

EXTENDED EXECUTIVE SUMMARY

Rural Connectivity and Energy Initiative Program Design Phase

Winrock International

1. INTRODUCTION

The Executive Secretariat for Integral Development of the Inter-American Agency for Cooperation and Development (SEDI/IACD), in collaboration with the Renewable Energy in the Americas (REIA) Initiative of the Organization of American States (OAS), is establishing a Rural Connectivity and Energy Initiative with the aim of supporting the use of information and communication technologies (ICTs) in rural communities in OAS Member States, thereby facilitating the provision of high value community services. The Initiative will work to identify, test, demonstrate, transfer, and replicate “best practices” in the areas of energy, communications, and information technology systems, program and project design, high value applications of ICTs, and training packages for teachers and other personnel using or supporting rural ICT facilities. The goal of this “best practices” approach is to enable Latin American countries to significantly advance the quality of community services in rural villages.

Winrock International developed a technical paper with the IACD and the OAS Unit for Sustainable Development and Environment/REIA during the Initiative’s Program Design Phase. The Executive Secretariat for Integral Development of the Inter-American Agency for Cooperation and Development (“SEDI/IACD”) entered into a cooperative agreement with Winrock International, under which Winrock worked with the IACD and the OAS Unit for Sustainable Development and Environment/Renewable Energy in the Americas (REIA) on the Program Design Phase of the Rural Connectivity and Energy Initiative. Winrock is an independent non-profit organization with extensive experience in rural economic development, including rural renewable energy development, and assessment and planning of rural development and investment programs. The Telecommons Development Group, a Canadian consulting firm, also assisted in the preparation of this report. Winrock made an in-kind contribution equivalent for the implementation of the Program, consisting of staff time, travel expenses, and consultant fees and/or subcontract expenses incurred in the implementation of the Program. Sandia National Laboratories, a U.S. Department of Energy National Laboratory, also provided support for this investigation.

Winrock has assisted with accomplishing two critical tasks leading to the launch of this Initiative: assessing the market conditions for the Initiative, and characterizing typical energy, telecommunication and information technology packages that meet the community service needs in the target communities. This study focused on four countries as examples: Bolivia, Colombia, Guatemala, and Honduras. Information on Belize was also reviewed. As a result of this effort, it is anticipated that pilot projects will be designed and developed in one or more of the countries participating in this study; and a broad program description will be prepared and distributed to OAS Member States that highlights the opportunities that exist throughout the region for the implementation of similar projects.

2. INFORMATION AND COMMUNICATION TECHNOLOGIES (ICTs) FOR DEVELOPMENT

ICTs can contribute to development goals at both the micro and national levels by increasing the effectiveness and reach of development interventions, enhancing good governance, and lowering the costs of service delivery. Moreover, the right complement of targeted ICT interventions has the potential to play an even more substantial role in accelerating a sustainable dynamic of social and economic development in developing countries. ICTs can be a powerful enabler of development goals because their unique characteristics dramatically improve communication and the exchange of information to strengthen and create new economic and social networks. These characteristics suggest that ICTs have the potential, if conceived as a means and not an end in themselves, to be powerful enablers of development.

The positive benefits of ICTs generally fall into the following categories:

- ***Improved Educational Services and Distance Education*** – ICTs can enhance the quality and efficiency of education available in existing schools by expanding teachers’ and students’ access to instructional materials and other resources via radio, video, TV, computers, the Internet, and so on. ICTs can also be applied to facilitate “distance education” in areas where desired educational facilities are either insufficient or non-existent, such as in remote schools or in situations in which the student does not live near the educational facility she/he desires to attend. In poor, remote areas, affordability and geography have been real barriers to access to quality education. Combining ICTs with broadcast technologies and thoughtfully designed content can be an extremely efficient and cost effective way to address the problem of shortages of teachers and physical materials. In some cases, this is more cost-effective than building new physical structures and infrastructures.
- ***Increased Access to Information for Economic Development*** – The introduction of new ICTs such as telephones and the Internet can provide rural people with tools, skills and information needed to compete on an economic level with others in their own country and around the world. ICTs can help facilitate greater economic opportunities for people and enterprises by widening access to and efficiency of markets, allowing greater access to expanded economic networks, and creating new opportunities for employment. ICTs can enhance rural productivity in a number of ways, including: a) by providing access to practical information, for example, on small business accounting, weather trends, or farming best practices; b) by providing timely access to market information via communications networks to allow small entrepreneurs to make more informed decisions about where to do business, where to sell their products and at what prices, and where to get the best prices for inputs; and c) by facilitating access to rural finance.
- ***Agricultural Development*** – Information is an important input to the business of agriculture, and communication systems have been used very effectively by and for farmers even before the advent of the Internet. Broadcast media, particularly radio, has proven an extremely useful tool for agricultural development. However, the growing pressure of competition in the global market has created a growing need for farmers to access market information, to interpret this information to make informed business decisions, to diversify their products

and find new ways to market them. The Internet and ICT systems can be powerful tools for accessing this critical market and technical information, and because this is recognized throughout the agricultural sector, a significant demand has been created for improved telecom services in rural areas.

- ***E-governance*** – ICTs can help foster greater participation and political empowerment of the populace, and can help make government processes more efficient and transparent. ICTs can play a role in amplifying the voices of marginalized populations or those living in remote areas. E-governance is aimed at ensuring that common citizens have equal right to be a part of decision-making processes which affect them directly or indirectly, and influence them in a manner which best improves their conditions and the quality of lives. ICTs are also being used by local, regional, and national governments for improving the delivery of government services. ICTs can assist governance in a number of areas, including: a) supporting internal management; b) supporting policy and regulatory decision-making; c) making information publicly available; d) supporting public services, such as education, health and transport; and e) providing information regarding effective governance processes, such as how to manage participatory planning and stakeholder meetings.
- ***Health and Wellness*** – Recent and continuous advancements in ICTs and reductions in cost for an increasing number of ICT tools is making telemedicine and telehealth a reality for an increasing number of rural and remote communities both in developed and developing countries. ICTs are being used in many developing countries and communities to: a) facilitate remote consultation, diagnosis and treatment; b) facilitate collaboration and medical research among physicians; c) provide relevant medical training, such as “teach and test” modules; d) disseminate public health messages and disease prevention techniques; e) enable more effective disease surveillance and epidemic response mechanisms; and f) improve the administrative efficiency of public health systems and medical facilities. For example, ICTs have been useful in helping to raise awareness about family planning issues and as a tool for combating HIV by helping to spread information about prevention and treatment options.
- ***Disaster Mitigation and Response*** – ICTs are being deployed to monitor and respond to natural disasters, thereby reducing developing countries’ vulnerability to these events. ICTs are also heavily used as an information and networking medium, informing citizens about important and timely environmental issues such as drought, and offering them a readily accessible way to make their views known to decision-makers.
- ***Improved Environmental Information*** – ICTs can be used to collect, process, and disseminate information between distributed locations, enabling a better understanding of issues such as climate change and biodiversity, and helping to monitor ecological conditions so that prevention and mitigation measures can be activated. As discussed above, ICTs can also be used to reduce the consumption of energy, water, and other natural resources through more efficient agriculture and industrial procedures.
- ***Cultural and Indigenous Knowledge Preservation*** – ICTs appear to have potential as a tool for recording and preserving indigenous populations’ culture and traditions, and for educating the rest of the world about the importance of protecting indigenous values and

ways of life. The development of scientific research networks is also helping to empower indigenous research and development programs around the world.

