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A HANDBOOK FOR PLANNING TELECOMMUNICATIONS SUPPORT PROJECTS

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This handbook is based on an earlier checklist prepared by the Rural Satellite Program and includes materials developed by Anna Stahmer, consultant to the Academy for Educational Development.

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PREFACE

The past three decades have seen a revolution in telecommunications—from the first television transmissions via satellite in the early 1960s to the video- and computer-conferencing activities of the 1980s. Today, telecommunications serve as the "nervous system" of many societies; they are multi-purpose in use and pervasive in effect. Telecommunications provide significant social and economic benefits critical to improving and maintaining national economies and, by extension, the quality of life.

In the relatively short time that communication satellites have been with us, satellite technology has displayed amazing range and versatility. The technology has demonstrated its value to telephone and telex communications, radio and television broadcasting, business communications, and the delivery of public services to isolated communities.

It has also proved a sound financial and, according to many, productive development investment. Indeed, telecommunications' vital contribution to development was noted in The Missing Link, a report by the ITU's Independent Commission for Worldwide Telecommunications Development:

> Henceforth no development program of any country should be regarded as balanced, properly integrated or likely to be effective unless it includes a full and appropriate role for telecommunications and accords a corresponding priority to the improvement and expansion of telecommunication.

In the last decade, it has become evident that the developing world also considers telecommunications a worthwhile investment. Indonesia, India, Brazil, Mexico, China, and a coalition of 22 Arab nations have launched their own satellites. Through INTELSAT, 27 other developing nations have established internal satellite-based communications systems.

Satellite communications offer the potential to reach the isolated and rural areas which characterize much of the Third World and which have long remained outside the vital flow of information.

In 1980 the U.S. Agency for International Development initiated the AID Rural Satellite Program to explore the potential of telecommunications as a means of extending scarce expert resources and expanding educational opportunities to remote and rural areas. Building on simple, interactive, and inexpensive telephone-based technologies, the Program developed teleconferencing systems for use as a development tool. Three pilot projects—in Indonesia, the West Indies, and Peru—were implemented to test and demonstrate that audioteleconferencing could reliably and affordably support development activities in education, health, and agriculture.

In Indonesia and the West Indies, distance education programs were established with national universities. Linking 13 distant universities in Indonesia and six universities in the West Indies, audioconferencing systems are used to provide academic courses to university students, to upgrade faculty skills through in-service training programs, and to

facilitate administrative and institutional communication. The effect is to make the expert resources of each institution available to all members of the network, thus multiplying each professional's outreach and effectiveness. Over 15 courses are taught each semester to thousands of university students in Indonesia. The University of the West Indies trained over 500 doctors and nurses in 1985 and doubled the annual number of teaching certificates awarded because of expanded training opportunities offered by the teleconferencing system.

In Peru, the Rural Satellite Program provided basic telephone service to seven rural communities and established an audioconferencing link for in-service training of health workers, agriculture extension agents, and teachers—connecting them for the first time with experts in the capital city of Lima. Over 300 audioconferences were requested by field personnel in 1985; over 92 percent of users indicated that the training improved their work.

The experiences of the Rural Satellite Program in Indonesia, the West Indies, and Peru have shown that:

- Telecommunications can be adapted to provide affordable communication services in rural areas and provide a cost-effective means of extending social services to these areas.

- Telephone-based technologies can be made to operate reliably in the developing world. The RSP pilot project networks operate at a 90 to 98 percent reliability rate.

- Teleconferencing, specifically audioconferencing, is an effective means of providing quality instruction and essential training to rural and isolated public service personnel.

Beyond these major research conclusions, the Rural Satellite Program projects have afforded valuable lessons in the planning and implementation of distance education programs, the design of appropriate technical systems, the programmatic and technical management required by these programs, the process of technology transfer, and the identification of the most suitable uses and audiences.

The following report, one of a monograph series, describes one aspect of the experience of the Rural Satellite Program.

INTRODUCTION

The goal of the Rural Satellite Program (RSP) is to use telecommunications to support and strengthen established public service systems, institutions, and organizations. Rather than develop new methodologies for information delivery for agriculture, health care, or education, the Rural Satellite Program provides a new means of delivery—telecommunications—to increase the outreach and effectiveness of operations in these sectors.

In Peru, for example, the Rural Satellite Program identified ways in which telecommunications could improve the effectiveness of field extension programs in health and agriculture. In Indonesia and the West Indies, the RSP established distance education programs to improve the quality and outreach of existing higher education institutions.

The technology that the Rural Satellite Program used was **telephone.** The communications support service it developed was **audioconferencing** supplemented by other telephone-dependent technologies—facsimile, telewriters, slow-scan video, and microcomputers. Audioconferencing provides interactive, two-way communications which can effectively support training, institutional outreach, and administration. It facilitates discussion, question and answer, and immediate response. Further, its technical requirements can be made compatible with the developing world environment.

The Program's objective is to explore the particular network configurations, "end use" equipment, training, and operational support that rural telephone services require in order to offer more than a basic commercial telecommunications service—in other words, to provide services and facilities which will directly support development activities.

Based on its various experiences throughout the world, the Rural Satellite Program has identified several key points at the project planning level that influence the viability and effectiveness of telephone-based communications support projects:

- Interactive telephone-based communications networks can answer development needs. They can improve institutional effectiveness, overcome management bottlenecks, and extend scarce resources over vast geographic areas. They can be used to reduce costly and time-consuming travel.

- For effective support of public service programs, the telecommunications system must include certain "end" equipment which is not currently a standard offering of telecommunications carriers. Network control equipment for point-multipoint switching within a dedicated system and audioconferencing equipment, such as microphones and loud speakers, are basic. They can be augmented with additional devices such as facsimile machines, telewriters, slow-scan video, etc. All these services require only a single telephone channel.

- Teleconferencing services alone are not likely to yield significant development benefits unless they are combined with sound programming and training. Users must be taught to take advantage of the two-way communication capability. Programs must be responsive to cultural differences in communication, learning,

and teaching practices. Users must be shown that an interactive network can help them. Acceptance takes time.

- To ensure the success and longevity of a telephone-based program, its services should benefit many user groups and support many purposes. For example, the communications network used for distance training of agricultural workers can also be used to train health workers and teachers. Economically, for instance, single-purpose systems are more vulnerable to budget cuts. By establishing a broad user base and by supporting diverse activities, the communications network will be more cost-effective, be better integrated into the rural communities it serves, and be more likely to enjoy popular support.

- Telephone-based communications support projects flourish best where there is a serious commitment and effort to develop rural areas or targeted institutions. Only under such conditions does it make sense for the communications carrier to provide development services, as the carrier will achieve recognition for its contributions to national goals and probably will receive budgetary and other concessions necessary to operate the public service component.

The experience distilled in this handbook reflects six years of Rural Satellite Program activities, including pre-feasibility, feasibility, and program planning studies conducted in very different countries: the Philippines, Indonesia, Pakistan, Sudan, Senegal, Peru, and parts of the South Pacific and the West Indies. This experience is further augmented by the actual implementation of three projects in Indonesia, the West Indies, and Peru. Although each project had a different character and focus, all were based on a single objective: to use interactive, telephone-based communications to support rural and national development.

Purpose of the Handbook

Pulling together these experiences and lessons, the Rural Satellite Program has developed this handbook to assist planners in discovering the best way to use existing and anticipated telecommunications systems to support development efforts. It focuses on the processes and issues of planning telephone-based communications support projects, addressing pre-feasibility, feasibility, and operational planning stages.

Specifically, this handbook is written to help:

- **development planners** identify potential uses and benefits of telephone-based communications systems to support national and regional development activities;

- **sector planners** assess communications needs and develop appropriate programmatic and technical specifications to facilitate and extend sector operations; and

- **telecommunications planners** integrate special needs of the developmental and rural sectors into telecommunications systems design.

Although this handbook is written from the perspective of the U.S.-based planner working overseas, it is intended for planners in any country, within any sector—public or private, education or agriculture—and within any institution—ministry or university, telephone company or extension service.

Section I presents the user with a general planning methodology and approach to using this handbook. Each subsequent section is introduced with a summary discussion of salient issues followed by a series of questions--or guidelines--for the collection of information on the factors which must be considered if telecommunications systems are to be an effective development tool.

Section II sets out the general socioeconomic and structural issues that may affect a communications project and provides suggestions for tools and information sources that may be helpful to the planner. Section III guides the planner on how to assess communications needs and develop applications, with particular reference to the areas of health, agriculture, and education. Section IV looks at the crucial aspect of the quality and quantity of the existing and planned telecommunications infrastructure that will serve as the basis for the envisioned communications support system. Section V addresses cost issues and guides the planner in identifying the resources required to implement a communications support project. The final section provides advice to the planner on how to organize and analyze this information and begin the process of operational planning.

SECTION I: HANDBOOK OBJECTIVES AND PLANNING METHODOLOGY

This handbook is primarily designed to aid in the preparation of pre-feasibility and feasibility studies, although parts of it may prove useful to those doing detailed operation plans. Because pre-feasibility and feasibility studies are sequential, the information from the former usually serves as the groundwork for the latter. The scope of coverage and level of detail are greatly increased in the feasibility stage.

STEPS	GENERAL GOALS
I. GENERAL IDENTIFICATION OF A COMMUNICATIONS NEED OR PROBLEM	Communications need/problem is identified by prospective users or other group. New telecommunications facilities create opportunity for expanded services.
II. PRE-FEASIBILITY STUDY	Confirmation of importance of the problem and applicability of communications solution. Identification of general user groups and locations. General assessment of technical needs, feasibility, and cost effectiveness. Decision to carry out detailed study.
III. FEASIBILITY STUDY	Specification of the needs, sectors, user groups, locations, types of uses, and institutional support structure. Detailed analysis of technical system, its feasibility, and type of communications services that satisfy the needs. Estimate of total cost and sources of funding. Determination that the intended impact is worth the estimated cost.
IV. DETAILED PROJECT PLANNING	Detailed work plan and project structure. Selection of staff. Completion of necessary agreements among involved parties.

At the pre-feasibility stage, the objective is to examine a general or specific problem and decide if a solution exists that merits further study. In the communications area, such a study may be caused by a strong communications need that is identified by prospective user groups or by a desire to explore the potential of an existing or expanding telecommunications network. The study should seek to define and assess that communications need and to identify key interested individuals, organizations, and projects, suitable geographic areas, sources of policy support, and required resources. The study should determine whether or not or under what conditions it is advisable to proceed with a more detailed study and set out some of the options that should be analyzed.

At the feasibility stage, the objective of the data gathering and analysis is more detailed and specific. It should look at the options identified in the first study and identify those with the best chances of success and high impact. This requires detailed analysis of the specified needs and nature of the involved sectors or regions; of specific development bottlenecks (where, for example, rapid communication can make a difference); of financial, human, and organizational requirements; and of the conditions under which the project can succeed. In the case of telecommunications projects, it also requires a thorough investigation of existing and planned communications facilities, their performance, reliability, manpower levels, mandate, types of technologies, and tariff schedules. The feasibility study should recommend a specific course of action and delineate the resources that must be mobilized, the constraints that must be overcome, and the benefits to be gained.

In order to be of use to people in many different types of situations, this handbook is simultaneously both general and specific. It is general in its coverage so as to be relevant to planners who are at different stages in the planning process (i.e., pre-feasibility, feasibility, initial planning) and who may not yet have a definite idea of the sector or type of system to be developed. It is also specific in its comprehensive coverage of multitudinous planning considerations. It is not expected that any planner will have to answer all of the questions posed in these guidelines. Each person will have to work within his own context. The planner who is asked to develop a proposal for the use of audioconferencing for health services at five specific sites will naturally have a more limited scope of inquiry than the planner who is asked to determine if a telephone-based communications system can in some way support educational activities. Each person will have to use his own situation as a filter to select those guidelines that are most relevant to his particular task and context. However, in reaching a conclusion over the viability of meeting a certain communications need, all planners will wish to include four basic elements in the intellectual process they follow.

IDENTIFICATION AND ASSESSMENT OF THE COMMUNICATIONS NEED	How important is it? Are the prospective users a significant and motivated group? Can the need be satisfied by a telephone-based system?
ASSESSMENT OF THE EXISTING COMMUNICATIONS SYSTEM	Can it meet the identified needs or be expanded to do so? Will it be reliable and affordable?
IDENTIFICATION OF THE SPECIFIC NEEDS, USERS, AND USES	What are the specific types of needs? Is the demand extensive? Intensive? How many people in how many locations? What types of services are necessary?
ASSESSMENT OF THE OPERATIONAL CONTEXT	What are the resources and constraints affecting t' e project's success? What changes have to be made in the present situation to ensure success? Who will judge what "success" is and what will be the criteria?

This process is both linear and interactive. A complete grasp of the process stages will greatly ensure that the final decision and plan are viable and productive.

This handbook is organized around a very simple principle for planning a telephone-based communications support network:

NEED + TELECOMMUNICATIONS INFRASTRUCTURE + COST →
COMMUNICATIONS SUPPORT PROJECT PLAN

These components and their interrelationships serve as the elements of a planning base and compose the major sections of this handbook.

SECTION II: PREPARING FOR THE JOB

The first step in planning a two-way communications support project is to develop a general information base which provides an initial answer to: **Where does a telecommunications support project fit into the national development scheme?** This information will establish general guidelines and broad parameters for the project as well as help to narrow the focus on the more likely applications of a telephone-based network. For example, if government policy stresses manpower development or if a potential donor agency emphasizes training efforts, the planner should seriously consider addressing these issues if policy-maker attention and support will be required at some point. Furthermore, the planner must establish if there is, indeed, a "legitimate" and pressing need for telecommunications services. A brief examination of the country's geography and infrastructure can answer this question.

This series of questions guides the planner to areas which most often affect telecommunications project planning--from general political and development issues to previous communications support experience.

A review of political and development issues will indicate any special constraints and/or areas of potential for applications policy:

- What are major development problems? What is the average level of education? What is the national literacy rate? What are primary health problems? What are life expectancy, infant mortality, and population growth rates? What is the level of food production? What is the agricultural export-import balance?

- What are national development priorities and strategies? In addition to the national "five-year" development plan, government policy can be discerned through special interventions, projects, and budget allocations.

- What are donor agencies' priorities? Country Strategy Statements are prime sources of information. Are there policies which prohibit infrastructure support or equipment purchases?

- What is the national political power structure? What is the "approval" process for major policy decisions, budgetary outlays, special projects, etc.?

- How stable is the government? Will its policies and initiatives endure over a significant period of time? Are any elections scheduled which may affect the planning process?

A review of geography, infrastructure, and communications services will indicate any special need for telecommunications services and assist to delineate their role in development support. Telecommunications is used to overcome distance and physical barriers to communication and information exchange. It can often compensate for the lack of other infrastructural resources and services, such as roads, transportation systems, reliable postal service, etc.

- Does national geography make physical movement difficult? For example, is the country an island nation or an archipelago? Are there mountains or deserts or jungles that fragment the terrain complicating communications and transportation?

- Are there significant population centers in rural areas isolated from the rest of the country by lack of transportation or communications services?

