reduce the costs associated with such activities while increasing the amount of on-site quality control. These firms provide the needed fluency in various regional dialects to facilitate ease of communication and possess the necessary credibility at the local level to achieve desired survey response rates.

- Group meetings. The problem of trying to observe and synthesize RSP-related activities occurring at several locations simultaneously may be avoided by holding quarterly group sessions involving one or two key staff from each of the local user institutions (or alternatively, six to eight staff from various levels of a single institution) and one or two senior staff from the evaluation team These meetings should provide both users and evaluators with a clearer picture of system progress and problems and may lead to modifications in user procedures as well. Should the AMC hold planner/user group forums of a similar nature, attendance at these meetings by EMC staff may serve the same purpose.

The data collection mechanisms described above will be supplemented by direct on-site participation and observation by members of the Abt Associates evaluation team, but the main thrust of the data collection will depend upon the local resources discussed above. These resources will be utilized to gather the type of formative evaluation data that would be too costly to compile otherwise. The training and management of the in-country observers and subcontractors therefore loom as very important elements of the evaluation plan, and these elements are addressed in Section 8.3 below.

8.3 Recruiting, Training, and Managing In-Country Observers and Subcontractors

In-country observers will be selected through a careful screening process whereby interested and qualified applicants are identified with the assistance of host country institutions, the local AID mission, and AAI, AED, or MIT contacts. They will be selected based on fluency in the languages received, local knowledge and acceptance, familiarity with evaluation and telecommunications, and personal references.

In-country subcontractors will be selected through a process which will allow assessment of firms' and persons' qualifications, prior survey experience, current workload, ability, flexibility, and cooperativeness in accomplishing the needed tasks. Prior work references will also be checked.

The selection criteria for interviewers will depend upon the types of interviews required. Informal or in-depth open-ended user interviews must be conducted by individuals familiar with the topic under consideration and who have been, or are easily, trained in the skills of nondirective unbiased interviewing. For this reason, these interviews most likely will be conducted by the in-country observers (trained by Abt Associates staff). Structured interviews designed to gather more quantifiable data from a larger body of individuals should be conducted preferably by local people with no vested interest in the success or failure of the program who already have experience in interviewing, preferably in rural settings. Such people may come from a local university, a local research firm, or a market research firm, or they may live at or near the site itself, as would, for example, village teachers or social workers.

Staff members from Abt Associates will work with the in-country local staff according to an agreed-upon work plan. Because it is anticipated that much of the data collection will be performed by these in-country local personnel, Abt Associates will provide training and supervision as necessary to assure quality control.

For purposes of training in secondary data abstraction, the training will include:

- Discussion of variables

  - the variables to be collected
  - the priority of each variable
  - the data source for each variable
  - the year, geographic level of detail, specification, and availability of data items;

- Review of data logistics sheets detailing the specific protocol to be followed in accessing secondary data and persons to contact prior to the collection of data;

- Review of data abstraction sheets;

- Trial runs and practice sessions of the data collection procedures;

- Supervision of any data collection pilot tests;

- Administration of data collection refresher courses as needed.

For the purposes of training in primary data collection, the in-country observers will be trained in nondirective interviewing techniques by Abt Associates' staff who will describe strategies for probing and for recording lengthy responses. Practice interviews will be conducted in a role-playing fashion between the observer and the project staff, and the first interviews will be conducted by an observer and staff member together. Training for formal interviewing (or, possibly, mail surveying) will be held at the offices of the in-country survey subcontractor and will be conducted jointly by senior subcontractor staff and by Abt Associates' staff. As highlighted above, these sessions

will combine a review of the topics, procedures, and instruments with an opportunity to practice administering the survey in a role-playing fashion. Abt Associates' staff will remain on-site as data collection commences until any initial survey problems have been resolved.

Both the in-country observers and institutional counterparts should receive continual guidance from the evaluation team regarding the types of information needed for evaluation purposes and the frequency and format in which the information is desired. Ongoing monitoring by the EMC of the data collection process will be incorporated into the data collection system Since scheduled task payments will be made contingent on satisfactory completion of tasks, some control of in-country activities can be maintained by the EMC. Scheduled monthly project status phone calls, quarterly progress reports from in-country personnel, and periodic EMC and AMC visits will help enhance communications among all parties and lead to increased efficiency in the performance of local in-country personnel.