- ***Cross-cutting ICT and Development Issues*** – There are also a number of cross-cutting issues that arise in nearly any development-oriented application of ICTs, such as equity in access to and use of ICTs, the flexibility of ICTs and capacity to reorient the technology to multiple uses, the need to ensure information flows across the “connective” or digital/non-digital frontier, and the question of information content production for ICT use.

However, access by the poor to ICTs—both “low tech,” such as radios and telephones, and more advanced, such as computers and the Internet—remains limited, particularly in rural areas of developing countries, where approximately 2 billion people lack access to reliable, affordable electricity. ICT development in rural areas will face a number of challenges related to scarce human resources (i.e., ICT-adept people located in rural areas), lack of electricity, and limited Internet connectivity which, when it exists at all, will often tend to be slow, unreliable, and expensive. Furthermore, ICTs should not be seen as a substitute for other development efforts. Rather, ICTs can be seen as a tool for strengthening overall development strategies by widening access to information products and services, and allowing for more efficient project implementation and impact monitoring.

The OAS/IACD recognizes that ICTs can make unique contributions to rural economic and social development. At the same time, numerous factors render rural use of ICTs more challenging. The OAS/IACD Rural Connectivity and Energy Initiative is designed to address the unique barriers to the rural application of ICTs.

3. RURAL ICT FACILITIES AND HIGH-VALUE SERVICES

A number of key issues affect the successful development of rural ICT initiatives, including common success factors, the critical role of rural telephony, and impediments and challenges to rural ICT deployment. The report discusses in detail four key types of development-related ICT applications: telecenters, ICTs for agricultural applications, ICTs for rural education, and telemedicine/telehealth programs.

Successful ICT initiatives employ the following eight common elements:

1. ***A good understanding of the market and a commitment to being demand-driven.*** Fundamental to the success of any ICT project is an initial assessment of the communication and information needs of the intended users. Equally important is the need to engage community members in a participatory planning process. This will help identify key stakeholders and community leaders, as well as existing organizations and information systems, upon which any ICT project must be based.
2. ***A strong awareness building campaign.*** Awareness building at all stages of ICT planning is critical for success. This needs to be directed to potential users of the services, but also to decision-makers who may not be aware of the possible uses of the ICT services. Successful

marketing is also vital to ensure that a telecenter or other ICT service is an integral part of the community.

3. ***An awareness of the importance of identifying and supporting local “champions.”*** In order to facilitate the introduction of ICTs as smoothly and as quickly as possible, local champions who believe in the project objectives and methodology need to be incorporated in the process from the start.
4. ***Effective strategic partnerships to ensure all project objectives are met.*** Through the formation of local private and public sector collaborations, projects can be better equipped with the human, technical, and financial resources needed to produce sustainable results. Partnerships may include project proponents, donors, private sector representatives, government, NGOs, and community groups.
5. ***Sustainability mechanisms.*** A telecenter initiative can become sustainable and maintain its sustainability if it meets the needs of the community; is based on cost effective networks and applications; the network and applications are easily upgradeable so that more services could be added with little extra cost; and the demand for connectivity is aggregated with other business/organizations that operate in the same community. The sustainable implementation and operation of ICT initiatives, especially telecenters, is dependent on a number of inter-related factors, including technical, cultural, economic, and political factors; the training, information and technical support provided; and the degree to which the initiative is integrated with existing building and management structures and projects.
6. ***Capacity-building for staff and clients.*** Capacity-building activities are necessary to ensure that both staff and clients will be in a position to utilize the technology and thereby have a stake in its future success and development.
7. ***Appropriate and user-friendly technology and a sound technical support system.*** In order for the proposed technologies to be easily understood and implemented, the applications should be appropriate to the context of the region where they are to be utilized. At the same time, the ICTs should be as user-friendly as possible, and should have a sound technical support system in place with qualified, professional, well-trained, enthusiastic, and skilled technical support personnel or volunteers.
8. ***A system for monitoring, evaluating and sharing experiences.*** Continuous monitoring and evaluation of the ICT initiatives is important for providing decision makers with information on how the initiative is being implemented, the utilization of different resources, how the objectives are being or have been met, and the level of satisfaction of both the users and the providers.

Key Issues in the Development of Rural ICT Initiatives

The Critical Role of Rural Telephony

The policies and programs implemented in support of rural telephony services are a critical part of the supporting environment for other rural ICT initiatives. In most cases rural connectivity can best piggyback on or leverage infrastructure also intended to support rural telephony. Among rural populations, voice communications will usually be the most immediately useful and easily accessible service (application). In addition, experience generally shows that for telecenters that serve as the primary means of access to rural telephony, voice communications (i.e. phone calls) will provide the overwhelming majority of telecenter revenues. For these reasons, it is important to examine in detail the rural telephony policy and programmatic issues that form part of the operating environment for broader rural ICT/connectivity initiatives.

Universal Access: Policies and Market Demand Assessments

The use of ICTs for rural and remote communities generally fall within the scope of “universal access” policies of national governments and telecommunication regulators. “Universal access” refers to the presence of a working, affordable telephone within reach of the whole population of a country, as opposed to “universal service,” which refers providing telephone service to all community members (based on the North American concept of a telephone in every home). Even now in Latin America, it is common for there to be fewer than ten telephones per 100 people, compared to over 64 lines per 100 people in the United States.

Typical access targets are one public telephone per 500 people, or four to five telephones (one payphone plus three to four business or institutional lines) per village. In some circumstances where populations are particularly dispersed, universal access policy may require only that people in rural and remote areas have access to telephone service within a certain distance from their community. In order for universal access targets to accurately reflect the needs of rural and remote people, regulators must engage rural and remote stakeholders in meaningful dialogue to establish jointly agreed upon targets. If regulators seek only to measure universal access in terms of tele-density (the number of lines per 100 people) operators may be encouraged to deploy lines regardless of location, people’s access, affordability or ease of use.

Armed with meaningful market demand data, regulators can design universal access policies to attract private investors, providing them with a fair operating environment, and enabling them to serve market demand. Such policies will have the objectives of making rural and remote telecommunication services financially attractive investments and of making the developed services fully available to their users. The demand for telecommunication services in rural and remote areas is often much higher than many people believe, and within an appropriate policy environment this sector can capitalize on that demand to achieve maximum commercial and socio-economic benefits.

It is frequently assumed that universal access policies must be based on the “fact” that rural and remote service is expensive and therefore unprofitable. Despite extensive evidence to the contrary, many regulators continue to believe in the myth of universally unprofitable rural and

remote service. However, commercially managed telecom services in competitive contexts can provide users with extremely affordable prices and high quality of service. Accurate and independent market appraisals and parallel involvement of rural and remote stakeholders in the design of universal access policies can help foster a viable competitive rural telecom market. People generally spend 1.5% to 2% of GDP per capita on telecommunication services. This general figure can be used to calculate the affordability and return-on-investment for rural telecommunications services. Applying simple formulas such as this one should in no way replace detailed demand assessments for rural telecommunication ventures; however, they can provide an indicative picture of the viability of rural ventures, and can help identify rural communities that are deserving of more intensive demand studies.