- Is the transportation system adequate? Are roads in good condition? Are there navigable rivers and waterway networks?

- Are there bus, plane, train, or boat services? How reliable is each means of transportation? How costly? And how long does it take to get from a typical rural area to major commercial and political centers?

- How do people in rural areas obtain information, news, assistance, etc.? How do they communicate with other areas?

- What are the means of information distribution?

- Are radio, television, and telephone services already available to rural areas? To what percentage of the population?

- How are newspapers distributed? When do they reach rural areas?

- How extensive, reliable, and costly is the postal service? How long does the post usually take to reach the rural areas?

A review of national telecommunications experience and orientation can be enlightening as to policies and potential support prevailing in this sector.

- Is the government a member of any international association or agreement, such as INTELSAT, PANAFTEL, ASEAN, or the Lome Convention? Such an affiliation can indicate national telecommunications policy and philosophy.

- How sophisticated is the telecommunications sector? Is a satellite used for domestic service? How many telephones are there per capita in rural areas vs. urban areas?

- What services are offered—even if only in urban areas or on international routes? Computer service is often a good indicator of carrier sophistication.

- Has the country previously participated in a telecommunications or communications support project? For example, Project Satellite, AIDSAT, Project Share, SITE, etc.? What were the results and consequences? Who were the sponsoring and participating organizations? What led to national involvement?

Finally, a few miscellaneous issues which will affect planning should be addressed:

- To what extent is the country electrified? Does it provide reliable service? These are important factors at the feasibility and planning stages of a communications support project as the need for stand-alone power services add an additional level of complexity and expense.

- Are there any trade agreements or regulations in effect that govern the purchase of communications or electronic equipment? If so, the planner will need to consider a new subset of parameters.

- Are there any cultural or language barriers which divide the nation that would inhibit two-way communications?

- What are budgetary and fiscal planning cycles? These will be most salient in setting timelines for study conclusions and proposal presentations.

* * *

As evidenced by the preceding discussion, the process of feasibility assessment and project planning is largely one of data collection. This process is greatly facilitated if the planner arms himself with a few basic tools and a list of information sources.

BASIC TOOLS

MAP
TAPE RECORDER
CAMERA
SLIDES, VIDEOTAPES, DIAGRAMS
BACKGROUND INFORMATION

- MAPS provide major assistance to the planner as telecommunications projects are primarily aimed at "bridging the distance" between people, expertise, and resources. It is therefore essential to understand the distances and locations involved in order to proceed with site selection and planning.

Maps are an efficient way of organizing information as well. They can be used to plot potential user groups, record user group activities and functions, as well as indicate the telecommunications infrastructure.

Because it is often difficult to find accurate maps in-country, detailed maps—showing topography, roads, administrative divisions, and the telecommunications system—should be obtained prior to departure. In the United States, NASA, the U.S. Air Force Map Publication Center, and the ITU Documentation Center are good sources. Once in-country, try the ministry of interior or natural resources. Tourist maps are not sufficiently detailed.

- TAPE RECORDERS can record formal interviews, informal discussions, face-to-face training sessions or classes, although permission should be obtained from participants in advance. And remember that recording can sometimes interfere with the free flow of information, so it may not always be appropriate.

- CAMERAS can document conditions in the field as background for project planning, such as buildings where equipment might be installed or where groups might meet (schools, municipal offices, or the telephone company offices), the general conditions of the terrain, the existing telephone system, and the nation's electrical

facilities. Before taking pictures of communications equipment, it is advisable to inquire about government rules and regulations.

• SLIDES, VIDEOTAPE, DIAGRAMS, ETC. provide an easy way of explaining the uses of a communications support project. Slides or a videotape depicting activities similar to those planned will go a long way in engaging the attention of policy-makers or those unfamiliar with the concept of communications support. Furthermore, pictures of the equipment in use diminish the "high-tech" aura of a teleconferencing network. Diagrams of similar network configurations can serve as a planning base for telephone company personnel. Exploratory discussions are greatly facilitated by enhanced user understanding of the proposed activity and technology.

These materials can usually be obtained from other communications support project principals--such as the user institution, implementation contractor, or donor agency. The Rural Satellite Program, for example, has prepared a videotape on its pilot project activities. Some sources are AID, INTELSAT, ITU, the World Bank, etc.

• BACKGROUND INFORMATION consists of donor agency reports and studies, such as AID Country Development Strategy Statements and Policy Papers, the U.S. Department of State's Country Profiles, the World Bank Sector Policy Paper, and the United Nations Yearbook. National development plans ("Five-Year Plans") and sector plans are of equal importance.

INFORMATION SOURCES
U.S. Agency for International Development
World Bank and other multilateral assistance agencies
Clearinghouse on Development Communication (Academy for Educational Development)
University libraries
Host government officials
Telecommunications authority staff
Business managers
Potential users

In the United States, desk officers and subject specialists at AID, the World Bank, and relevant U.N. agencies can be prime sources of information. Consider as well private voluntary organizations and consulting firms which have worked in the country or on telecommunications projects. Visit or write to the World Bank library and the Clearinghouse for Development Communication (Academy for Educational Development) in Washington, D.C., which maintain current publications and other documentation on a wide range of communications topics.

University libraries in the United States are also a useful resource for books, journals, and perhaps even the country's newspapers. In addition, university departments and individual faculty members often receive unpublished materials. The Foreign Area Studies Division of the American University in Washington, D.C. publishes an area

handbook that is worth reviewing. Other libraries specializing in communications and area studies can also provide information.

In the host country, more information, of course, will be available, including the country's most recent development plan, national census reports, and so on. The most basic resource is the wide range of people who are interested in or could use telecommunications.

- LOCAL COUNTERPARTS can guide the planner through the government bureaucracies, provide insight into policies and politics, and overcome any language problems. In the pre-feasibility phase, this individual need not be affiliated with project participants or involved institutions, although he will be more effective if he has access to key people. At the feasibility stage, it is important that the counterpart be officially associated with the project as continuing informed support will be needed for negotiation, planning, and implementation. Thus, the local counterpart should be associated with the group that would be ultimately responsible for the project.

- GOVERNMENT, DEVELOPMENT AGENCY, AND PRIVATE SECTOR OFFICIALS who have some responsibility for the project under consideration will be valuable sources of information. Government memos, circulars, previous and projected budgets, and project evaluation reports are all important resource tools.

- LOCAL BUSINESS MANAGERS can provide good information about the quality of the telephone system and service. Because they use it for business purposes, they are likely to be more accurate in their assessment of its quality and utility. Electronics retailers are generally able to describe telecommunications equipment repair and maintenance capabilities, spare parts availability, and the most common problems with electronics equipment in the area.

- POTENTIAL CONSUMERS can be visited, not just at high policy-making or management levels but also at the field level. Talk to village leaders, teachers, health care workers, extension agents, managers of small businesses, farmers, telephone technicians, etc. about their communications needs, their uses of the telephone system, uses of communications media in their work, etc.

SECTION III: APPLICATIONS PLANNING AND SECTOR ANALYSIS

Seldom is a development planner given "carte blanche" to develop a communications support project wherever or for whatever purposes he selects. The reality is that projects (and planners) have clients with specific needs and who have generally made the first step in determining what institution or activities a communications system will, indeed, support. This section has been developed to assist the planner in acquiring the necessary information to identify the specific sector's communication needs and determine the best network and programmatic configurations to meet these needs.

Telephone-based communications systems can be used to support a variety of development activities. The Rural Satellite Program focused on the health, education, and agriculture sectors. For this reason, detailed planning bases have been provided for these sectors. However, the application possibilities of a telephone-based system in these and other sectors are similar: in-service training and staff upgrading programs, instructional and information exchange programs, and institutional administration and multi-site management. For the most part, the planning guidelines are generic and apply to all sectors. And the key questions remain the same:

- Are there communications needs which can be addressed by a two-way communications support project?
- How can a two-way communications network be used to meet important developmental needs?
- Is there a demand for the services provided by a two-way communications network?
- Are the needs being addressed significant enough to justify a communications support project?

Applications Planning

Attributes of a Telephone-based Network

A first step in applications planning is to know the attributes—both advantages and drawbacks—of the proposed technology.

A telephone-based network offers two-way communication. It supports immediate interactive voice and/or data communication. This interaction is central to effective coordination, information exchange, and instructional and training efforts. Teleconferencing networks can link many groups of people at one time for multi-site, multi-participant conferences, seminars, and training sessions.

ADVANTAGES OF TELEPHONE-BASED NETWORKS	DISADVANTAGES OF TELEPHONE-BASED NETWORKS
• interactive • multi-site linkages • spontaneous • immediate • personal • hands-on usage • cost-effective	• limited audience • requires close coordination • requires careful program development

Like an ordinary telephone call, teleconferencing allows for spontaneity, immediacy, and a certain "intimacy." The end equipment--simple microphones and speakers--is easily operated by the users. Unlike radio and television, a technician does not serve as an intermediary between the user and the equipment, nor is the user separated from his audience by the time between taping and broadcast. And like the telephone, a teleconferencing network is a relatively restrictive media. Participants must come to predetermined conference locations; active participation and interaction, its key assets, necessitate that the audience remain limited. It cannot duplicate the sheer numerical outreach of the mass media, radio and television. **However, where there is a need for immediate, interactive communication between specialized groups at multiple, widespread locations, a telephone-based network can be invaluable.** It may actually be the only efficient and cost-effective means of carrying out some activities.

Unlike the ordinary telephone, however, a teleconferencing network links many people at one time to closely approximate face-to-face meetings and seminars. And similar to face-to-face meetings and seminars, teleconferences require careful preparation to be effective. A productive meeting will always require an agenda and direction; a successful training seminar will always include a pedagogically sound, well-planned presentation and support materials. An easily used delivery system such as a teleconferencing network does not obviate the need for advanced planning. Users are easily "seduced" by the spontaneity and ease of use and tend to ignore the preparation these activities normally require.

In addition, there are special considerations for program delivery posed by the distance separating the sites. Although easily bridged by telephone circuits, the intervening miles can complicate support materials distribution, scheduling, and participant notification. Careful coordination is required, even if these tasks are facilitated by special equipment, such as a telewriter or facsimile machines.

Based on these attributes, a telephone-based communications support project should meet the following criteria:

- Fulfill a developmental need which can be addressed by expanded two-way communications. Specifically, extend institutional outreach capabilities, expand instructional opportunities and audience, strengthen institutions through staff development and improved administration and management, and provide a means of maximizing scarce human resources.

- Replicate or complement actual communication patterns and institutional linkages.

- Fit into institutional organization or structure. For example, a communications support project could become a component of the extension department of the ministry of agriculture or the training section of the department of health. It is risky to establish a new, separate "department" without having a previously developed constituency or support structure.

- Serve a broad enough clientele to spread the financial responsibility and to justify unified investment.

- Be congruent with available resources. For example, if a distance training program requires support materials or study guides, both the resources to produce the materials and the means of delivery should be available.

- Be consistent with user schedules, availability, abilities, and needs.

- Employ technology compatible with project objectives. Telephone-based systems, such as audioconferencing, are well suited to training and coordination efforts; in short, any activity which is enhanced by two-way communication. However, if project objectives call for broad information dissemination to the general populace, broadcast media are appropriate.

Needs Identification and Analysis

Whether the planner is responsible for a single sector analysis or a multi-sector one, he must be familiar with the priorities and objectives, successes and failures of the area(s) under investigation. A communications support project must not only prove useful to the ultimate users, but it must be congruent with client—be it government, ministry, or institution—goals and policies. Otherwise, investment in the communications support project may not be forthcoming. Conversely, it is not the government or institution which will eventually participate in a teleconference, but the individual user. Therefore, analysis must take into account both institutional and individual needs in order to identify the most feasible applications. The figure below shows the relationships of the various factors which should be examined in a sector analysis.

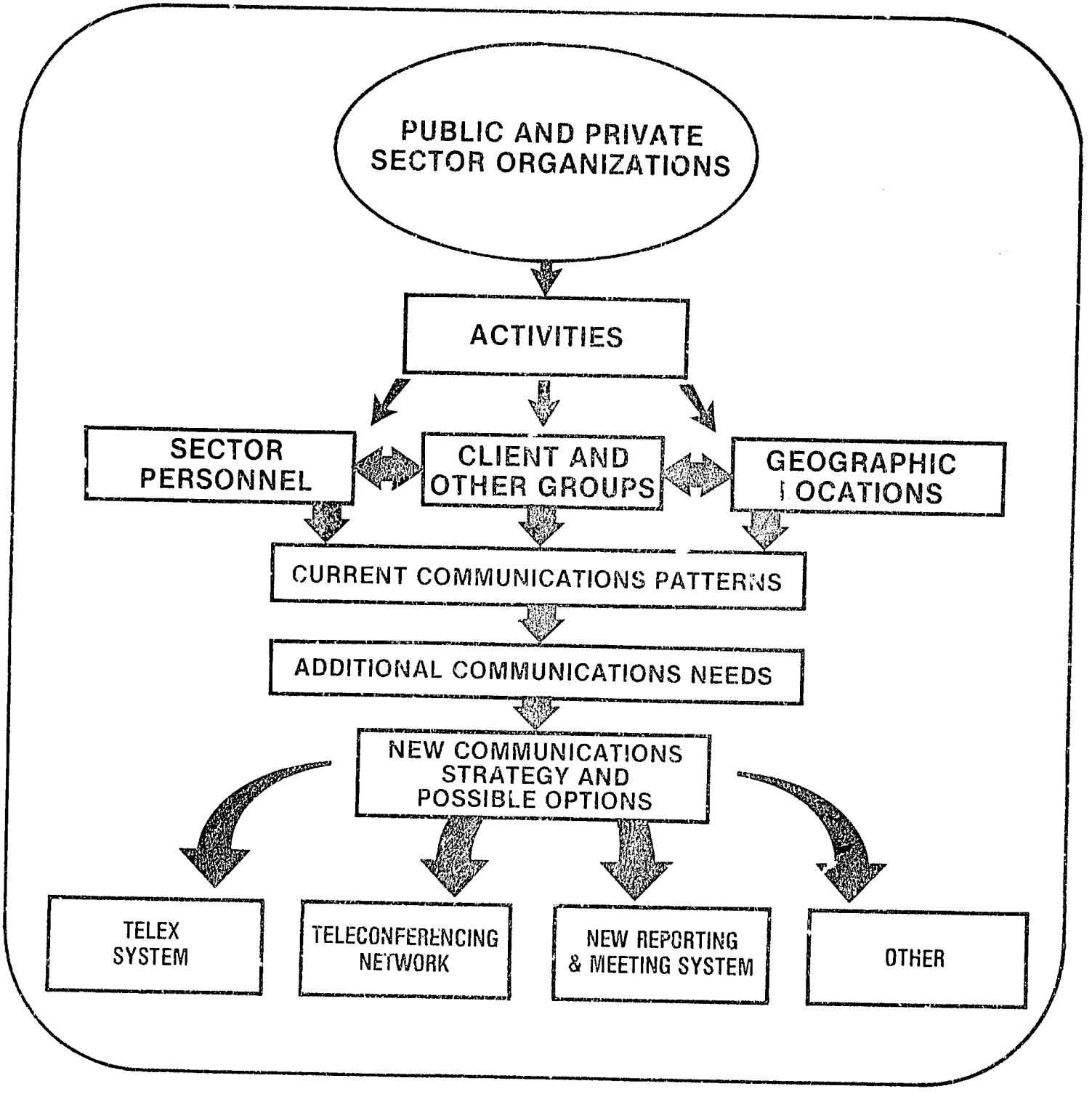
The following questions should assist in developing a sector profile and to identify needs:

- What are general national development goals? Is there an emphasis on a specific sector? Are certain regions or geographic areas the subject of focus? For example, is the development of a river basin area a target for government action?