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9.0 IMMEDIATE WORK IMPLICATIONS OF THIS PLAN

This RSP evaluation plan describes a complex set of activities which must be carefully coordinated to avoid bottlenecks and delays. In particular, the collection of field data concurrently with the operation of each of the five pilot projects will be a complex effort. Details regarding the data items to be collected in this phase may be found in Exhibit 7-1 above. To ensure that project-specific activity can proceed immediately upon host-country agreement to participate as a pilot project, it is important that certain other evaluation-related activities take place before project startup, and in some cases even before projects have been identified. These activities are described in this chapter.

9.1 Work to be Performed Before Project Identification

Considerable relevant data are available from international bodies and industry sources. These include, for example:

- Projections of the capabilities and costs of satellite and ground link technology;
- Financial criteria used by satellite operators, consumer carriers, and lending institutions; and
- Compatibility requirements of satellite operators and carriers.

The eventual on-site monitoring of system traffic can be simplified using software built into the system itself. Appropriate software packages and associated hardware must be located and evaluated for later installation.

On-site observers, ministry liaison personnel, and other indigenous staff will have to be trained in their functions. Development of basic training materials should be done as early as possible so that appropriate site-specific details can be added to each training package as soon as a site is identified.

9.2 Work to be Performed Before Project Startup

Once a project is identified, but before it is in operation, data collection should concentrate on obtaining all site-specific information which is not actually an outcome of the project. Examples of such data are:

- Organization of governmental ministries and private groups affected by the project, including rate structures of pertinent communications organizations.
- Infrastructure, including availability and wage structure for trained (or trainable) labor; means of recruiting operators and maintenance personnel; and channels for ordering, stocking, and transporting spare parts and supplies.
- Economic incentives and barriers, including government subsidies available to users and operators; import and capital-repatriation restrictions; and exchange-rate imbalances.

Most of the impact- and process-related data, of course, can be collected only while the projects are in operation. Therefore, the above activities should be commenced as early as possible in the evaluation effort in order to prevent a data-collection logjam during actual project implementation.

10.0 EVALUATION FINDINGS AND THEIR CONSTITUENCIES

This chapter, the final chapter of the Program Evaluation Plan, summarizes what the final products of the RSP evaluation will be and how they will be organized. It also outlines the way in which the evaluation's discipline-specific analyses will be interpreted and how the expected results of the evaluation relate to the program's five constituencies.

10.1 Final Products of the Evaluation

At the conclusion of the evaluation, we propose to deliver seven separate reports as the "Final Report". These reports are as follows:

1. Technological Analysis
2. Financial Analysis
3. Economic Analysis
4. Social Analysis
5. Institutional Analysis
6. Findings of the Evaluation of the Rural Satellite Program
7. Findings of the Evaluation of the Rural Satellite Program: Executive Summary

The content of the first five of these deliverables is discussed at some length above and, thus, requires no further elaboration here. Each of these five analytical reports will appear as a separate volume that interested constituencies will be able to refer to independently of the rest. Furthermore, as discussed in Subsection 4.3.1 above, each report will contain stand-alone chapters to match the particular perspectives of different constituencies.

The sixth report will integrate the evaluation's major findings and summarize them in comprehensive form. In contrast, the seventh report will be a brief executive summary of the evaluation and will be written for general audience reference and use.

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As discussed in Section 4.7 above, AID's expectations as to the final results of the RSP evaluation will serve as the framework for the integration of the evaluation's five discipline-specific analyses. These seven expected results will be the principal chapters of the evaluation's comprehensive summary and will be used to structure its executive summary as well.

10.2 Integration of the RSP Evaluation's Discipline-Specific Analyses

The comprehensive summary of the RSP evaluation will build upon, and integrate, the findings of the evaluations's technological, financial, economic, social, and institutional analyses. Exhibit 10-1 illustrates which analyses will offer significant source material to each of the evaluation's expected results. The areas marked with an "X" indicate the types of analysis that will be major sources; the remaining areas indicate the types of analysis that will be of relatively minor importance for the results in question.