There are different approaches to financing universal access programs, some of which are conditional licenses; fees for connection to the backbone; incentives, including tax concessions, removal of duties and lifting of foreign exchange restrictions; rural development funds; micro-credit programs; build, operate, and transfer arrangements; and cooperatives and community-owned systems. From a regulatory perspective, if subsidies are used to promote universal access, the amount of subsidies and their specific application should be measurable, identifiable and transparent to ensure that they are not regarded as anti-competitive.

Key Regulatory Issues

Some of the key regulatory issues affecting universal service and the emerging ICT sector include:

1. ***Reform Means Liberalization and Privatization*** – The provision of universal ICT access includes the formation of independent regulatory bodies which promote competition, the encouragement of private investment to expand rural telecom networks, the process of deregulation, the provision of telecom opportunities for under-served populations, and the need for government to step back from their participation as providers of general telecommunication and ICT services, which are more efficiently run by the private sector. At the same time, countries may want to consider the issue of diminished national ownership of the sector through the increasing number of foreign investors entering the market. Compared to other sectors, restructuring and privatization of the telecom sector has had generally favorable results.

Latin America, along with Asia, has telecom and energy sectors boasting the largest worldwide success in attracting private sector investment. The example of Chile's success with rural telecom ventures highlights why it is a role model for other countries attempting to manage their rural telecommunication initiatives. The Chilean experience suggests a number of lessons that may be broadly applicable in other emerging economies. The key to accelerating rural telecommunications development is competition. An environment that encourages new entry and competition can go a long way toward meeting basic telecommunications needs in rural areas on commercial terms. Given the right policy environment, limited government subsidies generally suffice to close gaps between the commercial and social objectives of rural voice telecommunications development. Market forces can usually determine which projects really need subsidies and how much.

2. ***Interconnection*** – If new rural telecenters are established using the services of operators other than the incumbent, addressing interconnection agreements is imperative.
3. ***Unbalanced Tariffs*** – Most telephone calls within a rural network are calls that originate in urban areas or other countries and terminate at the rural network. For the rural operator, this kind of traffic pattern requires a tariff scheme that insures that the operator receives a portion of the revenues from calls that terminate at the rural network. If the national government or regulator legislates uniform tariffs, regardless of service area, rural and remote communities may be denied service if operators cannot afford to provide service. Thus, rural network operators and independent operators of telecenters need to be able to charge fees that may be higher than those in urban areas.
4. ***Entrepreneurial Public Calling Offices*** – The number of small commercial telecom entrepreneurs, often known as “public call offices,” which offer one or a few telephones and sometimes a fax machine, has hugely increased in the last few years, usually with no external financing from governments or external donors. More and more are starting to offer other services, such as photocopying and even Internet access. In many countries it is illegal to resell telephone service in such manners, despite the fact that this is an efficient way to move toward universal access. Entrepreneurial operators of telecenters and PCOs continue to bypass rules that work against them, but any initiative that involves government and/or donor involvement will need to look closely at inhibiting regulations of this nature.
5. ***Incentives for the Operators*** – Policy makers need to explore a range of alternative incentive packages for the provision of rural service, and select those that are most appropriate to the local context and national development objectives. These incentives can include universal service funds, public-private joint ventures, rural concessionary licenses, build-operate-transfer schemes with international investors, cost-based tariff reform tied to interconnection agreements that favor rural operators, special incentives for indigenous investments that support universal service, and “smart” subsidies.
6. ***IP Telephony and Technological Convergence*** – Internet Protocol (IP) telephony bypasses traditional telecom operators in favor of Internet gateways that utilize satellite technology for transmission and connectivity. The consequence of this for national telecom operators is that their long-standing telephone revenue streams are being reduced. Countries must face the threat that IP telephony might pose for future rural service provision due to the loss of capital by the operators.
7. ***Internet and Applications*** – The role that ISPs have—and should be enabled to have—in the future figures largely in the rural ICT access debate. It is important to protect ISPs to promote diversity in the sector. Such protection could include decreasing Internet costs while ensuring that liberalization is combined with the growth of local ISPs. It might also include introducing special tariffs to promote Internet usage, thus enabling users to make local calls to their ISP. E-commerce can also play a role, but there should be cooperation with ISP operators in the provision of low-priced telephone access, and telecom equipment should be made available to ISPs at internationally competitive prices.

8. ***Civil Society Participation and Gender in Policy Development*** – Policy needs to be developed with much greater participation from civil society—including women and youth—and non-governmental organizations so that rural ICT access programs truly meet nationally recognized, sustainable development objectives.

Impediments and Challenges to Rural ICT Development

Physical isolation, low income levels and lack of ability to pay, and underdeveloped infrastructure in rural areas all combine to jeopardize the sustainability of information and communication services. Rural areas share several characteristics that have a powerful cumulative impact on the provision of rural telecommunication services. ICT project designers and implementers should anticipate these potential obstacles and devise approaches to mitigate them.

One common obstacle to rural communications is scarcity or absence of public infrastructure systems, such as reliable electricity supply, water, access roads, and regular transport. This can be mitigated through the use of low-power, low-maintenance technologies and off-grid energy systems. Underdeveloped social infrastructures, such as health clinics and schools, are often much harder to address, and are often themselves the subject of ICT interventions. Another common obstacle is scarcity of technical personnel. This might be solved using remote network management over communication lines. Rural ICT initiatives also often face severe climatic conditions that make critical demands on the equipment, and difficult topographical conditions, such as lakes, rivers, hills, mountains or deserts, which render the construction of wireline telecommunication networks very costly. Technical solutions, such as ruggedized or tropicalized equipment and equipment shelters, and satellite or terrestrial wireless infrastructure, can be used to get around these barriers. Usually, the most difficult obstacles to address are those having to do with the demographics of the community, such as poverty, lack of activity in the cash economy, low population density, and so on. In these areas, it is important to ensure that ICT initiatives are incorporated into broader community development activities, and to focusing on providing universal access, rather than universal service, as a first step.

When multimedia services such as Internet access, video-based educational programs and telemedicine are added, the difficulties of maintaining rural networks are compounded. Some general factors should be considered when selecting technologies and applications for rural areas, including:

- ***Infrastructure*** – Ease of installation and operation and maintenance; tolerance of environmental extremes.
- ***Energy*** – Level of power consumption; compatibility with off-grid energy solutions.
- ***Social Benefit*** – Variety and flexibility of service applications; support for local languages; skills and/or training required by end users.
- ***Cost*** – Modularity and scalability; compliance with recognized standards; initial and lifetime costs; “future proof” technology evolution.

Rural ICT Applications

In the rural development context, ICTs can be a means of promoting *improved services*. The following sections describe some of the ways ICTs can be applied to promote improved services for rural areas. The first describes community ICT centers that provide a myriad of ICT-related services, which we have lumped here under the general term, “telecenters.” Subsequent sections focus more narrowly on ICT applications for improving services within specific development sectors, including education, agriculture, and health.