- What are the development priorities of potentially supportive donor agencies or international organizations? Are they compatible with national, regional, or sectoral goals?

- What are the policies, mandates, and priorities of the sector at a national level? Regional level? District level? A review of the sector development plan and discussion with policy-makers and leaders at the various levels will be revealing.

SECTOR ANALYSIS



- What are actual sector activities? These activities may vary from region to region. For example, the ministry of agriculture may concentrate on rice production in one area, casava production in another; or the ministry of health may have to contend with yellow fever in a tropical area, goiter in mountainous areas.

- What are the current special projects or campaigns initiated by the sector? For example, has the ministry of education instituted a teacher-upgrading program in response to a national emphasis on improved education? Has the ministry of health initiated a national vaccination campaign? These types of activities can generally benefit from the support offered by telephone-based communications networks and often provide the persuasive rationale for the required investment.

- Has the sector developed any special strategies to promote its goals? For example, a campaign to increase agricultural production may emphasize training of extension workers or sharing of field research.

- What are budget allocations? Priorities of any type generally can be deduced from the amounts next to line items.

- What do sector personnel--throughout the hierarchy--identify as priorities? Delve beyond the institutional representation to what the individual himself feels is needed. What would help him do his job better? Or his employees? Perhaps he requires better coordination, management, support, access to information, or skills training.

Throughout this process, the distinction must be noted between "need" and "demand." The planner will probably identify many needs. But if those needs are not perceived by the potential users and if solutions to these needs are not demanded, there is a chance that a project deemed feasible in the concept stage will not prove feasible in the implementation stage because it will not have a constituency for its services.

Communications Support

Essentially, the analysis underlying a communications support project will focus on information flows between different groups and locations comprising the sector. Within the various sectors, these communications structures generally exist:

- Management or reporting structures--essentially reflecting the organizational or institutional hierarchy such as central office relations to field offices, etc.

- Administrative structure--reflecting the self-maintenance functions of the organization such as personnel, accounting, etc.

- Primary activity structure--reflecting the mandated functions of the organization such as agricultural extension and research, health care delivery, etc.

The interaction among these units, the information flow and the information processing is the focus of the communications support project. Its goal is to facilitate and support these functions to improve outreach or administration or substantive performance. Specific points in the communications process where a two-way communications

network could help—whether for training or logistics coordination or anything else—must be pinpointed.

In addition to the official structural blueprint for sector operation, it is important that actual patterns of communication or organization are observed so that applications planning is based on reality. Often, the central office's representation of how branch offices work does not accord with actual practices or field operations. Essentially, **who talks to whom for what purposes and how frequently?**

The nature of the communications support project will determine at what level the communications patterns are explored. Project focus may be overall sectoral support, or support of a few institutions within the sector or perhaps a single institution. In investigating an entire sector, agriculture, for example, all the organizations and institutions must be considered. At a more "micro" level, the linkages between a few designated institutions—possibly research and extension—or within a single institution—research alone—will be subject to analysis.

These questions focus on identifying existing communications patterns and on exploring how a telephone-based communications support project might improve information flows. On a sectoral level:

- What are the organizations and institutions within the sector? Although it is likely that most sectoral activities under consideration in the fields of health, agriculture, and education will fall under the aegis of the national ministries, non-governmental or private organizations and activities should also be identified. Farmers' cooperatives, business associations, or private universities represent both potential users and resource providers. For example, in the Peru Rural Satellite Project, a collaborative distance training program was established between health care field personnel and the private Colegio Medico.

- What are their duties? What are the institutional linkages? How do their activities affect each other? Do they collaborate on joint projects?

- With whom do they collaborate or communicate? For example, a health ministry's nutrition unit may interact with the agriculture ministry's crop research unit, or within an organization such as the ministry of agriculture the research unit may collaborate with the extension unit. A highly centralized system may have many institutions reporting back to a central headquarters.

- What means of communication are currently employed? Meetings? Telephone conversation? Mail?

At an institutional level:

- How is the institution organized? Does it have a headquarters and field offices in different geographical regions? Is it organized along functional lines, as a training unit in one place, research unit in another? An organizational chart which identifies key roles and individuals is helpful. If possible, it is a good idea to ascertain staffing patterns. Many organizations rotate staff to various positions, including field assignments. At higher levels, personnel are often political appointees and subject to changes in administration. At later planning and implementation stages, the planner may find that the originally supportive personnel have moved on.

- How does it provide for internal communications? Consider the "systems" in place for information dissemination, staff meetings, logistics support, in-service training, program reviews, etc.

- How does it extend its mandated services? For example, how does a university operate its outreach or continuing education program?

Institutional Support

Although a major question of any applications planning exercise is "How can a communications support project assist sectoral or institutional activities?", the planner must also ask:

- What support will the sector or institution provide the communications support project?

- Are there sufficient resources to support the project such as personnel, facilities, materials, etc.?

Section V looks more closely at the resources required to operate a communications support project; however, the planner should keep the following in mind while considering applications needs.

Institutional structure and organization will play a critical role in the feasibility assessment and later implementation success. It must be remembered that the operable word in "communications support project" is "support." The technical network and delivery system are relatively neutral entities. If the operating structures and procedures of the targeted institutions are not sound, it is unlikely that the communications support project will have much impact. In all likelihood, it will serve to point out operational shortcomings. In short, the communications project will be most productive if the institution's operations are reasonably effective. Institutional reform, rather than improved productivity, will require more than a communications support component.

On a more immediate level, the institution(s) will have to provide operational support of the project by integrating it into existing structure and providing personnel and materials as required.

Institutional use of the telecommunications network should be extensive and significant. If sector or institutional use is not sufficient to warrant a network, other potential uses should be investigated.

For example, once the viability of an agricultural support project is established, it is prudent also to find ways in which the health care system can use the communications network. First, sharing facilities distributes the costs and increases the time they are used. In the Peru Rural Satellite Project, for example, the teleconferencing rooms (and network) serve the education, health, and agriculture sectors, with use totaling about 300 hours per year. Second, the need for additional support which can be provided by a telecommunications network in a country is likely to exist across sectors, because sectors face similar shortages. At the same time, however, the involvement of several sectors makes the planning exercise more complex: facilities of the different sectors can

be some distance apart, supervisors may not be at the same locations, or project responsibility may be diffuse.

Telecommunications services need not always be shared among sectors, as in the case of university-based distance education programs. In the Indonesia and the West Indies Rural Satellite Projects, the potential number of users in the key organizations—specifically the national universities and campuses—were sufficiently numerous to warrant concentration solely on the needs of the principal group interested in the telecommunications system. Although these projects served national universities, it should be noted that the faculties were diverse enough to cover several different sectors (e.g., medicine and public health, agriculture, basic sciences, etc.) and the uses of the system were varied (e.g., undergraduate courses, faculty seminars, administrative meetings). Furthermore, university extension and outreach activities encompassed governmental and community organizations. Therefore, although one type of institution was served, its interests were broad.

Finally, it must be remembered that the communications support project goal is to improve operations and perhaps even streamline institutional procedures. Although many things could be accomplished effectively through the use of a telecommunications network, other demands on the institutional personnel must always be kept in mind. Physicians have to attend to clinical duties along with providing diagnostic support to rural health care workers; extension agents must work with farmers who are often scattered across a large area; teachers are naturally occupied with classroom duties. In-service training or administrative meetings take them away from these vital activities. It is best to schedule a few well-planned and needed sessions that hold the interest and attention of the participants than to fill up "air time" with so many programs that their professional duties are compromised.

As discussed above, there are many general issues which must be taken into consideration when planning telecommunications applications regardless of sector. The following are sector-specific considerations for planning such programs.

Sector Analysis

Health

The health care system in developing countries has traditionally been the sector most interested in using telecommunications to support its activities, primarily through two-way private radio networks. The major focuses have been the coordination of emergency evacuations, patient evaluation, and the movement and in-service training of physicians, nurses, and other medical staff. With the expansion and improvement of rural telephone services, other valuable applications are being developed. Telephone-based networks have the potential to provide:

- administrative and logistical support, such as ordering supplies, transfer of patient records, or planning the visits of specialists;
- diagnostic support of patients for health care workers in remote areas;
- patient management support, including decisions about the need to transfer a patient to another facility;

- support and coordination of public health campaigns, epidemic control, and public health emergencies;
- more efficient gathering of health care statistics; and
- in-service training for all levels of health care personnel.

Tools and General Information

As the above applications suggest, telecommunications support is generally aimed at health care providers, i.e., doctors, nurses, health workers, and administrators. The telecommunications network links these health professionals for training and vital information exchange; the direct impact on patients is very limited. Therefore, some organizational structure for the delivery of health care must be in place for a developing country to benefit from telecommunications.

To establish the extent of that structure, read sections of national planning documents that refer to the health care sector. Reviewing major regional development plans, such as those for irrigation projects, can also be worthwhile. They often have significant health care components that do not necessarily show up in the sector documents.

Visit hospitals, health care centers, private and government clinics, training institutions, and universities to observe daily activities and to discuss priorities and concerns. If patient transfer logs and other internal record-keeping systems are available, a review of them can be useful. Posters, pamphlets, and brochures can provide valuable information on past and current public health activities, as well as an appreciation of the skills and resources available in the country.

Although telecommunications support of a health care system does not have the patient as the immediate audience, the outcome of improved communications, of course, should be better services for consumers. During the planning stages, therefore, it is important to sample consumers' reactions to learn if their perceptions of the system's problems match those of the health care staff. Talking with the ultimate recipients of health care can also help establish whether there are some services they need that the health care system is not providing.

Sectoral Organization and Structure

Obviously, no health care system in the past was planned with telecommunications support in mind. Yet the manpower and material resources scarcity facing many developing countries makes telecommunications a valuable tool in this sector. For many years to come, rural health care workers will receive only limited training and will have to rely on a centralized system for information and support, which is exactly where telecommunications can be of assistance. To develop a profile of this potential role, here are some questions to consider:

- How is the health care system structured? A description of the administration, including national, regional, state, and municipal responsibilities, is clearly an important starting point. Investigate how supplies are provided, how patients are

managed and transferred, how staff are trained, and how salaries and other payments are disbursed.

- Where are the components of the health care system--including such special facilities as malaria control units or family planning clinics--actually located within the country? At what level are laboratory or medical research facilities available?

- How do the different levels of the system interrelate for the different activities? Do physicians, nurses, or specialists routinely visit rural clinics? Do rural health care workers have a say in ordering supplies and, if so, how do they go about it?

- How does information move through the system? Information flows to be investigated include not only paper records, but also word of mouth. Try to identify bottlenecks in the flow of paperwork. Of course, more efficient paper flow does not in itself improve performance: What happens to the documents and information after they are collected and assembled? Could more efficient information flow resolve problems? Or do present levels of staffing and other factors make it difficult to institute real change?

- What is the reporting hierarchy? Which level is responsible for which function?

- What is the general condition of the health care facilities? What type of supplies are available at a typical facility and to what extent? Issues to consider in this area include whether facilities have been built as rural health care stations and what facilities exist for the efficient and safe delivery of health care.

- In what form are patient records kept and transferred? When special tests are required, how are their results transferred and which level of the health care system acts on them?

- Do the official linkages for patient transfer or advice correspond to actual practice? Hospital and clinic records and discussions with health care staff can help identify the actual linkages, which are often based on such practical considerations as availability of market roads, air taxis, or particularly relevant expertise at a given location--details that can get lost in national sector planning.

- How are more routine data collected and analyzed by health care personnel? Are such data used for monitoring or for regional or long-term planning of the health care system?

- Is the organizational structure the same for curative and preventive health care? If other ministries or regional development projects are involved in activities related to primary health care, identify their structures and their relationship to the health care sector. Learn where the points of contact are, even if it is only that facilities or staff of the different projects are in the same town. Do different channels of information and responsibility exist for special campaigns?

- In summary, what are the frequency, volume, and regularity of all categories of contacts between different locations in the system? And what changes in

service outcomes could be anticipated if such communications were regular and immediate?

Prospective User Base

Telecommunications systems can effectively extend the reach and services of scarce professional staff to support health care workers in the field who are less well trained. Some basic questions need to be asked, therefore, about who is available both to provide the support and to receive it:

- How many physicians, specialists, and nurses are there, and where are they located? If a general project area has already been identified, a detailed accounting of staff should be made. Otherwise, a more general description in terms of rural and urban distribution should be possible.

- What are the general job functions of the staff at the different levels for medical tasks as well as for administrative chores and those related to public health?

- What outreach functions of the staff require travel and transport? Consideration here should be given not only to the frequency and urgency of such travel but also to the value the staff assigns it because they can accomplish non-job-related tasks or personal business.

- How does the staff divide the responsibilities associated with the transport of supplies, patients, and patient records? How much paperwork is there and what administrative processes, such as signatures and authorizations, are involved?

- What training and qualifications do the main categories of personnel have? For example, are rural clinics staffed with nurses or community health care workers with limited training? Is the training that rural staff receive well-suited to the principal health care problems they encounter?

- Do the staff have access to refresher programs or to courses on new techniques or on problems they have not previously encountered. such as sudden epidemics? How are such programs administered--must staff travel to a central site? How often do the programs take place?

- Can the health care staff identify bottlenecks in their day-to-day activities that can be helped by immediate and reliable telecommunications services? Take particular note of their concerns and cautions.

- Is the health care staff, particularly at the more senior levels, under pressure to do outreach and community visits? Their views on this, especially in light of the limited time they have available and the great distances often involved, can be invaluable. Do they see telecommunications--and in particular teleconferencing--as a bridge between field realities and professional pressures? (For this last task, it is important that the health care staff have a good understanding of the communications support project--both what it can do and what the user and equipment will look like. The Rural Satellite Program has found that general discussions about telecommunications tend to assume science-fiction, space-age proportions that either intimidate or alienate potential users. Describing the

potential in concrete terms and the equipment from the user's perspective, i.e., simple speaker phones and/or microphones, will elicit generally helpful responses.)

Communications Support

In many instances, communications projects will be familiar to health care staff in terms of radio or television campaigns directed at the general public. In some cases, two-way radio systems will have been used for emergency measures or for coordination of physician travel, but they are not readily available to the rural health care worker. As mentioned above, to develop the proper planning base, it is important to describe in practical terms the differences between the mass media--radio and television--and telephone-based systems.