Looking at the exhibit vertically, we find that the evaluation's institutional analysis will be directly relevant to six expected results, that the economic and social analyses will be directly relevant to five results, that the technological analysis will be directly relevant to four results, and that the finanical analysis will be directly relevant to three results. When the exhibit is examined horizontally, we see that four different patterns emerge:

- The first and second results will rely on all five types of analysis for source material.

- The third and seventh results will not rely on the evaluation's technological or financial analyses but each will use material from the economic, social, and institutional analyses.

- The fourth and sixth results will each use the technological and institutional analyses as sources, and the fourth result will also rely on material from the social analysis.

- The fifth result will rely on only the financial and economic analyses for source material.

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Exhibit 10-1

Relationship of Types of Analysis to Expected Results of RSP Evaluation

EXPECTED RESULTS	TYPES OF ANALYSIS				
	Technological Analysis	Financial Analysis	Economic Analysis	Social Analysis	Institutional Analysis
1. Range of Conditions for Which Satellite-Based Telecommunications is Cost-Beneficial	X	X	X	X	X
2. Economic Trade-Offs Among Specific Technologies	X	X	X	X	X
3. Socioeconomic Impact and Institutional Effectiveness of Two-Way Communications and Broadcast Radio			X	X	X
4. Most Conducive Arrangements for Effective Application of Telecommunications	X			X	X
5. Market Justifications for Investment in Rural Satellite Communications		X	X		
6. Comparison of Resource Requirements of Telecommunications-Delivery Systems with Traditional Means	X				X
7. Benefits of Improved Rural Communications Services			X	X	X

These four patterns do not emerge accidentally. Rather, what they refelct is a certain conceptual affinity of the results within each pattern. This suggests that a reordering of the results according to these four patterns may be advantangeous in presenting our evaluation findings. In our comprehensive summary, therefore, we propose to adopt just such an organizational scheme.

10.3 Relationship of Expected Evaluation Results to the Different Constituencies of the RSP

In our presentation of the overall conceptual framework for the evaluation in Chapter 4, we stressed that the findings of the evaluation would need to be responsive to the program's diverse readership and that the needs of the RSP's constituencies had to be accounted for in the initial stages of the evaluation design. In this final subsection of our Program Evaluation Plan, we now wish to come full circle and show how the expected results of the evaluation will in fact respond to each constituency's needs.

Exhibit 10-2, which is structured like Exhibit 10-1, illustrates the relationship of the evaluation's expected results to the RSP's different constituencies. In Exhibit 10-2 we find that each result is of major interest to three different constituencies, namely, user institutions, Ministries of Communications and Planning, and international lending and technical assistance organizations. In contrast to this marked congruence of interest, the interests of rural poor people and telecommunications equipment and service providers are sharply divergent: there is no overlap whatsoever in their major interests.

Since the expected results of the RSP evaluation flow directly from the purposes of the program, and since these results appear to be responsive to the varied needs of the program's constituencies, the framework we propose for the integration of the findings of the RSP evaluation appear to be reasonable and appropriate. Moreover, the non-overlap of major interests between the first and fourth constituencies will allow us to tailor our findings to the differential needs of these groups not only in the evaluation's five discipline-specific analyses but also in the body of the comprehensive summary of the evaluation.

Exhibit 10-2

Expected Results of RSP Evaluation that are of Major Interest to Different Constituencies

EXPECTED RESULTS	CONSTITUENCIES				
	Rural Poor People	User Institutions	Ministries of Communications and Planning	Telecommunications Equipment and Service Providers	International Lending and Technical Assistance Organizations
1. Range of Conditions for Which Satellite-Based Telecommunications is Cost-Beneficial		X	X	X	X
2. Economic Trade-Offs Among Specific Technologies		X	X	X	X
3. Socioeconomic Impact and Institutional Effectiveness of Two-Way Communications and Broadcast Radio	X	X	X		X
4. Most Conducive Arrangements for Effective Application of Telecommunications	X	X	X		X
5. Market Justifications for Investment in Rural Satellite Communications		X	X	X	X
6. Comparison of Resource Requirements of Telecommunications-Delivery Systems with Traditional Means		X	X	X	X
7. Benefits of Improved Rural Communications Services	X	X	X		X