Telecenters

Telecenters have emerged in the last ten years as the primary means for providing public access to a range of telecommunications services and particularly the Internet. Telecenters may offer a broad range of services—from basic telephony to a variety of enhanced specialized services as sophisticated as video conferencing and on-line banking—and employ a variety of management structures. Regardless of type, size, or management structure, the development of a rural telecenter project or program should invariably follow the subsequent set of steps: 1) Conduct a community audit; 2) Select the telecenter site(s); 3) Select the operator(s)/management group(s); 4) Create a forum for operators and managers; and 5) Select the equipment used in the telecenter(s).

There remain many challenges to telecenter operations. Some include:

- *Not promoting a system that leaves the community dependent on external agents.*
- *Introducing new technologies such as the Internet and the telephone to rural areas when they may not be regarded as permanent or regular sources of information.*
- *Overcoming illiteracy as a barrier to telephone and computer use, especially in cases involving computers and rural farmers.*
- *Providing adequate information on and promotion of telecenters throughout the community.*
- *The need for local content, especially contending with the need for information material in the local language.*
- *Adapting to and meeting the community’s training needs.*
- *Developing appropriate pricing levels that meet the abilities of low-income users.*
- *Staffing telecenters, in terms of identifying staff needs, addressing training and resource issues, and retaining skilled staff.*

ICTs for Rural Education

In recent years a great number of ICTs have been developed for and applied to the improvement of rural education programs, changing the foci and increasing the efficiency of traditional distance education models. This has led to more and better educational tools to meet the educational needs of child and adult students at a variety of different levels in rural areas. ICTs are increasingly used to supplement educational services in the following ways: a) by providing teacher materials and curriculum support; b) as an additional skill or subject matter for students

to master; c) as enrichment for existing courses, offering new pedagogical approaches; and d) for distance education.

The most often discussed and dramatic use of modern ICTs in education focuses on distance education, where the technology either significantly supplements or entirely replaces a human teacher. There are several models of ICT-enhanced distance education that are presently in use, including interactive radio, Internet use, School Linking, Virtual Schools, and video-based instruction. A wealth of materials has been developed to support teachers in remote classrooms. For example, Mexico's Telesecundaria program has developed thousands of hours of instructional video programs for transmission through its Edusat Network, as well as educational CDs that can be used by students to both learn curricula and develop computer skills.

ICTs for Agriculture

Information is an important input to the business of agriculture. The growing pressure of competition in the global market has created an increasing need for farmers to access local, national, and international market information, to interpret this information to make informed business decisions, and to diversify their products and find new ways to market them. ICTs can be powerful tools for accessing this critical market and technical information, and broadcast media, the Internet, and other ICT tools can be used very effectively by and for farmers in developing countries. Various manifestations of agricultural applications of ICTs exist in developed countries and are emerging in developing countries. They include:

- Dynamic information, communication, and learning tools, such as World Wide Web databases, electronic mail networks, electronic newsletters and bulletins, and distance education programs that are facilitated via the Internet and telecommunication networks;
- Applications of voice telephone or text messaging systems for communication and information sharing tools that provide agricultural information hotlines and research directories;
- Creative relationships between Internet tools and other media such as rural radio and print media;
- Linkages between electronic media and face-to-face workshops, discussion forums, and "kitchen table" meetings;
- Geographically distributed video and audio conferencing systems via telecommunication networks and satellite systems;
- Publicly accessible geographic information system tools; and
- Linkages with community communication centres and community organizations for improved information dissemination and feedback.

There are a number of emerging examples of agricultural applications of information and communication technologies that hold significant promise for replication in developing countries. Some include: the FAO/UNFA FarmNet program in Uganda; the Philippine Department of Agriculture/Winrock International PinoyFarmer program; FAO's Virtual Extension-Research Communication Network (VERCON) in Egypt; the Counter-Narcotics Consolidation of Alternative Development Effort (CONCADE) in Bolivia; the CAB International Compendia of agricultural, trade, and environmental "practical knowledge solutions;" and the WorldSpace Foundation's Connect Rural Knowledge Venture in Africa.

Telehealth/Telemedicine

Recent developments in ICTs have raised the hopes and expectations related to broader use of telehealth and telemedicine. Continuous advancements in the ICT sector, associated with the lowering of costs for ICT services and the integration of such technologies have made possible the introduction and use of telemedicine in an increasing number of rural and remote communities all over the world. Today, telemedicine applications range from the use of telephones to high-speed specialized data and video communication networks. Use of ICTs for real-time diagnosis and treatment is still expensive, particularly compared to the limited funding available for rural health programs, due to cost of doctors' time and high bandwidth connectivity. ICTs can support more efficient and effective management and operation of rural health services, however, in a number of pragmatic "telehealth" applications that are less ambitious and expensive than telemedicine per se.

4. CHARACTERIZATION OF TYPICAL ICT AND ENERGY SYSTEMS

This chapter outlines the process of selecting ICT and energy equipment packages—including wireless communications technology—for rural settings, and of conducting a thorough analysis of application requirements and site characteristics in order to determine a suitable wireless solution. This chapter also offers models of possible rural telecenter solutions that might be applied in Latin America, including ICT equipment, connectivity options, and appropriately sized power systems, and gives cost estimates for the various options. The telecenter types modeled differ in the type and number of computers (e.g., desktop vs. laptop, more energy efficient vs. less efficient) and telephone lines and the resulting bandwidth requirements.

Energy Needs and Rural ICTs

For ICTs to function, an adequate and reliable supply of electricity is essential. Although many rural areas in the world are connected to utility electric grids, there are still approximately 2 billion people in communities worldwide who do not have such access to reliable, relatively inexpensive electric power, the bulk of whom live in rural areas. In Latin America and the Caribbean, the percentage of the population without access to electricity is estimated at 14%, or 70 million people. These people, however, could benefit greatly from the use of ICTs. Although the coverage of electric grids is rapidly being extended throughout the world's developing countries, there still exist a vast number of communities that will continue to lack grid electricity for the foreseeable future. For these people, other energy options must be considered if they are to benefit from the use of rural ICTs. Fortunately, several "off-grid" energy options exist for rural areas.

While fossil-fueled mini-grid systems can be viable in many instances, in the case of rural ICTs, other considerations may make these systems less advantageous. For instance, the actual quality of the electric signals produced by the diesel generator can be low enough that they can damage the more sensitive components in an ICT system. Also, if a mini-grid is run for only a few hours each day, this can significantly inhibit the potential uses for a rural telecenter. These issues can

be overcome through the implementation of power conditioning equipment, battery banks, and even possibly the inclusion of renewable energy components, but all of these will add to the cost and complexity of a system.

Renewable energy technologies (RETs), such as solar photovoltaics (PV), small wind-electric turbines, and micro-hydro systems, are often the best way to meet energy needs in rural areas in developing countries, especially as they relate to the use of ICTs. Although the initial purchase cost of a renewable energy system can be considerably higher than a small diesel or gas generator, the cost savings over the lifetime of the equipment, in terms of fuel, operation, and maintenance, can make RETs a much more economically viable option. In addition, RETs offer considerable environmental advantages, with essentially zero emissions of pollutants during their operation. In locations with micro-hydro power or 24-hour diesel power, the energy costs of ICTs will be fairly low. In many cases, however, PV systems will be the most appropriate power option. Use of PV does require careful selection of end-use equipment, however, in order to minimize the cost of the power system. This report mainly focuses on the use of PV systems.