To obtain a baseline for the communications strategy, consider questions such as these:

- Do people in the project area have experience with the use of two-way radios or other broadcast media? For what purposes and to what effect? How have these media been used in the health care system itself?

- Has the rural health care staff been actively involved in radio campaigns or other related projects? If any campaigns are currently in progress, what is the general reaction to them?

- Which points in the health care system are linked by telephone? What is the phone system being used for and by whom?

- Is the present telephone system part of the regular telephone service or is it a private network? Who maintains and services the equipment and what power sources are being used?

- What is the potential level of telephone usage? Between which locations is the use most frequent or most critical? Staff at facilities that already have telephones can indicate other locations they need to communicate with as well as assess the benefits and problems of the current service.

- How is the telephone service integrated into the operations of each health care facility? In other words, who is in charge of answering the phone or routing calls and relaying messages? How successful and reliable is the process? What are the restrictions on its use in terms of service availability?

With the information obtained from these questions, the planner will be able to identify sector communications needs, to determine whether a telephone-based communications network would meet these needs, and to assess which units, groups, or levels within the health care system would benefit most and best utilize a communications system.

Education

Over the past decade, the use of telecommunications for education has increased, particularly in the areas of educational television and radio. Although these media have been used with some success at the primary and secondary school levels, most distance education programs have focused on higher, continuing, and professional education. Telephone-based audioconferencing systems have successfully supported distance education in the United States, Canada, and Europe. The Rural Satellite Program projects in Indonesia and the West Indies have demonstrated that audioconferencing is an efficient and effective means of delivering training and instruction over vast distances to isolated and remote audiences.

There is less precedent for the use of telecommunications systems in the field of nonformal education. The Rural Satellite Program teleconferencing projects in Peru and, again, the West Indies are perhaps the only examples of this application in the developing world. However, as telecommunications services become more widespread and available in rural areas, nonformal education can benefit significantly.

In general, telephone-based systems are an effective and successful way to deliver education when:

- the instruction is relatively specialized and not easily accessible
- the number of learners is somewhat limited
- interaction is important to the learning process
- the students are motivated and are experienced learners
- face-to-face instruction is impossible, low quality, or too expensive
- highly skilled teachers are not readily available locally

Broadcasting systems, on the other hand, are cost-effective for teaching mass audiences. Telephone-based systems are not cost-effective for teaching mass audiences, but they have a definite place in more specialized learning situations, because they allow discussions and responses to individual questions. This interactivity has long been recognized as an effective and essential teaching technique.

With the expansion of telecommunications systems in developing countries, several education areas could benefit, such as:

- in-service teacher training;

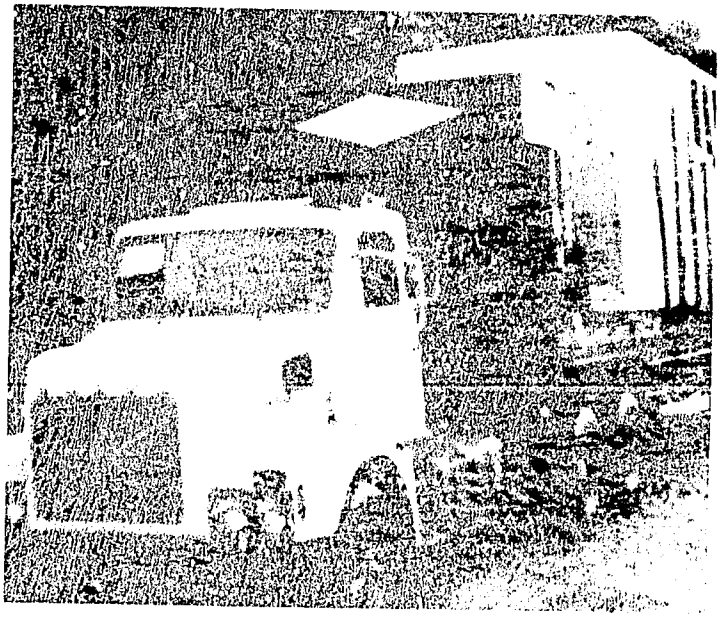
- higher education, in particular to bring scarce and specialized staff resources to different campuses or to support local study efforts;

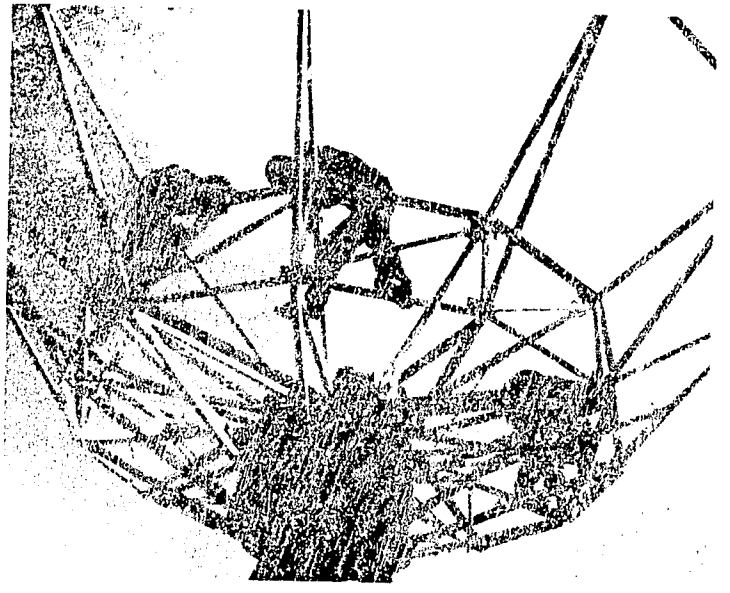
- staff and professional education, especially for people in remote and rural areas, but also for those in distant cities that lack qualified teaching resources, such as in accounting or management;

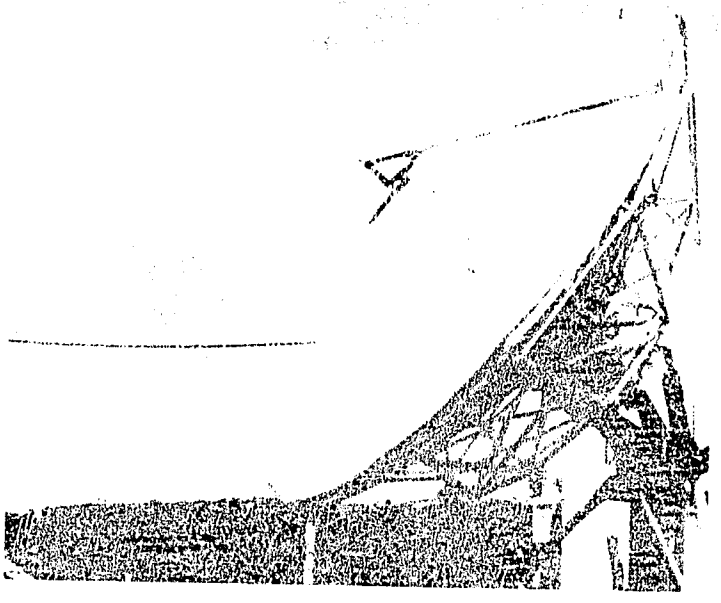
- skills upgrading for relatively specialized technical jobs, such as laboratory technicians;

- administration services, including curriculum discussions or review of systematic teaching methods; and

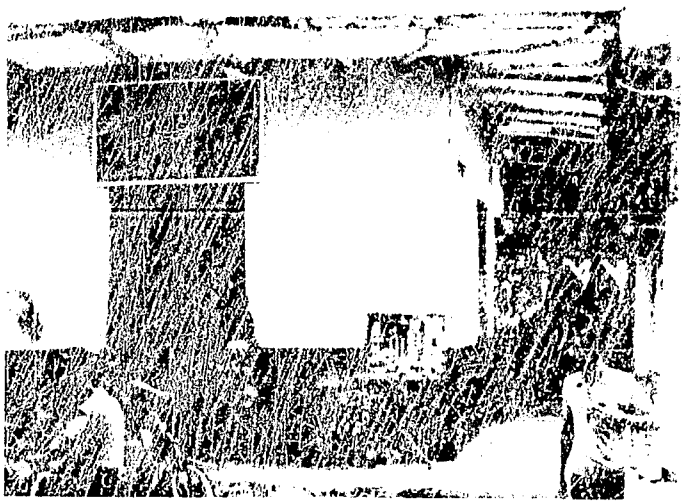
Images from the AID Rural Satellite Program



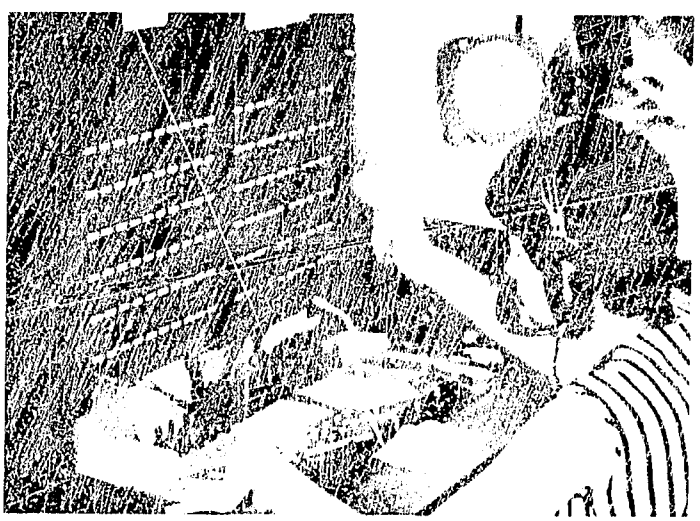




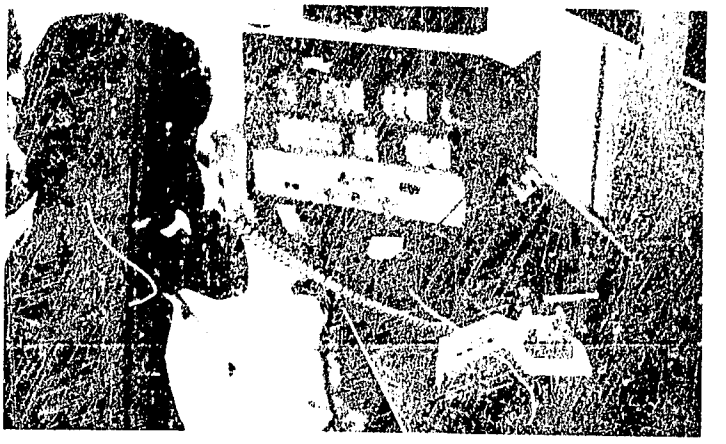
Satellites can provide telecommunications services to remote and rural areas. The smaller the earth stations, the lower the costs. The Peru Rural Satellite Project is the first to successfully use small six-meter stations with the international satellite system for internal communication.



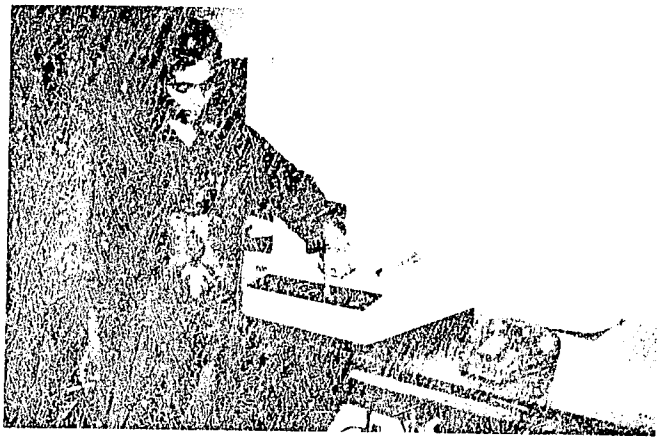
Basic telephone service is essential to rural development. For the first time, the rural Peruvians in the remote San Martin region are connected with the nation's commercial and political centers--and with each other. Within months, the new telephone system was used to capacity and has since been expanded twice to accommodate heavy usage. Over 110,000 phone calls were made in 1985, generating over $100,000 in revenues.



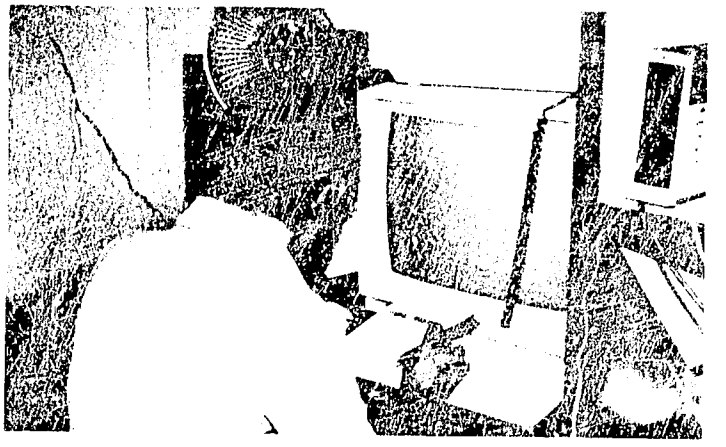
Push-to-talk microphone



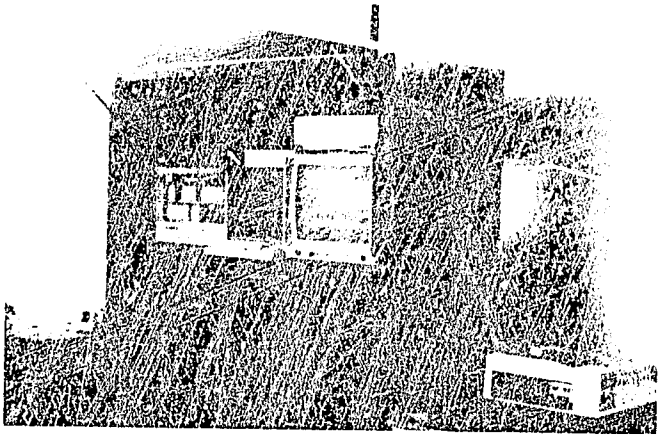
Telephone terminal and private telephone



Facsimile machine

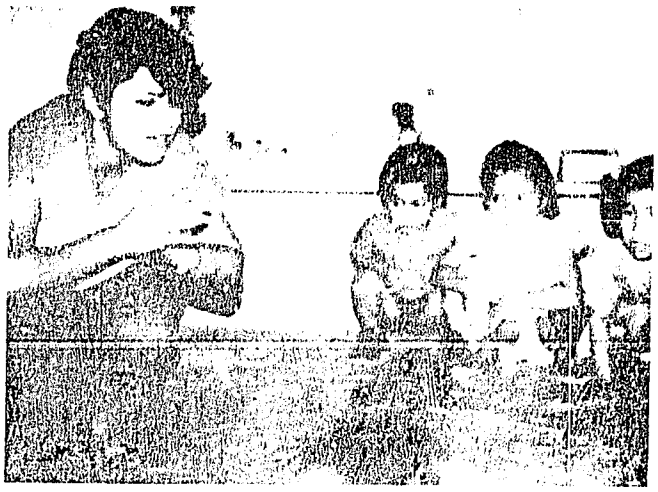


Telewriter/graphics display



Typical classroom layout

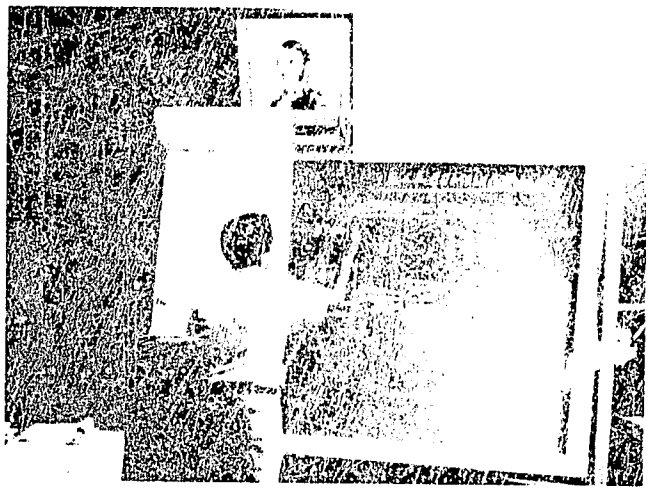
Special equipment attached to telephone lines can transform ordinary telephones into audioconferencing systems linking many groups over vast distances. Using a simple telephone circuit, groups of people can talk, view pictures transmitted by telewriters, and receive text via facsimile. The Rural Satellite Program installed 25 "electronic classrooms" for three different projects.



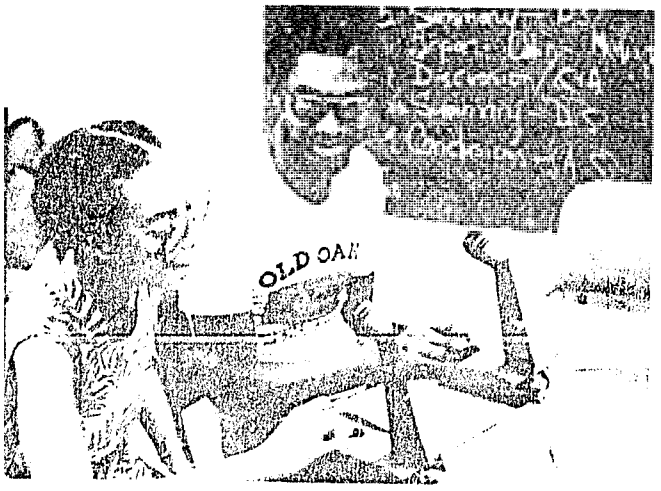
In-service training of primary school teachers

Administration of rural institutions

University teaching to thousands of students



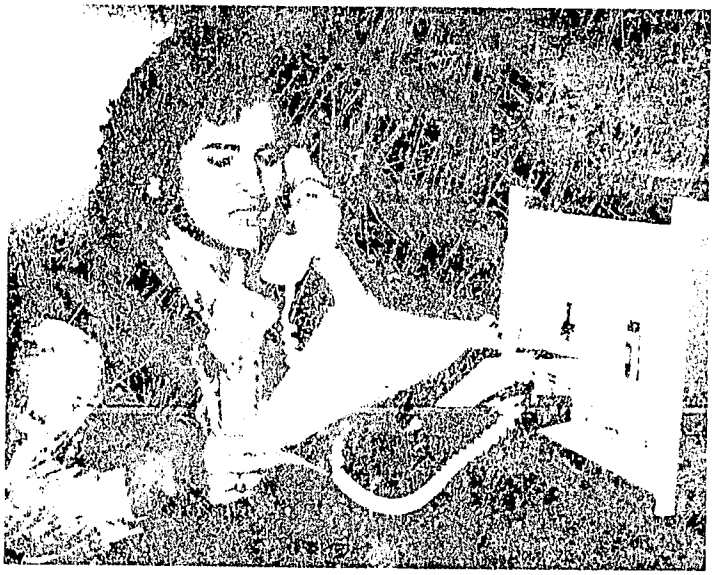
Technical training for telecommunications personnel

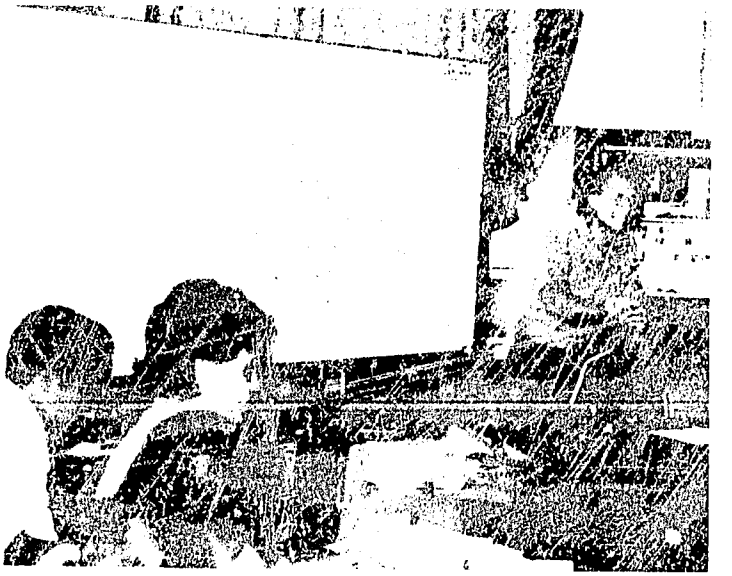


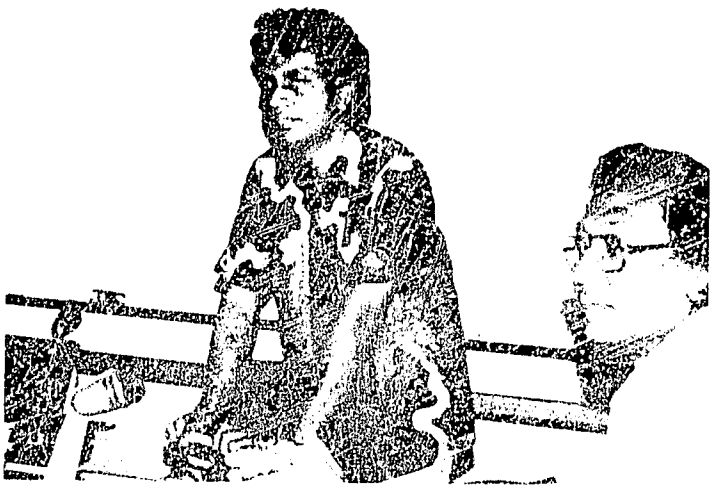
Interactive audioconferencing networks can reliably and affordably support many different development activities. Audioconferencing provides a means of extending scarce expert resources and educational opportunities to remote and rural areas. The Rural Satellite Program explored its applications for health, education, and agriculture. The Pilot Projects in Indonesia, the West Indies, and Peru used audioconferencing for university teaching, in-service training of health care workers, teachers, and agricultural extension agents, medical consultations, research exchange, and rural administration. Over 92 percent of the participants indicated it helped them do their jobs better.

Animal husbandry training for extension agents

Coordination of Child Health Campaign







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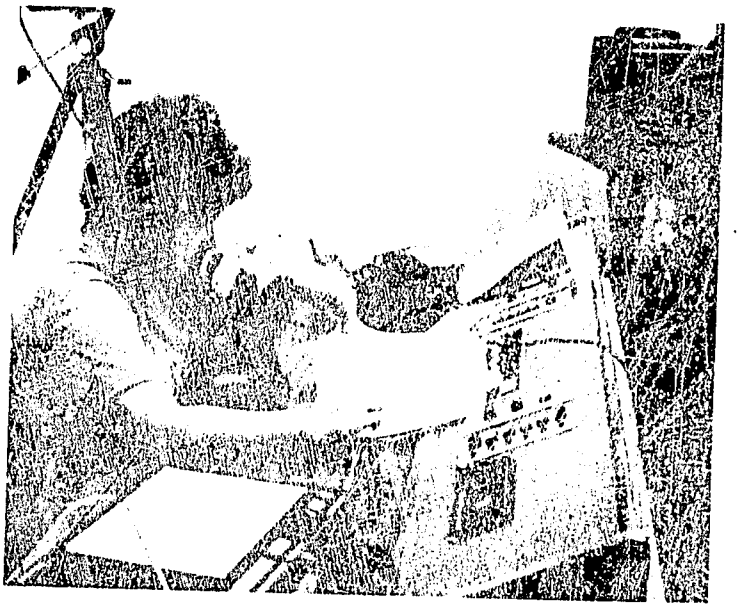
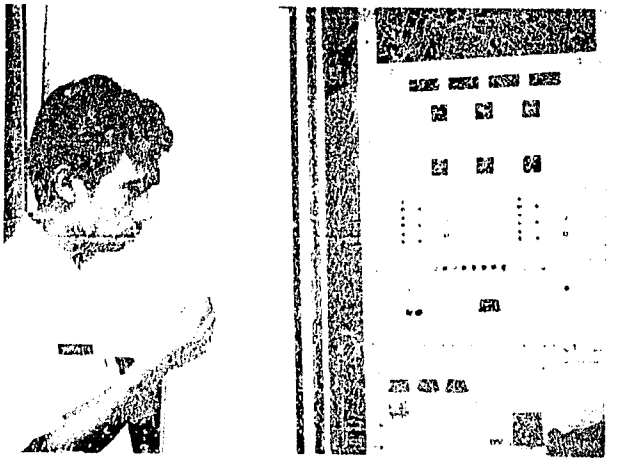
Effective audioconferencing programs need careful coordination and management of programming, technical, and administrative components. General requirements for successful communications support projects include:

- a central coordinating office supported by staff at all sites
- accurate identification of user needs and appropriate program development
- thorough training of management and technical staff, as well as program presenter and general users
- development and distribution of educational support materials
- adequate budget for central office and local site operations

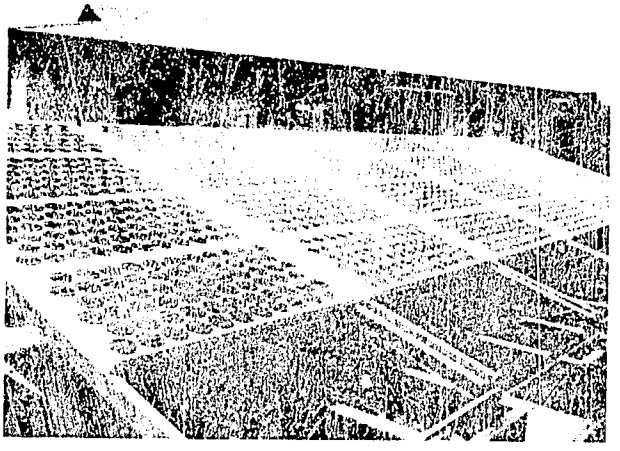


Earth station, photovoltaics, and audioconferencing room

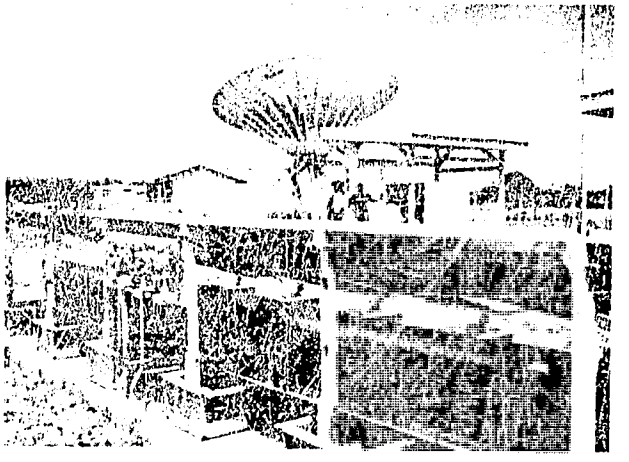


Station requires only quarterly maintenance visits

Satellite technology can be adapted to withstand the rugged conditions prevailing in rural areas. In the remote Indonesian village of Wawatobi, the Rural Satellite Program designed and installed a small solar-powered earth station and photovoltaic array. The station provides multi-channel telephone service with low maintenance and power requirements. It operates on less electricity than a home steam iron.



Photovoltaic panels



Panels and storage batteries

- the nonformal education sector, which could receive administrative and specialized support from resource people.

The facilities used for these services can range from a small room in a municipal building with a few microphones and a loudspeaker to university facilities with classrooms for 100 students, administrative offices, several loudspeakers, many microphones, electrowriters, and facsimile, computer, and slow-scan equipment. The number of points connected in such a network varies considerably: in Indonesia, the Rural Satellite Program project supports fifteen 80-seat classrooms; in the West Indies, six classrooms with a 25-person capacity comprise the system. It remains to be seen how many more classrooms can be added.

However, a cautionary note is in order. When planning projects in developing countries, it is advisable initially to limit the number of sites because both technical and coordination difficulties can escalate as the number of teleconferencing sites increases. Indeed, it is prudent to start with a small number of sites and, as management patterns are established, then to add sites incrementally. Thought should be given to planning a series of small systems, rather than one large one.

Tools and General Information

Investigating the role telephony can play in a country's education sector will involve a review of national planning documents and discussions with a wide array of individuals, from rural teachers to university deans to education ministers. Talking to business leaders, "modern" sector employers (such as the telephone company), and trade and professional associations can provide a sense of professional education needs as well as future manpower and skills requirements. It can also be useful to identify and review staffing and skills development activities that do not traditionally fall within the education sector, such as the training schools of the telephone company.

From the opposite perspective, it is important that at the same time, the planner investigate and identify sources of expertise which will complete the other half of the equation. Often skilled trainers and professional resources are found not only at universities but also in the private sector as well.

Primary and Secondary Education

Telecommunications systems are used for primary and secondary students in isolated instances only when special learner needs and economic conditions allow a relatively high capital and operational outlay per student. Nevertheless, the primary and secondary education sectors certainly can benefit from telecommunications services and their requirements should be considered when such services are being planned. Uses are likely to be in the areas of in-service teacher training, upgrading of laboratory skills, and discussion of curriculum and other administrative issues. Student participation probably would be limited to enrichment areas, such as discussions with a regional politician or a known historian and storyteller. To consider the contribution telecommunications can make to primary and secondary education in a country, a few basic questions can be asked:

- How many teachers and students are at each school?

- What is the organizational structure of the education system? A map is a key tool for plotting where rural schools are located, which district they belong to, how many schools or entities are supervised by each level in the hierarchy, and how supervision takes place.

- How often do teachers in rural areas have to come to a central town or village to collect paychecks or other materials? How often do supervisors or heads of schools travel and for what purposes?

- What are the teacher training needs? Do most teachers need to obtain additional certification? Is there a mandatory teacher upgrading program?

- What opportunities exist for in-service training for teachers? Where does it take place and how frequently or over what period of time?

- What is the general condition of the school facilities and supplies? Do the buildings have other important functions, such as providing space for local meetings?

Higher, Continuing, and Professional Education

Higher, or university-level, education has proved a fertile area for the use of telecommunications. The need for communications, staff development, and expert resources makes teleconferencing a particularly appropriate and flexible means of institutional support.