In the implementation of renewable energy systems as part of a rural ICT project, several important considerations must be addressed to assure the quality and longevity of the energy system. These considerations principally involve assuring that the capacity of local suppliers is sufficient to adequately design, install, and maintain the system, and that the users receive adequate training in its proper operation. This, of course, is of equal importance in regard to the ICT equipment. In addition, component guarantees and an overall system warranty should be required of the equipment supplier and installer. All parties, including technicians and operators, should be trained in the proper use and maintenance of all related equipment.

Basics of Wireless Communications

Selecting wireless communications technology for rural settings requires a thorough analysis of application requirements and site characteristics. Perhaps the most important step in designing a robust, cost-effective wireless solution is defining the application and services for the end users who are expected to utilize them. Network designers need detailed information on the application requirements and physical location of the equipment in order to create a workable solution providing for the connectivity, bandwidth, and quality of services required.

Among the factors affecting connectivity and bandwidth requirements are: a) application (e.g., email, WWW browsing, telephony, video, etc.); b) number of users (per site / total); and c) type of data generated by application (symmetric vs. asymmetric, burst vs. continuous, real time vs. delay-tolerant). Wireless technology selection and configuration is primarily influenced by location characteristics; in other words, whether the terrain is hilly or flat, the amount of clearance available, whether there are path obstacles or interference from nearby radio sources and electricity installations, the presence of an appropriate site for antenna mounting, the distance between the antenna mast and end user terminals, and the geographic distribution of end users. There is no “one size fits all” wireless solution. The choice of one technology over another, and the selection of a particular system among competing options within each category, require a careful analysis of the economic, engineering, and application requirements specific to each ICT project.

Some wireless connectivity options include: very small aperture terminal (VSAT) networks; cellular telephony networks; fixed wireless access (FWA); broadband spread spectrum FWA; multi-access radio (MAR) point-to-point (PTP)/point-to-multipoint (PMP) systems; multipoint multichannel distribution service (MMDS); local multipoint distribution service (LMDS); and packet radio.

Costs: Factors Influencing Computer and Other Equipment Selection

- **Imported vs. Locally Assembled Computers** - Computers in Latin America are either imported from brand name manufacturers abroad or assembled from imported components by local companies. Brand name desktop systems (including a CRT monitor) can be bought for as little as \$650 in many countries, while a new laptop computer typically starts at \$1000-\$1200. Locally assembled clones or “white boxes” cost significantly less than imported models.
- **Computer Power Consumption: Desktops vs. Laptops** – The energy consequences of computer selection can be significant. It is estimated that a telecenter with a standard desktop computer and CRT monitor consumes much more than twice as much power as the same telecenter outfitted with a laptop—about 940 watt-hours per day compared to 370 watt-hours, respectively, for a telecenter with one computer. This difference increases to a factor of three or more as the number of computers increases, representing a greater portion of the overall energy consumption. A simple comparison of the power required to run a laptop versus a desktop underscores the impact this choice can have on power system cost. As illustrated in Table 1 below, even the most efficient desktop consumes roughly five times what a laptop consumes. For every additional “efficient” desktop, the associated investment in power system cost can range from \$4,500 to \$6,000, compared to only \$900 to \$1,500 for each laptop. In the case of less-efficient desktops, which are often the “cheaper” and more available models in Latin America, the additional power system investment can be as much as \$10,000 per computer. Thus, a \$1,000 savings for a desktop (or a donated unit) cannot be justified on an energy basis.

Table 1: Laptops vs. Desktops: Power and Cost Comparison

Computer Type/Efficiency	Typical Average Power Consumption	Energy System Cost per Computer
Laptop	15-20 W	\$900 - \$1,500
Desktop + Monitor: <i>efficient</i>	100 W	\$4,500 - \$6,000
Desktop + Monitor: <i>average</i>	140 W	\$7,500 - \$10,000

There are two main reasons why desktop systems consume much more power than notebook computers. First, notebook computers use energy-saving liquid crystal display (LCD) monitors as opposed to standard CRT monitors. Second, the CPU, software, and components in a notebook are designed to conserve power so as to maximize battery operation times. A number of manufacturers offer desktop systems with lower than average power consumption, which are often sold with LCD displays. The issue of laptops versus desktops merits special

attention given the impact it can have on energy consumption and therefore system size and cost. The choice of computer hardware is not, however, always a simple decision of cost, but is often complicated by such factors as: whether or not to accept hardware donations (new or used); the importance of field ruggedness; ease and cost of repairs, etc.

- ***Rural Equipment Selection*** – Given the disparity in power consumption and the cost of off-grid electricity systems, there would appear to be no justification to use desktop computers in off-grid telecenters. However, there are other factors that come into play in determining whether laptop computers really save money for off-grid telecenters over the life of the equipment. First, when it is time for a desktop system to be replaced, the owner can usually save \$100 or more by continuing to use the old CRT monitor. Second, laptops tend to be more susceptible to damage in the rural environment. Third, laptops are more difficult and costly to repair than desktop systems. In rural areas, the cost of replacement parts is compounded by the relative scarcity of notebook repair facilities. Thus, selection of specific computer models for telecenter use is typically a decision made by the telecenter operator after balancing multiple factors, including: price of hardware, software and peripherals; usability in a telecenter environment; energy consumption; warranty, maintenance and repair services; and dealer incentives, such as bundled software packages.
- ***Other Equipment Options*** – Different types and models of other, non-computer equipment, such as printers, fax machines, televisions, lightbulbs, and so forth will also impact power requirements and costs of the telecenter. With printers, for example, the average laser printer for commercial use consumes 77W in active mode and 25W in low power mode, whereas the average inkjet printer consumes only 17W in active mode. Inkjet printers are also significantly less expensive than laser printers. With lighting, while compact fluorescents are several times as expensive as incandescents, their lifetimes (typical rating is 10,000 hours) outweigh the cost differential, and they offer significant energy cost savings.

Examples of Rural Energy and Connectivity Solutions

This study provides four examples of complete rural telecenters, including ICT equipment, connectivity options, and appropriately sized photovoltaic (PV) power systems. The first scenario is a basic telecenter without connectivity. The three subsequent scenarios include a telecenter with VSAT-based satellite connectivity, one with narrowband packet radio, and one with 802.11b spread spectrum fixed wireless access. These technologies represent the leading edge of current efforts to supply affordable connectivity in remote areas. The costs of the ICT equipment, along with the power requirements and related PV system size and cost, are compared for each scenario.

Telecenters in Latin America vary widely in terms of size, services offered and population served. In order to provide meaningful ranges for the costs and energy requirements of rural telecenters in the region, this report defines three different telecenter sizes with associated levels of service. The telecenter types differ primarily in the number of computers and telephone lines and the resulting magnitude of their bandwidth requirements. Type A telecenters contain one computer, Type B telecenters contain five computers, and Type C telecenters contain 10 computers (Table 2). All of the telecenter types modeled for this study provide telephony, email,

printing, and at least minimal WWW browsing services to the end users in their service area (in some cases the web-browsing capabilities/bandwidth are significant). Model telecenter configurations are described in the table below.