Higher education is the area in which telecommunications has made the most significant advances as an instructional support tool. Telephone-based or teleconferencing systems allow for two-way communications, question and answer sessions, discussions, and immediate responses to learner needs. They also provide access to scarce educational resources and expertise often otherwise unavailable in many Third World areas. Teleconferencing systems are equally well suited to the individual learner as to groups of students. They can be used to deliver entire courses to several university sites or one-time special sessions as part of an established local curriculum.

In addition to supporting basic undergraduate curricula, telephone-based systems are often critical in extending graduate training opportunities which are extremely limited in the developing world and practically non-existent in rural areas.

The higher education area provides a ready constituency for distance programs. Both students and faculty are eager to obtain advanced degrees. Often, in fact, faculty members are compelled by governments to improve their skills either through existing academic programs or formalized skills upgrading programs. Researchers, isolated from adequate library facilities and from their professional colleagues, can employ a teleconferencing system to obtain information and keep in touch. In the academic environment, general information and "enrichment" seminars delivered over the telecommunications system meet enthusiastic responses. In Indonesia, a series of seminars on diverse topics attracted over 1,800 voluntary participants from all walks of university life.

Telecommunications systems have also become an efficient means of institutional management, administration, and coordination. In general, higher education institutions

in the Third World belong to a national university system closely tied to the administrative and policy center of the ministry of education. Distance, remoteness, and lack of regular communications degrade the efficiency of such centralized systems. A teleconferencing system linking universities with the ministry office and each other can eliminate management bottlenecks and facilitate decision-making. The University Registry at the University of the West Indies holds weekly teleconferences.

Other university distance education projects, such as print-based correspondence courses, open university programs, etc., can benefit from a telecommunications system. The University of the South Pacific's education project, for example, reports that administrative uses of a teleconferencing system enabled it to increase its student enrollment by 50 percent.

In considering telecommunication's vital role in this sector, here are some of the questions that need to be explored:

- Where are all the institutions of higher education (public and private)? How many students and faculty are there, and what is each school's admission policy and educational mandate? Medical schools, for instance, might teach only, or they may also provide outreach and patient care.

- What academic programs would these institutions like to offer that they are not presently providing? What types of expertise are needed to strengthen their existing curricula? Discussions with the university leadership, deans, and department heads will provide the answers. Other faculty members and students can provide information on how courses are presently taught and the areas for improvement.

- What cooperative arrangements exist among the institutions for faculty or curriculum sharing, joint course development, or transfer of credits? Do faculty members travel to other institutions for lectures and seminars? Do some institutions have severe shortages of faculty and staff while others have many personnel?

- What percentage of secondary school graduates do not enter higher education institutions and why? Would some of them pursue university studies if access were available on a more flexible basis or if more job-related certificate programs were offered?

- What priority is accorded to higher education within the national development plan in terms of budget and plans to build new facilities or increase enrollment?

- What links exist between universities and institutes of research? Some universities do essential research in conjunction with development ministries, for example.

- Do any of the institutions have particular strengths in educational technology and media either as tools to support teaching on campus or as part of the curriculum?

- Finally, what is the physical condition of these institutions, including laboratories, libraries, audio-visual facilities, and so on?

In many countries, higher education institutions have mandates to provide "outreach" services to people physically distant from the campus and unable to enroll as full-time students, and to generally support the communities in the area. These services primarily consist of adult, continuing, and professional education programs, which provide short-term, specialized instruction resulting in a diploma or certificate. They are not degree programs. Often universities maintain extramural centers with minimal administrative staff who arrange tutorials or provide facilities for visiting specialists. These outreach systems have in the past been a primary focus for telecommunications support. For institutions with a strong outreach mandate but without qualified staff or adequate resources, the introduction of telecommunications systems could provide the nucleus for an extramural center.

Where extension departments already exist, the following issues need to be explored:

- What are the main sources of financing for extension programs, the overall budget, and the approximate per-student costs? Describe the nature and structure of the extension and outreach work, including the facilities, staff, and task functions. What degrees, courses, seminars, or workshops are available?

- What outreach is currently done by higher education institutions? In some cases, medical students work in remote areas, professors and students supervise rural cattle breeding programs, tropical forestry experts advise on reforestation, early childhood specialists conduct training workshops for preschool teachers, and administration faculty provide in-service training for civil servants. How and where do such activities take place, how often, and how many people participate?

- Who participates in these programs? Are they reached through correspondence, through broadcast, or through visiting faculty? Do participants have access to local tutorials, study groups, or library facilities? Information will be needed on registration, examination, and accreditation.

- Are present extension activities satisfactory or is there a significant unmet demand? Perhaps more people would participate, for example, if the opportunity existed at their place of work or in their hometown or if different subjects were taught. Are there geographical areas that are currently underserved but that have considerable potential for participating in extension programs?

- What instructional methods are used: audio-visual equipment or study guides? What expertise exists within departments in terms of instruction designers, content specialists, administrators?

- How popular and credible are the extension services in the view of the students, the general public, and current or future employers?

- How are courses or activities identified and selected? Do they mirror those taught in traditional departments or are they specially developed for the extramural center? What role do students, employers, and others have in this process?

- Overall, what are the main problems for effective teaching, for a broadening of service offerings, and for effective administration? How can an effective

telecommunications system overcome some of these? What other support technologies would be important, such as computer networking to trace student enrollment?

Nonformal Education

With the extension of telecommunications services into rural areas, nonformal education will gain a powerful training resource. Several questions need to be explored in the planning phase:

- What are the key successes and failures of nonformal education in the rural areas? Can programs be upgraded with more frequent coordination, supervision, and staff training or support?
- Which sectors and organizations provide nonformal education programs? Why? Are there linkages among the sector activities?
- How are the programs structured, administered, and staffed? Is interaction through travel, written directives, seminars, or some other means? Identify the physical location of the field staff and the administrative and content resource people. Who needs to talk to whom?
- Is contact and support sufficient in the eyes of the field staff?

Agriculture

Agriculture is the cornerstone of rural society and a key to rural development. In the past, major agricultural development projects have employed two-way, private radio networks to coordinate logistic activities. Satellite communications now make possible reliable telecommunications service in rural areas. Telephone communications and related technologies can play a significant role in the agricultural sector.

Basic commercial telephone service can give individual farmers access to:

- seed, fertilizer, and other farm product suppliers
- agricultural extension support network
- weather forecasts
- market information
- commodity dealers/buyers

By building on the telephone system to provide teleconferencing service, three key components of the agriculture sector can be served: extension, research, and rural credit. Teleconferencing can promote needed communication within these individual components as well as provide for the crucial linkages among them. A few applications are:

- in-service training of extension agents
- information dissemination of new technologies, such as new seed varieties or pesticides
- exchange of research information
- feedback to researchers about problems in the field
- feedback on field test results

- field office coordination with a central marketing board
- farmer and marketing cooperative negotiations
- coordination of rural credit bureaus with national credit sources

The Rural Satellite Projects in Peru and Indonesia have actively supported the agriculture sector. In Peru, 55 training courses for extension agents were presented over the teleconferencing system in 1985. In Indonesia, nine remote, agriculturally oriented universities were linked by a teleconferencing system with the Institut Pertanian Bogor, the national agriculture research institute on Java. Experiences show that such communications systems can positively affect the operations of organizations and institutions within the agricultural arena.

A cautionary note here is in order: As indicated above, an organizational structure and system must exist if a delivery system (i.e., teleconferencing) is to have any impact. This is true for any sector. The Rural Satellite Program has found, however, that organizational systems within the agricultural sector are much more diffuse than in health and education. Not only does the field worker's job require him to spend most of his time literally "in the field" (and not in the local office), but agricultural priorities and practices necessarily vary from environment to environment. A planner must take into account the variations of schedule, climate, crop rotation, etc., when developing a communications support project that serves the needs of the agricultural community.

Tools and General Information

To familiarize oneself with the agricultural sector, a review of national planning documents should provide information on agricultural export earnings, their share of the gross domestic product, and historical trends within the sector. In addition, materials from the scientific and research sectors can be useful, because they often elucidate long-term agricultural objectives. The national bank should be a good source for information on rural credits. Furthermore, many countries have established different agencies—often with their own extension and credit functions—to promote special crops or even entire integrated regional programs.

Marketing boards are important to any profile of the sector, not only because they collect, store, and transport the produce but also because they are instrumental in setting prices. Another key consideration is the vitality of the private sector, which collects and markets products or provides supplies and often credit to farmers. Often non-governmental organizations active in a given country have a good idea of the strength of these markets and credit sources.

Organization and Structure

After a general picture of the country's agriculture sector is developed, investigations about a telecommunications system initially focus on the official agricultural system—extension services, research agencies, marketing boards, and so forth. Here are some of the major questions to be answered:

- What are the agricultural institutions and organizations in the country, region, etc.? What are their functions and mandates?

- What are the key locations in the agriculture sector, including extension offices, research facilities, credit and marketing boards, and agricultural schools and training facilities?

- Can the key agricultural development areas and programs be identified on a regional basis? Or by crop? Within these programs, pinpoint the locations of the different types of activities—field workers, supply centers, repair or maintenance depots, research activities, training facilities, and other points in the system.

- How does information flow between the various locations and where are the decision-making points? How frequently do these contacts take place and what form do they take—written or verbal?

- What bottlenecks are identified by administrators and field staff? Are sufficient operational resources available for the field staff to visit farms, for instance, or for transport of specialized equipment?

- What role does the private sector play in the context of agricultural development? Is the country's agricultural system primarily controlled by government? Do merchants supply seeds, fertilizers, and equipment? Do entrepreneurs provide transport or processing plants, purchase the products, give credit, and so on? What are the coordination and liaison requirements?

- How much acreage do farmers in the project area cultivate? Are they primarily subsistence farmers or do they market surpluses? Do they grow different crops for the market than for household consumption? Are there large farms or estates?

- What is the structure and scope of the extension activities in the project areas and how effective is the current system? Do farmers play a role?

- How and to what degree is agricultural research linked to agricultural extension services? Do they maintain joint field plots? Checking into the way current agricultural research findings are communicated to extension staff can be useful. How can extension staff obtain assistance from research facilities in emergency situations? Conversely, how do researchers discover field problems?

- Does the government participate in any activities of the international agricultural research centers?

- How are crops transported to the market? Are the key products perishable? Are the markets close by? Are there local or regional processing facilities? Could a more efficient flow of information result in better market prices or in less spoilage?

Prospective User Base

As in other sectors, some knowledge about staffing levels, problems, and constraints is essential for the effective use of telecommunications systems. To help develop a profile of potential telecommunications use in the country's agriculture sector, questions such as these should be addressed:

- How many extension personnel work in the project area? Knowing their physical locations and the extension methods they use--model farms, visitation, group meetings, and so on--can be important.

- How much time and effort is put into the various facets of the agriculture sector? Does the agricultural extension supervisor travel a considerable distance to discuss and review progress in the field, for example? Does the field staff send a vehicle to project headquarters to obtain written authorization before an irrigation pump can be repaired locally? How much time elapses between requests and the receipt of approval?

- What is the level of training for extension staff? Do they have access to regular refresher courses? If so, where are the courses held? Who teaches them?

- Do extension staff use or have experience with communications systems?

- Do extension agents deal with specific crops or a variety? Are they the farmers' main contact point for most goods and services, such as credit and supplies, or do different organizations deal with different field-level inputs?

Communications Support

The way information has been delivered throughout the agriculture sector is, of course, the primary consideration when a telecommunications system is being planned. A profile of previous and current communications systems should include answers to questions like the following:

- What roles have communications media played in reaching extension personnel with information? How credible were these programs?

- If a communications system is currently in place, what is it used for, how has it performed, where is it physically located, and who operates it?

- How reliable or frequent is the mail or transport system between various agricultural centers and institutions?

- How is research information gathered, analyzed, and shared? Is rapid dissemination important?

- What communications support does the extension service have at its disposal for working with farmers? Check into brochures, posters, mobile vans with projection equipment, and radio broadcasts. How well coordinated are the activities? Do extension workers know, for example, when appropriate broadcasts are scheduled?

- How do extension workers get information when confronted with non-typical conditions, such as unusual plant disease, floods, and so forth? How are new information, technologies, and methods delivered to extension workers?

- How significant for farmers are the services of extension workers compared with other potential sources, such as radio or merchants?

- In summary, how can telecommunications be used to increase the timely availability of supplies, credit, weather information, and the many other goods and services that farmers rely on? What actions have to be taken to facilitate this?

SECTION IV: TELECOMMUNICATIONS INFRASTRUCTURES

The extent and organization of the national telecommunications system is central to communications support planning efforts. As the focus of this guide is on the utilization, adaptation, and, to a limited degree, expansion of existing telephone services for rural development purposes, a thorough knowledge of the telecommunications carrier and infrastructure is mandatory. In addition, the planner should have a good understanding of the general issues of Third World telecommunications and a reasonable familiarity with the technology. Both the feasibility study and planning stages require engineering assistance.

Most Third World telecommunications administrations are organized along similar lines. Either a parastatal or state agency, the telecommunications authority is nationally owned and operated by the government. It is responsible for the technical management and delivery of telecommunications services, such as telephone and telex, and often data and broadcast signals. However, unlike other governmental departments dealing with basic infrastructure (e.g., transportation, public works) and services (e.g., education, agriculture), the telecommunications authority is frequently expected to produce sufficient revenues to support itself, sustain infrastructural growth, and yield profits to the national treasury. This last point is particularly significant to the development planner as seldom are thin-route systems serving rural areas self-sustaining and an expansion priority. It is essential that the planner be aware of national policy determinations, trends, and tendencies in this area in order to understand the factors affecting communications support projects.

The Rural Satellite Projects in Peru, Indonesia, and the West Indies were the result of government commitment to rural development, telecommunications authority interest in expanding rural service, available transponder space, and attractive donor support.

Some revealing questions about infrastructural expansion are:

- How willing or eager are the government and telecommunications authority to support rural communications? Is it perceived as a political issue?

- Is there a governmental mandate to extend basic telephone service to rural areas? Has the telecommunications authority set as a goal a particular per capita or area service level? For example, in Indonesia the government has pledged to provide telephone service to each district government headquarters.

- What is the current expansion plan and amount of investment slated over the next five to 15 years? What are the technical priorities—satellite service or terrestrial systems?

- What are the government budgetary and funding cycles? This is important to keep in mind in considering project start-up dates, etc.

Analytical Base

In examining the telecommunications sector and assessing its role and viability for communications support projects, there are three key aspects for analysis:

- locus of technical responsibility
- extent and availability of service
- quality of service

Beyond the sheer physical parameters delineated by existing telecommunications systems, these issues have management and cost implications which are critical to communications support project feasibility and design.

Locus of Technical Responsibility

Considering the locus of technical responsibility is the initial step in developing a communications support project. Who or what institution(s) will provide, manage, and maintain telephone service? For basic telephone systems the answer is obvious: the telecommunications authority--or, less likely, local operating franchises--is responsible for the telecommunications network. However, with telephone-based systems, such as teleconferencing networks, the issue of responsibility becomes less straightforward. There are various options to be explored. Keep in mind, however, that this determination cannot be made solely on the basis of existing telecommunications infrastructure, but must concurrently include consideration of sector needs, resources, and capabilities.

Essentially, there are two components of technical service for teleconferencing networks: the **outside plant**, consisting of the space segment (satellite) and the ground segment (earth station, microwave, land lines) and the **inside plant**, consisting of "end equipment" (audioconferencing microphones and conveners, microcomputers, etc). Responsibility for these components can be apportioned in various ways between the telecommunications authority and the user. The Rural Satellite Program pilot projects are good examples.

In Peru, the existing telecommunications system was extended to provide both basic telephone service to the rural region and teleconferencing service to the field operations of the ministries of health, education, and agriculture. Because a telecommunications system did not previously exist in this area, the involvement of the national telecommunications authority--ENTEL--was essential. However, in addition to its responsibility for the outside plant, ENTEL assumed control of the inside plant as well as programmatic leadership, based on the multiple users, and anticipated less-than-full-time system use required for sector support. In this case, the intent was to avoid the problem of fragmented responsibility posed by many users. ENTEL staff, thus, had to undergo considerable training on both the teleconferencing technology and programmatic issues, so that the company could provide effective communications support service. And, most significantly, ENTEL was willing to modify its traditional role of commercially oriented technical service provider to become a social service provider.

In Indonesia and the West Indies, the locus of responsibility was split between the telecommunications authorities and the users, with the telephone company in charge of outside plant operations and the users in charge of inside plant and programmatic activities. This configuration was possible because in each case the users were limited to single entities--the Eastern Islands University Association and the University of the West

Indies. Furthermore, these users required full-time use of the teleconferencing systems. In the West Indies, however, responsibility for outside plant operations was divided among several telecommunications carriers because of the international nature of the teleconferencing system. Linking campuses in six different nations, the system fell within the jurisdiction of national telecommunications authorities as well as that of the international carrier, Cable & Wireless. Thus, the national companies provided local line service, while Cable & Wireless provided satellite, microwave, and troposcatter international links.

The issue of "locus of responsibility" holds particular significance for system reliability and performance. If the users cannot supply the resources or technical skills to operate the inside plant, service will be degraded. If the telecommunications carrier is unwilling to provide inside plant support, multiple user systems are likely to fall prey to the "what belongs to all, belongs to none" syndrome.

The experience of the Rural Satellite Program suggests a number of questions:

- If the communications support project crosses national boundaries, which telecommunications carriers will be involved? What organization provides domestic service?

- What is the ownership and organizational structure of the telecommunications authority? Are there multiple telephone companies? What is the division of authority for local or distance service, for rural and urban service, for domestic and international service? An organizational chart for the telecommunications sector is a helpful tool.

- How are rural telephone services operated? Are public call facilities operated under local franchise arrangements? Or are they managed by the telecommunications authority?

- Does the telephone company already offer telephone-based communications service (e.g., data, facsimile, teleconferencing)? If not, does it wish to offer such service? What functions does it assume or envisage? Does it offer programming assistance as well as "delivery" service?

- Is there a government regulation requiring that the telephone company own, operate, and control all telecommunications equipment?

- Will the telephone-based network serve multiple institutions with disparate functions? Or will it serve several groups within one institution or association? Is it likely that a central coordination office be established and supported by the user groups?

- Does the user group (and/or the telephone company) have the capability, resources, and staff to operate and maintain a telephone-based network?

Extent and Availability of Service

The extent of the existing telecommunications infrastructure and the availability of service are fundamental, albeit obvious, building blocks of information. If telephone service does not exist in the area or areas targeted for communications support, the

planner must add several steps to the assessment of project feasibility and to the planning process, namely:

- determine the means of extending the telephone system and the amount of required investment to put it in place and operate it
- project telephone use and traffic
- analyze anticipated revenues to projected costs
- ascertain willingness of the telephone company both to expand the system and invest in expansion
- identify other funding sources (donor agencies, user groups, etc.)
- assess user benefits in relation to investment (general public usage as well as private teleconferencing networks)

In comparison, if telephone service does exist, planning a telephone-based support project becomes essentially an exercise in coordinating user needs with technical facilities. Whereas the Peru Project required expansion of the telecommunications system into the targeted area through the addition of three earth stations, both the Indonesia and West Indies projects relied on existing infrastructure. Where telephone lines did not run directly to designated university facilities, new lines were laid from the distribution plant.

Availability of service is also an important factor to consider in planning a teleconferencing network. The capacity, i.e., number of channels and the amount of traffic sustained by the telephone system, should be ascertained before proceeding with program planning. Rural telecommunications systems are often characterized by a limited channel capacity and a high volume of use. For example, in the Peru Rural Satellite Project, the earth stations originally provided four channels apiece, which meant that a one-channel "dedicated" teleconferencing network would claim one-quarter of the telephone system serving the entire populace of the region. For obvious reasons, the telephone company may be unable or reluctant to provide service at this level.

It is, therefore, important to consider early on the nature of the network—whether it is to be **dedicated** or **non-dedicated.** The merits of dedicated networks are numerous: assigned channels for exclusive use (i.e., limited to the communications support activity); controlled, uniform usage resulting in higher line quality and less frequent degradation of audio levels; and greater ease of maintenance as problems are more readily isolated and treated. Conversely, non-dedicated networks are likely to suffer from inaccessibility, degraded and variable quality, and longer mean-time between repairs. It is unlikely that the attributes of the dedicated network will be eschewed in favor of the non-dedicated. However, other network selection criteria come into play. First, as mentioned above, is the issue of availability. Traffic volume may preclude the option of a dedicated network. Second is cost. Dedicated networks are more expensive to lease, providing 24-hour service as opposed to as-needed service.

If, as in Peru, anticipated use of the teleconferencing system presents a low hour-per-day rate, a dedicated system may not be warranted. In Peru it was determined that the relatively small number of development workers in the region available to participate in teleconferences precluded a dedicated network. The teleconferencing activities share

channel capacity with regular public telephone service, requiring careful scheduling to accommodate both users and the telephone company. On the other hand, the high volume of teleconferencing and the large number of participants in Indonesia and the West Indies justified dedicated networks. Pertinent questions are:

- Is there telephone service in the targeted areas? What type of service (telex, facsimile, computer, etc.)? A telephone book is a useful, albeit incomplete, source of information.

- Do the targeted user groups have telephone service? At what facility (e.g., central campus, regional headquarters, field offices)? If not, where is the closest telephone facility to targeted users? Again, a map is a handy tool to plot the reach of the telephone system in relation to the users. It is also helpful to consider alternative locations that the groups might have access to if there is no possibility of a sectoral or institutional facility, such as a municipal building.

- Does the telephone company offer subscriber service or only public call service? Do local businesses and governmental offices have telephone service?

- Are lines and channel capacity available to "dedicate" to a private communications support network? If not, can the telephone system offer reserved space to the user groups?

Quality of Service

Quality of the existing infrastructure must also be ascertained. This includes not only the quality of the lines, but also the quality of service. Reliability is paramount in telephone-based or teleconferencing networks. If the technical delivery system is not reliable, user confidence will wane, and teleconference participation and attendance will be discouraged. Nor will the communications support project be able to fulfill its mandate to ease existing communication bottlenecks, facilitate information flows, and provide for immediate response and dialogue.

Although quality programming is the other important element of a successful communications support project, a fully functioning technical system is a prerequisite. The existing infrastructure must be able to support such a project. Indicators of its ability are the type of distribution system, the voice quality, telephone user attitudes, and statistics about the telecommunications system's performance and usage. Investigations should include all geographic areas that will participate in the communications support project, including international, regional, and local telephone systems as appropriate.

- What is the means of signal distribution? Is it a terrestrial network, microwave, or satellite-based system? In general, satellite systems will offer the most reliable means of signal distribution. Terrestrial systems are maintenance intensive and liable to frequent problems in the resource-scarce Third World.

- How far is the intended teleconference facility from the point of distribution and by what means can it be connected with the telephone system? The longer the land lines run to the point of distribution, the greater the chance of frequent down-time.

- Is the quality of the existing telecommunications infrastructure high enough to support the anticipated uses (e.g., voice, data, graphics transmissions)? If not, is the telecommunications authority willing and able to upgrade and maintain the quality of service? A simple first test would be to make calls within, into, and out of the targeted area. Is there noise on the lines? Can you hear and are you heard clearly? Did the call go through easily and swiftly? Try to replicate the envisaged communications support network as far as possible.

- What changes will have to be made in the existing structure to permit point-to-multipoint communication? Is the telephone company able and willing to make those changes including the purchase of additional equipment and the modification of operating procedures?

- Does the telephone company offer similar service or access to other (including international) data, teleconferencing, computer, etc., networks? If so, it is a good indication that both technical quality and operational experience can support a telephone-based network. Talk to the users to verify.

- What are the general public attitudes about the regular telephone service? Are they satisfied with the quality? How do they describe the quality? This is an important point to explore because often line quality that is marginally satisfactory for individual communications is not sufficient for lengthy multi-site teleconferences. Comments such as "I can hear, but I have to shout" reveal potential problems.

- What is the number of calls placed? What percentage are successfully completed? Are the reasons for non-completion technical and/or administrative?

- Does the business sector use the telephone system? Are they satisfied with the service? How often do they use it?

- What is the general state, age, and condition of the equipment comprising the telephone system? Are the land lines aged, worn, and damaged by water, insects, etc.? Do the manual bridges exchanges perform adequately? Talk to staff at various levels in the telephone company from the central operations bureau to the local technical office.

The quality of the telephone system will also affect the network configuration and the type of services provided by the communications support project. All three Rural Satellite Projects have used multi-site audioconferencing networks with marked success in rural and remote areas. However, the experience of using three different systems serving a total of 25 sites provides useful lessons for project feasibility assessment and planning.

"Network configuration" describes the number of teleconferencing facilities serving the user groups and the way in which these sites are linked by the telecommunications system. Some sites may be connected into the communications support network by microwave, land lines, or satellite—including the possibility of a small earth station at the local sites. As mentioned above, the telephone service distribution system can affect signal quality; it also can influence network configuration.

If the quality is "noisy" at each site because of worn or damaged land lines and the distribution system adds even more noise (e.g., electrical storms can cause noise in the

network), the effect is cumulative. The more sites, the more opportunity for noise to degrade quality and inhibit clear communication.

If the potential for noise appears high, the feasibility of a communications support network is low. However, there are other options: the number of sites can be decreased or limited to those with the "cleanest" reception/transmission, or the planner can explore the possibility of a "gating" device which prevents sites from transmitting noise into the system. This device was created by the Rural Satellite Program for the Indonesian Project which, with 11 initial teleconferencing sites, experienced the greatest noise problem of the three projects.

Noise is also a factor in the selection of end equipment—which essentially determines the type of services the communications network will offer. Central to a telephone-based communications system is audioconferencing. If the voice quality of the general telephone system is poor, it will not improve over an audioconferencing network without special adjustments. Voice quality required for teleconferencing networks not only must be comprehensible, but also be of a quality that can be easily listened to for an extended period of time. It is the Rural Satellite Program's experience that most telephone systems can be treated to provide acceptable voice quality over a teleconferencing network.

Other end equipment is not as forgiving as basic audioconferencing equipment. Equipment offering graphics capabilities—telewriters, facsimile, microcomputers, slow-scan video--are extremely sensitive to noise on the telephone system. In fact, their performance, and hence utility, can be so severely degraded as to be incapacitated. In Indonesia and the West Indies, the two Rural Satellite Projects which experimented with graphics transmission, the telewriting equipment was never well integrated into the audioconferences because of erratic performance.

If user assessment shows the necessity of graphics transmission, the telephone system must be carefully scrutinized to determine its capacity for carrying non-voice transmissions. It may be unable to support such equipment. Awareness at the feasibility stage will ensure realistic implementation planning at a later date.

- What is the quality of telephone reception at each site, or at the nearest telephone terminus?

- By what means will telephone service be provided to each site?

- Which sites pose potential problems? As usual, a map is helpful in charting a proposed network.

- Does telephone system quality correlate with any natural phenomenon, such as rain, electrical storms, etc.? Ask the local telephone company technician or exchange operator. How often does this occur?

- Can the telephone system be "treated" to improve quality? Could a "gating" device be an acceptable solution? Would the telephone company permit such devices to be installed at its locations.

- What user needs have been identified? What services should the communications support network provide?

- Is the end equipment compatible with the telephone system quality?

The planner must also address the resources necessary to maintain and support a telephone-based network in order to determine the feasibility of a communications support effort. The availability of resources—as diverse as skilled technical assistance and personnel to operate end equipment—will affect the design of the communications support project.

- Are staff available to operate and maintain the teleconferencing network? Do they have the necessary skills? Can they be available on a full-time basis? Do they have other responsibilities? Are they familiar with teleconferencing technical networks?

- How will required technical training be provided? Does the telephone company operate a training school, or can it provide training for teleconferencing equipment?

- Beyond telephone service and end equipment, what other material resources are needed? Is there a reliable power source? What is required to supply electricity? Who will do it? This is a basic item to consider. In Peru, some isolated and unmanned teleconferencing sites were operated on batteries which required frequent recharging. The consequence was that the batteries were not maintained as required, resulting in frequent down-time.

- Is equipment locally manufactured or supplied? Where can replacement parts be obtained? Within what time frame?

- Will the project provide for spare parts supply?

- Is there a local repair facility? Where can equipment be repaired? What is the time frame?

The basis of accurate feasibility assessments is a comprehensive analysis of the telecommunications sector. This section has provided initial questions. The planner must add his own to reflect the uniqueness of his project.

SECTION V: CONSIDERING COSTS

Cost is the final element to consider when planning a telephone-based communications support project.

Expanding telecommunications infrastructure to provide rural communications services is not always an "economically" rational thing to do. In general, rural telecommunications systems cannot be counted on to produce sufficient revenues to cover capital and operational costs. Such decisions must address the larger issues of the social, developmental, and ultimately economic benefits yielded by telecommunications systems. Persuasive arguments, which are gaining credibility in the developing world, contend that telecommunications systems should be regarded as other basic infrastructural amenities that support the common weal, such as roads, water supply systems, etc. However, the fact remains that most telecommunications authorities are expected to show a profit. Consequently, service expansion is generally governed by this guideline, with the result that rural areas are not always included in expansion plans. Therefore, policy decisions must be made at the highest planning levels and ultimately include not only the telecommunications authority but also the national planning administration and, quite possibly, sectoral ministries.

In those situations where the communications support network is primarily based on the existing telecommunications infrastructure, the capital investment costs are much less. Some new cable might have to be laid; some existing cable might need to be conditioned or replaced; bridging equipment might have to be purchased to allow for multisite communication. However, an entirely new infrastructure does not have to be put into place in a new locale. There is an expansion of communications services rather than infrastructure.

The purpose of this section is to aid the planner in determining the most cost-effective means of delivering communications support to targeted users in order to assess the feasibility of the project within the financial boundaries placed by the "client." The identification of resources required for a communications support project is the initial step in determining ultimate affordability. Thus, a basic understanding of cost implications is essential both during the feasibility and later planning stages.