Table 2: Telecenter Configurations by Type

Telecenter A Connectivity Equipment	Telecenter B Connectivity Equipment	Telecenter C Connectivity Equipment
1 PC	5 PCs	10 PCs
1 Inkjet printer	1 8-port ethernet hub	1 16-port ethernet hub
1 Telephone	2 Inkjet printers	3 Inkjet printers
2 Indoor lights	2 Telephones	5 Telephones
1 Outdoor light	1 Fax machine	1 TV
	4 Indoor lights	1 VCR
	1 Outdoor light	1 Multifunction fax/printer/copier
		8 Indoor lights
		1 Outdoor light

- **Model A Telecenters** represent the smallest telecenter unit with a simple configuration of one PC, one telephone, and an inkjet printer. Type A telecenters offer telephony, email, textual web browsing, and printing services. They may also offer offline use of the PC for services such as word processing and computer training. The telecenter requires one telephone (or voice) connection plus bandwidth for Internet access ranging from 9.6 Kbps to 64 Kbps.
- **Model B Telecenters** are comprised of five PCs, an ethernet hub to network the PCs together, two inkjet printers, two telephones and a fax machine. Services provided include telephony, fax, email, web browsing, printing, occasional photocopying, offline PC usage and computer training courses. The Type B telecenter requires three standard telephone lines plus Internet access bandwidth ranging from 48 Kbps to 256 Kbps. The absolute minimum bandwidth requirement of 48 Kbps was estimated based on the need to provide at least 9.6 Kbps per PC at any given time in order to support email and limited web browsing for five customers simultaneously ($9.6 \text{ Kbps} \times 5 = 48 \text{ Kbps}$).
- **Model C Telecenters** are the largest centers modeled in the study and they contain ten PCs, an ethernet hub, five telephones, three inkjet printers, a multifunction fax/printer/copier/scanner device, a 25" color television and a VCR. Services offered include telephony, fax, email, printing, computer training courses, offline PC usage, web browsing, pre-recorded educational videos, scanning, and copying. Bandwidth required for Type C telecenters ranges from 128 Kbps to 512 Kbps.

Table 3 provides an overview of the size and cost ranges resulting from this study. It is important to note how the power system cost is influenced by the use of laptops versus desktops, due to the significant difference in their power consumption. For example, under Scenario 2 (telecenter Type C with VSAT), while the connectivity and computer equipment costs \$1,840 less when the 10 computers are desktop PCs, the installed power system costs more than \$37,000 more than for

a system using laptops. Even with the assumption that approximately \$10,000 of this cost is estimated for installation and vendor fees, the cost difference remains significant.

TABLE 3: OVERVIEW OF RESULTS

Telecenter Type*	Connectivity Component	ICT Equipment Cost	Power System Size	Installed Power System Cost¹	TOTAL COST
Scenario 1: Single remote telecenter (no connectivity)					
<i>A – laptop</i>	None	\$1,432	150	\$4,125	\$5,557
<i>A – desktop</i>	None	\$1,250	400	\$7,807	\$9,057
<i>B – laptops</i>	None	\$6,832	600	\$11,028	\$17,860
<i>B – desktops</i>	None	\$5,922	1800	\$29,634	\$35,556
<i>C – laptops</i>	None	\$13,977	1050	\$18,383	\$32,360
<i>C – desktops</i>	None	\$12,157	3300	\$56,099	\$68,256
Scenario 2: Single remote telecenter with VSAT connectivity					
<i>A – laptop</i>	VSAT	\$4,432	300	\$6,319	\$10,751
<i>A – desktop</i>	VSAT	\$4,250	500	\$9,462	\$13,712
<i>B – laptops</i>	VSAT	\$9,832	750	\$13,693	\$23,525
<i>B – desktops</i>	VSAT	\$8,922	1800	\$29,270	\$38,192
<i>C – laptops</i>	VSAT	\$19,977	1200	\$20,801	\$40,778
<i>C – desktops</i>	VSAT	\$18,157	3400	\$59,815	\$77,971
Scenario 3(a): Wireless extension of connectivity from central telecenter to remote mini-telecenter (Packet Radio)					
<i>C – laptops</i>	Packet Radio	\$15,518	1050	\$17,960	\$33,478
<i>A – laptop</i>	Packet Radio	\$2,973	200	\$4,850	\$7,823
Combined: C+A	Packet Radio	\$18,491		\$22,810	\$41,301
Scenario 3(b)²: Wireless extension of connectivity from central telecenter to remote mini-telecenter (Spread Spectrum)					
<i>C – laptops</i>	Spread Spectrum	\$15,871	1050	\$20,992	\$36,863
<i>A – laptop</i>	Spread Spectrum	\$3,326	200	\$4,791	\$8,117
Combined: C+A	Spread Spectrum	\$19,197		\$25,783	\$44,980
Scenario 4: Central wireless ISP telecenter linked to 5 mini-telecenters with Spread Spectrum					
<i>B – laptops</i>	Spread Spectrum	\$9,171	600	\$11,028	\$20,199
<i>A – laptop (x5)</i>	Spread Spectrum	\$16,630	1000	\$23,955	\$40,585
Combined: B+A (x5)	Spread Spectrum	\$25,801		\$34,983	\$60,784

***Telecenter Type A:** 1 computer, 1 inkjet printer, 1 telephone, 2 indoor lights, 1 outdoor light.

Telecenter Type B: 5 computers, 2 inkjet printers, 2 telephones, 1 fax machine, 4 indoor lights, 1 outdoor light.

Telecenter Type C: 10 computers, 3 inkjet printers, 5 telephones, 1 TV, 1 VCR, 1 multifunction fax/printer, copier, 8 indoor lights, 1 outdoor light.

¹ Estimated Installed Power System Cost includes cost of power system (PV) equipment plus a flat fee of \$800 for installation and guarantees, and an estimated 30% vendor markup on equipment. Installation fees and markup will vary by country and by vendor, and potentially by system size, thus can significantly affect the total installed system cost. It is important to note that the flat installation fee assumed here yields installed power system costs that are disproportionately high for the smaller systems, which are likely to be lower in practice.

² Street prices for wireless spread spectrum LAN systems of the type described in this report have fallen since our initial analysis was done. As of spring 2002, street prices were generally running at 50-70% of the list price for the system modeled here.

5. COUNTRY STUDIES

Chapter 5 describes in some detail the rural electrification and rural telephony environments in the four target countries—Bolivia, Columbia, Guatemala, and Honduras—as well as a brief examination of these sectors in Belize. The countries’ current and proposed rural ICT initiatives are reviewed, with special attention paid to rural distance education programs, telecenters, development efforts and programs harnessing ICT tools for rural economic development. Rural ICT opportunities in the various sectors are identified, and broader policy and institutional issues are explored.

1. Bolivia

Bolivia’s telecom sector has undergone significant changes since it was opened to competition in November 2001. Many of the decisions about the telecom reform process have been delayed due to the country’s current electoral process, so many more significant changes are likely to occur in the upcoming months.

In general, Bolivia is a fertile environment for rural telecenter/ICT initiatives, with a number of different rural telecenter activities being implemented and planned by the Bolivian Government, including by the Vice Ministry of Energy and Hydrocarbons (VMEH), with proposed World Bank financing, and by the Vice Ministry of Transportation, Communications, and Civil Aviation based on national funding under the National Fund for Regional Development (FNDR) and the National Rural Telecommunications Development Program, PRONTER. A number of private sector entities, including for-profit and non-profit entities, are also pursuing rural ICT activities.

Recent rural ICT developments in Bolivia have been dominated by the PRONTER-related telecenter development project or program, which attempted to establish a chain of privately-operated, publicly subsidized rural telecenters, and by the proposed Decentralized Energy and ICT for Rural Transformation project currently under preparation with the World Bank. One of the challenges for the OAS/IACD will be to identify specific niches and complimentary roles it can play in these efforts, and where it can provide the greatest value.

At present, it appears that thinking and development efforts in Bolivia are relatively more advanced in the general area of rural telecenters, and generally less well advanced in the area of rural education. At the same time, the changes in the basic education program in favor of greater local autonomy, combined with near-term experimentation (whether labeled as such or not) in rural telecenter development appear to create an interesting opportunity for the OAS/IACD to work on development of ICTs for rural education activities in Bolivia.

In a similar manner, the near-term development of a significant number of rural telecenters will also provide opportunities for development and deployment of content and systems for economic development applications such as the possible PRODEM project discussed previously, where ICTs would be used to support the rural operations of a small enterprise financial institution, or for example to support provision of technical and market information to agricultural producers. While private telecenter operators would benefit from existence of such capabilities, it is by no

means clear that they will have sufficient financial incentive or resources to develop the necessary systems and content.

2. Colombia

Of the countries covered by this study, Colombia has the most fully developed program for promoting use of ICTs, including the Internet, for economic and social development, such as education, agricultural, health, public sector governance, and other applications. The national government has developed an initiative known as the Connectivity Agenda that is intended as a comprehensive set of policies and activities to support broad use of ICTs and make Colombia a leader in the use of ICTs for development and in IT industry development. Colombia also has the most advanced rural telephony program of the countries studied, and is in the early stage of supporting rural telecenter development. A number of the Connectivity Agenda policies and initiatives are potential models for replication in other OAS member countries, and some of the relevant agencies and personnel in Colombia may be able to support the OAS/IACD activities in other countries, through assisting in transfer and replication of best practices.

The OAS/IACD has identified the Department of Santander's proposed Regional Connectivity System (SCR) Project as a promising potential activity for possible support under the Rural Connectivity and Energy Initiative. The proposed "Norte de Santander Regional Connectivity System" (Sistema de Conectividad Regional – SCR) project is designed to provide connectivity and place ICTs in 40 municipal capitals and 60 smaller towns of the Department of North Santander in Colombia. The project would include establishment of an Internet Portal, and provide content/services in the areas of education, health, agriculture, and public administration. It is expected that in many cases, where the communities lack access to reliable power grids, the ICTs will be powered by sustainable renewable energy technologies—such as solar photovoltaics (PV). A number of factors create a favorable environment for the development of a telecenter project in the Department of North Santander. The Governor of North Santander has placed his full support behind the project. The Department of North Santander is also in dire need of the social services that the Rural Connectivity and Energy Initiative of the IACD might facilitate. The Department's guerrilla activity and extensive coca production require that steps be taken to improve the economic and social conditions of the population. The Department also suffers from inadequate health and education coverage. It has, for example, the second lowest school enrollment rate of the country, and all schools lack information technologies. As a result, the Department has been selected by the Ministry of Education for participation in the World Bank-financed Rural Education Project that could provide a valuable synergy for the proposed SCR project. North Santander has a population of 1,375,000 (73.8% urban and 26.4% rural) with a teledensity of only 6.7% and difficult terrain, which makes it hard to extend the landline telecommunications grid via line extension.

As part of its connectivity agenda the State supports specific programs, including the social telecommunications program COMPARTEL. This program was designed by the Ministry of Communications to facilitate universal access to telecommunication services in rural areas by subsidizing private sector operators through a telecommunications fund. In the first phase of the COMPARTEL program, through a bidding process Gilat was selected to provide rural telephony services. In a second phase, COMPARTEL is developing projects to establish telecenters with

access to the Internet in all the municipal capitals of the country (1,100), of which 600 are already in service. The SCR Project of North Santander will seek to reinforce this program by connecting still unserved geographical areas to the Gilat network or by linking government buildings, schools, and health clinics in areas where Gilat is operating to the Gilat-operated VSATs.

3. Guatemala

At present, Guatemala does not have a single focused rural ICT or telecenter initiative such as the COHCIT Aldeas Solares project in Honduras. Nevertheless, there are a number of factors that appear to create a favorable environment for rural telecenter and other rural ICT deployment. These include: a telecom sector that has already been restructured and partially privatized, and which fosters a high degree of competition between different service providers; a well defined and ambitious rural electrification program; strong interest in the use of distance education technologies in rural areas, including a 400 school Telesecundaria pilot program; and a number of different pilot programs supporting telecenters aimed at rural enterprise development and support or educational strengthening through teacher training.

Both USAID and the World Bank are supporting pilot telecenter initiatives aimed at supporting rural enterprise development and assisting producers to market products to foreign and domestic buyers. USAID has supported the development of six telecenters in the Department of Quiche, in conjunction with an association of exporters (Asociación de Gremial de Exportadores de Guatemala or AGEXPRONT), and in Alta Verapaz through an NGO, Talita Kumi. This is being supported under a component of the USAID Peace Program known as Inversiones Para la Paz (IPP) / Centros de Negocios Electrónicos. These telecenters—each of which has five PCs and satellite-based Internet access—are installed in electrified communities, although in some cases the electric service is very unreliable. (Supporting ICTs in rural areas with intermittent power is an area the the OAS may wish to consider supporting, since it involves some of the same competencies as supporting ICTs in unelectrified areas.) Also, while the market towns where these telecenters are located are electrified, many of the surrounding communities are not. One possible project opportunity for the OAS involves possible establishment of off-grid mini-telecenters and micro-telecenters in the surrounding communities, using low-cost wireless technologies to connect to the larger telecenters in order to utilize their satellite connection to the internet (i.e. the larger telecenters would basically serve as internet service providers or ISPs).

The World Bank is also developing telecenters focused on rural enterprise development, through a small pilot project called Micronets. This project, which is also being done in conjunction with AGEXPRONT, will focus heavily on supporting innovative business development services and simple computer-based tools and content for rural enterprises.

Providing rural producers with current information on prices and buyers/sellers for agricultural products and inputs is one of the high-value rural ICT services that can contribute to rural economic development. In Guatemala, the Ministry of Agriculture (MAGA) has developed a comprehensive Market Information System containing Guatemala City prices on approximately 100 agricultural products and 100 agricultural inputs (e.g. seeds, fertilizers, pesticides), with the prices updated several times a week. Pricing information on a smaller number of agricultural

products and inputs is also available for a number of smaller towns in Guatemala. MAGA staff recognized that rural telecenters of some type would be required for rural producers to be able to better access this pricing information. If the OAS Initiative supports rural telecenter projects in Guatemala, it should work to ensure reliable access to the Market Information System by rural agricultural producers.