Cost elements to be considered are:

- initial, one-time capital investments such as end equipment, additional outside plant, and related installation materials and expenses, and

- recurring costs for service delivery and operations such as transmission leases, technician salaries, and programming expenses.

Hardware and associated materials represent the most visible and probably the most easily quantified costs of a communications support project. In assigning values, the following should be considered:

- What type of end equipment is required or under consideration? How complex is it? The simpler the technology, the less expensive the equipment. For example, simple audioconferencing equipment (convener, microphones, speakers) can cost as little as $4,000 per site, while the more complex slow-scan video or telewriter

can cost up to $11,000 per site. Keep in mind that complexity will have ramifications for later maintenance and repair costs. Also complex equipment requires complex network control equipment which can also increase costs.

- What is the number of teleconferencing sites? What is the number of users? Obviously, the broader the user base the less the cost per user. More user groups or teleconferencing sites can help distribute the cost burden. However economically attractive, it must be remembered that there is a point at which the quality, efficiency, and utility of an interactive network decline.

- Are there cost reductions associated with bulk purchases? Offsetting this advantage may be reluctance to invest extensively in an untried network.

- What are the costs associated with installation that are necessary to make the communications support network work? Are distribution system or "line treating" devices required, such as a gating device? Must new lines be laid or old lines replaced to the teleconferencing facility?

- Will a teleconferencing facility (room, building, etc.) have to be constructed? Will existing facilities have to be renovated? For example, most audio-conferencing rooms require carpeting, acoustical tiles, security bars, etc.

- Will the end equipment require an emergency power supply? Air conditioning? Special furniture?

- What costs are associated with equipment and material transport? What are freight shipment rates, duty charges, and customs clearance fees?

- What are specialized services and manpower requirements? Does the equipment require professional installation and testing? Are technicians available to perform these tasks?

Recurring costs--or essentially the operating costs--are more difficult to identify and quantify because often the resources, such as manpower, are covered under other budgets.

- What are the transmission costs? Probably the most significant recurring cost will be the charges for telephone service. This will be affected by a number of issues.

- How many circuits or channels will be required? Can a single channel support both audio and graphics services?

- How many sites will be served? Can network design reduce the number of lines required? For example, in Indonesia the project used the satellite as a bridge, thus reducing channel requirements for ten sites from forty to two.

- Will "dedicated" or "non-dedicated" service be required? (See previous section for discussion.) How much "air time" will be required? What are hourly service charges?

- Have tariffs been established by the telecommunications authority for this type of use? Are there preferential tariffs? Can tariffs be negotiated? Are there economies of scale?

- How much will the manpower cost to operate, maintain, and repair the system? What are associated material costs?

- What are the monthly costs for teleconferencing facility operation, such as power, rent, janitorial services, etc.?

- What are the costs associated with program development and delivery? What manpower is required to coordinate program selection and scheduling, prepare and present programs, and develop materials? What are the costs of materials production and distribution?

Although pre-feasibility, feasibility, and initial planning studies do not necessarily require to-the-penny projections, the planner must realize that the cost implications of communications support efforts entail far more than the prominent telewriter or facsimile machine sitting at user headquarters. All the above questions must be considered to establish a "ball park" figure which is essential to feasibility determination.

After basic costs are identified, the planner must move to the next stage--determining cost feasibility. Generally, this must be viewed in light of existing resources. Obviously, if funds are available or have been earmarked for the communications support activity, the budget need only be analyzed from the perspective of the "bottom line" total.

It is a sad fact of life, however, that money is seldom readily available to support innovative programs. Although telecommunications appears to be rapidly gaining investment credibility in the developing world, the application of telecommunications to the problems of rural development is still a novel idea. Furthermore, telecommunications support networks by nature not only serve as supplements to institutional management and outreach capabilities, but in many cases also serve as a substitute for both infrastructure and manpower resources. Ultimately, the issue may be the diversion of funds from other programs to the telecommunications support activity. Therefore, the basic question shifts from "How much does it cost and are funds available?" to "Is investment in a telephone-based project warranted by the benefits obtained?"

Certainly, benefits do accrue from telecommunications support efforts--ranging from greater outreach to improved training and management capabilities, but is it worthwhile to divert or allocate scarce resources to a telecommunications project? At this point the planner must confront the dilemma of all cost-benefit analyses--how to quantify the benefits.

The object of a telecommunications support project is to improve the capabilities of institutions to fulfill their mandate to provide services to the inhabitants of rural and remote areas. Being a non-broadcast medium, these telecommunications networks will reach and directly affect only a limited number of the people in these areas. The aim of the network is to create a flow of information between specific groups at all sites. This information has to be delivered in a way that the recipients can understand and absorb. Once absorbed, the participants can use it to initiate changes that will result in improved living conditions in their communities. Unlike most infrastructure systems, such as sanitation systems which have a direct effect on community health, a communications

medium will only improve communications. To assess the human impact of a communications system, the end results of the information--be it simple messages or elaborate distance training programs--must be analyzed. Did the information provided to extension workers about the eradication of bean slugs cause farmers to adopt recommended procedures and thus result in increased bean production? Did the training program for health workers on infant diarrhea improve diagnosis and treatment and result in a decrease in infant mortality? Common sense says it should; many long-term and painstaking studies have convincingly demonstrated the impact of communications in concrete terms. Yet for the purposes of a feasibility and planning study, it would be difficult to quantify these ultimate benefits.

It is possible, however, for the planner to make the investment decision by focusing on direct products such as the telecommunications support project and by comparing the alternative costs associated with the telecommunications support activity and the programs it will be replacing or extending. For example, telecommunications typically can eliminate costly travel. Within a training context, the presence of a telecommunications network could substitute for the travel of participants to a seminar site or for the travel of trainers to a number of training sites.

In the West Indies Rural Satellite Project, it was found that a one-week face-to-face training course for 30 people from several islands would cost $19,000. Using the audioconferencing system to link the participants, the same training session would cost only $6,000. A fixed training budget stretches a lot further if basic costs are reduced.

Opportunity costs and increased outreach benefits should also be considered. To continue with the in-service training example: participants are professionals with duties and responsibilities which make extended absences from the work place both impractical and often impossible. In developing countries where the skilled manpower base is already strained, it is indeed a dilemma to excuse a doctor or health care worker from the urgent demands of his job to participate in a training seminar which would improve his skills. In economic terms, the cost could be assessed by determining the wage of a suitable replacement. The reality is that a replacement may not be available and the job would remain undone during the doctor's absence for training. In Peru, the Rural Satellite Project network was used to reach over 1,100 trainees in the health sector who either would have had to leave the area for training or not been able to participate.

By its ability to maximize resources to reach a greater number of people, unit costs are also reduced. In Indonesia, remote universities often relied on a visiting professor ("flying dosen") program to augment their teaching staffs. A professor, expert in a particular field, would leave his regular teaching duties to travel to another university for one to three weeks to present an intensive course to both students and faculty. As an alternative, the Indonesian Rural Satellite Project enables the professor to stay on his home campus, teach his regular students, reach students at many universities simultaneously, and teach at a more leisurely (and probably more effective) pace. Course delivery over the audioconferencing network is estimated at $10/course/student as opposed to the $64/course/student of the "flying dosen" program.

Other benefits are not so easily quantified. A telecommunications network can promote better institutional and personnel management, which may manifest itself in more efficient coordination of activities, increased work output, and better staff performance. Attention also has to be given to the intrinsic value of the activities carried out over the communications network. How does one calculate the value of knowledge gained, health conditions improved, or even lives saved? How does one

estimate and compare the value of training a doctor, family planning worker, graduate student, or high school teacher?

In summary, it is not always easy to assign a value to the benefits of a communications support activity. It is relatively easy to base an assessment of a communications network on quantifiable indicators such as numbers of programs, meetings, participants, and hours of use. An assessment can also be made of the cost of using the network compared with other communications means. It is much more difficult to assess the ultimate value of the programs themselves, their impact on the people and institutions involved, and the things that happened, that never would have happened if the communications network had not been in place. It is not enough for a communications support system to do many things; it should do important things well.

SECTION VI: PULLING THE PLAN TOGETHER

At this point, the planner will have collected the information relevant to his communications support planning goals. He can now proceed with information analysis and feasibility determination and move toward completing an initial project plan.

As discussed in Section I, there are three variables in planning a telephone-based communications project--need, telecommunications system support, and cost. The interaction of these variables will produce parameters and constraints which will serve to specify the most probable uses and the most viable technical options. As in any other feasibility or planning study, cost will become the final determinant.

The most efficient way to integrate information is again to use a map. Overlays can be used to "plot" the various types of information collected, such as:

1. The location of probable user groups and/or project sites;
2. the different types of user groups at each site (health vs. agriculture vs. education, if the communications support project is multi-sectoral);
3. the functions of the user groups at each site (central headquarters vs. field offices, source of expertise/information/decisions vs. receiving sites, provision of training vs. research vs. administration);
4. closest available communications facility to each site; and
5. technical services and equipment required at each site.

By this means, the relationships between the "variables" become apparent. From a feasibility perspective, a communications project may be precluded by the lack of affordable access to the telecommunications system or the fragmented organization and diffused needs of the user groups. From a planning perspective, perhaps one site will predominate as a good source of training or coordination; another potential site may be rejected because telecommunications facilities are too far removed; or a particularly remote site may be selected exactly because of its isolation from important information flows.

In the course of data collection, discussions with potential users of a telecommunications network have more than likely indicated considerable pent-up demand for communications services. Rare is the individual or institution which would eschew telephone service. However, the planner must analyze these needs very carefully in light of the communications support objectives (see Section II) to determine if they can, indeed, be satisfied by a telecommunications network. In other words: **Can a two-way communications network play a significant role in solving the identified development problem?**

Seldom can all "legitimate" applications needs be fulfilled by a single network or communications support project. Certainly in the early operating stage there is a better chance of success if the communications support project has a well-defined focus and user base. If applications have not already been clearly specified, the planner will have to prioritize needs according to the "social benefits" return of a telephone-based network and, of course, the viability of the users.

This last point is particularly important for both feasibility and planning efforts. Users should be assessed in light of their institutional affiliation and the support the institution can provide to the communications support project. This guide has focused on institutional use of a telecommunications network based on the Rural Satellite Program's experience that individual users, such as farmers or rural businessmen, have neither the resources nor organization to use a telecommunications network effectively.

As pointed out earlier, a telephone-based network which supports training, information exchange, and administration is best employed within an established organizational or institutional context. This does not mean that farmers do not have real communication needs, but that it requires some organizational responsibility to accommodate programming requirements as well as manage and maintain a telecommunications network. A farmers' or business association with a central coordination capability, such as a cooperative network or a chamber of commerce, would be an appropriate user.

Examination of the telecommunications infrastructure should answer the question **"Is there a viable means of providing telephone-based or teleconferencing service to targeted users?"** Engineering assistance at this point is a necessity.

The response is closely related to costs. At what cost level does a telephone-based network become viable? Obviously, telecommunications service can be provided anywhere, but the resources required may not be compatible with the resources available. If a communications support project will require the considerable expansion of outside plant in order to provide telephone service, the costs will be high. However, the project may still be deemed feasible if the alternatives and their associated costs are considered. For example, the costs of providing a teleconferencing network may be offset by savings from reduced travel expenses associated with administrative meetings, training seminars, etc. Or the social benefits of increasing the number of trained teachers may exceed the dollar investment in the technical system. **Do the developmental benefits of a communications support project justify the financial investment?**

In analyzing costs, the planner will have to consider the not easily quantifiable benefits and the resource investments from a perspective of time. Over a period of years, benefits generally accrue and costs—to some extent—decline.

Regretably, the experiences of the Rural Satellite Program cannot provide the values to assign to the "variables" of need, telecommunications support, and cost. Each situation will vary. Feasibility determination must ultimately depend on the weight ascribed by the client.

* * *

The information gathered by the planner also provides a firm basis on which to develop initial project plans.

At this point, user groups, project sites, telecommunications support, and budget guidelines have been identified. The following provides guidance in reconciling existing conditions with project objectives to produce a sound base for later detailed implementation planning.

- Identify suitable locations for the placement of the teleconferencing equipment, considering accessibility to users, type of power source, connector roads, etc.

- Consider the environmental factors which may influence equipment performance, such as humidity, dust, etc. Equipment should be selected or designed to withstand these conditions.

- Reconcile service requirements and equipment selection with technical and cost limitations.

- Consider the network installation process--transport, materials, and personnel availability.

- Identify management roles and responsibilities and consider a preliminary staffing plan. Who is in charge of the equipment? Who owns it?

- Establish resource contributions. Who will pay for what? How will expenses be divided? What will each site contribute? Each institution? Explore possibilities of in-kind contributions of staff, materials, etc.

- Identify skills and resources to support the project.

- Consider training requirements for software development, network management, and the technical system.

- Develop a budget including start-up and operational expenses.

- Establish realistic implementation schedules. Keep in mind that the processes of approval, system design, procurement, installation, burn-in, training, and operations development can take a few years.

CONCLUSION

Two-way, telephone-based communications networks can truly benefit rural institutions and users by providing access to expert resources, quality training, new technologies and methodologies, and scientific research, among other uses. They provide a means of communication with policymakers, a chance to ask questions and discuss problems, and an opportunity to participate in the decision-making process.

However, communications support projects that are truly effective must be based on thorough analysis, sound design, and realistic expectations. Technical networks must be integrated into institutional operations and supported with user and operator training. A state-of-the-art technical network alone does not ensure that desired benefits will accrue. It is the usefulness of programming and the suitability of applications which will determine the communications support project's impact on development. A network that fully satisfies important communications needs will prove to be well worth the investment.

This handbook is a first step toward assisting planners in achieving the objective of identifying such needs and creating such networks.

AID RURAL SATELLITE PROGRAM PUBLICATIONS

This report is one of a monograph series, "Telecommunications and Rural Development," prepared for the AID Rural Satellite Program by the Academy for Educational Development, including:

- **An Overview of the AID Rural Satellite Program**, Tietjen, K.
- **The Design and Installation of Rural Telecommunications Networks: Lessons from Three Projects**, Goldschmidt, D., Tietjen, K., and Shaw, W. D.
- **Distance Education via Satellite in Indonesia**, Shaw, W. D.
- **An Analysis of the Costs and Revenues of Rural Telecommunications Systems**, Goldschmidt, D.
- **A Handbook for Planning Telecommunications Support Projects**, Tietjen, K.
- **Training for Technology Transfer in Telecommunications Support Projects**, Tietjen, K.

Also included in the series is a report prepared by Florida State University:

- **An Evaluation of the Peru Rural Communications Services Project**, Mayo, J., Heald, G., Klees, S., and Cruz, M.

Other Rural Satellite Program reports available are:

- **Telecommunications Services for Agriculture and Rural Development: Experiences of the AID Rural Satellite Program**
- **Telecommunications Services for Health Care: Experiences of the AID Rural Satellite Program**
- **Peru Rural Communications Services Project: Final Field Report**

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