4. Honduras

The state of the telecommunications sector in Honduras is likely to be a constraint to the development of the COHCIT-IDB project and other rural ICT projects. The Government-owned HONDUTEL enjoys a monopoly in long distance and local telephone service, apart from cellular telephone service that is provided by CELTEL. A recent effort to privatize HONDUTEL failed when two of the three bidders withdrew from the bidding process. The lack of competition, and the desire for income or profits from HONDUTEL, result in fairly expensive services and relatively low investment in new infrastructure and services.

Supporting rural education with ICTs was one of the major areas of focus for COHCIT, the Ministry of Education, and the IDB during the preparation of the COHCIT project. There are several education projects or programs that appear to be relevant to rural telecenters and ICT deployment, including the Honduran Community Education Project (PROHECO); a 36 school pilot program known as Telebasica, which is a secondary-level video-based program modeled after the Mexican Telesecundaria; and the Educadores project. Each of these programs offers certain advantages and disadvantages, from the point of view of rural ICT programs.

The broader Rural Connectivity Initiative activities in Honduras are framed against the background of the significant OAS support for the Honduran Science and Technology Council (COHCIT) “Aldeas Solares” rural telecenter projects in San Ramon Centro, San Francisco, and Hicaca, as well as more modest support for projects in Las Montanas and Trojas. As a result of this support and involvement, the OAS is already a partner in the project activities, and has established a high degree of recognition and legitimacy for the Connectivity Initiative. It has also laid a foundation for possible participation in the telecenter project replication phase to be financed by the IDB under the project Ampliación de Capacidades Tecnológicas en Comunidades de Bajos Ingresos..

One issue that has arisen in Honduras appears to be a generic problem across many countries. In order to maximize the benefits from investments in rural telecenters or other rural ICT facilities, it is important these facilities be used to address needs in a variety of sectors including telecommunications (e.g. basic rural telephone service), education, agriculture, rural enterprise development, health, and others. At the same time, it is the usual practice of government agencies in many countries to focus exclusively on their own sector, and it can be difficult to foster inter-agency collaboration or coordination. In the case of Honduras, the IDB-financed project would involve a number of different sectors, which will present an interesting challenge for the project implementers. The OAS may be able to play a positive role in addressing these challenges of multi-sectoral projects, and broader project implementation challenges.

It is difficult to be certain at this point about the prospects for rural education ICT activities. While there are specific programs and pilot projects that provide a foundation for broader replication, such as Telebasica, PROHECO, and the Centros Basicos, it is not yet clear whether the new Government will support a major ICT-related initiative in rural education. One possible modest activity would be the development of 10-20 Telebasicas in unelectrified areas.

Due to the current state of the telecom sector and constraints to provision of rural telephone service, it appears that rural telecenters of any type will have difficulty achieving financial sustainability, and it will be extremely difficult to attract private sector interest. For these reasons, it appears that the only prospects for near-term activities will involve projects with significant public funding, such as the Strengthening Technological Capacities in Low-Income Communities Project, or in a rural education project.

5. Belize

Belize's electrification coverage rate is significantly higher than many other Latin American countries, at 91%. The country's telecommunications coverage is also relatively well developed, with a telephone density of 27.4 lines per 100 inhabitants in urban areas, and 2.9 lines per 100 inhabitants in rural areas. Still, among Belize's 537 rural communities (which house half the country's population), only 84 have a connection to the switched telephone network; only another 63 have community phones, and 390 communities remain without access to any telecommunications service whatsoever. Telecom legislation currently in place makes no mention of special characteristics of telecommunications in rural areas, nor does it mention any mechanism that supports service in these areas.

No current programs were identified involving the use of ICTs for rural education, and no examples of telecenters, telemedicine/telehealth, and ICT support for rural economic development were identified in the country.

6. CONCLUSIONS/RECOMMENDATIONS

Demand for Rural Connectivity and Energy

This investigation has clearly shown that there are many thousands of communities where the OAS Rural Connectivity and Energy Initiative could be relevant. This includes thousands of communities where there is no possibility of electrification via grid extension in the foreseeable future, and where even basic telephony services are currently unavailable, as well as communities served by part-time diesel generation where ICT project implementation will present a challenge. In addition, there are many thousands of communities where grid-based electricity is or will be available, but where wireless connectivity approaches will be least cost and most appropriate. In many cases, assistance such as the OAS/IACD can provide can be essential in addressing challenges to successful rural ICT programs and ventures. In many cases, grid-connected communities will be the best location for larger telecenter facilities and for some of the main connections to the Internet. In lieu of focusing exclusively on off-grid connectivity

and energy activities, the OAS/IACD should expand its activities to include grid-connected rural areas and communities served by part-time generation.

Key Role of Education Programs

The education sectors in several of the countries are leaders in efforts to apply ICTs to rural programs, including both traditional communications technologies such as television and radio and early efforts to integrate information technologies into rural education. Integrating computers and connectivity into more mainstream distance education programs can provide a lower-risk means of accelerating rural ICT activities, and tap into strong donor/MDB interest in supporting strengthened rural education. The OAS/IACD should seek to include in its Rural Connectivity Initiative at least one project focused on education which integrates IT into an already proven rural education model such as Telesecundaria/Telebasica (Colombia, Guatemala, Honduras), Escuela Post-Primaria Rural (Colombia), Escuela Virtual (Colombia), or Escuelas Rurales Activas (Guatemala).

Critical Importance of Voice Telephony

If rural ICT investments, particularly multipurpose telecenters, are to be sustainable and recover all or a significant portion of their investment and operating costs, it will be essential to ensure they can provide basic telephony access to rural communities, on a fee for service basis. General experience with rural telecenters shows that voice telephony generally accounts for a large majority of operating revenues, often in excess of 80%. For this investigation, a Demand Assessment was conducted in several Bolivian communities, which showed that projected revenues from voice telephony would constitute 90% of projected revenues in the initial years of telecenter operation. In some cases, legal or bureaucratic obstacles exist to incorporating voice telephony into rural telecenter. If these obstacles are not overcome, it will be extremely difficult to develop sustainable rural telecenter programs.

Content Issues

Significant educational content exists that is appropriate for secondary and upper level students, both for computers and for more basic ICT approaches such as video, and secondary and higher-level students benefit most from the ability to search out information from a variety of sources. Greater uncertainty exists as to quality and value of content available for primary school students. Good examples exist of specialized information systems appropriate for rural productivity, such as specialized agricultural information systems. To be genuinely useful in any given location, such an information system needs to be linked to local market information and local produce buyers and input sellers, and technical information provided needs to be adapted to local problems.

Challenge of Multi-Sectoral Interventions

Impact of investment in rural ICT facilities and services will be maximized if this infrastructure can support multiple sectors and respond in a flexible manner to needs in sectors such as education, health, agriculture, rural enterprise, improved governance, and other areas, as well as

supporting basic voice telephony. This presents a challenge for government agencies, which in most countries are accustomed to working within their specific sector. Development of effective rural ICT activities, and development of effective ICT programs in general, will require countries to develop integrated strategies combining different public sector efforts and private sector development efforts. The OAS/IACD can play a key role in helping countries analyze their ICT needs and develop integrated national strategies for promoting effective use of ICTs for development.

Early Point on the Learning Curve

Compared to developed country and developing country urban ICT development, developing country rural ICT activities are at a very early stage of development. Many experts and organizations are aware that they are at an early point on the learning curve, in terms of identifying best practices regarding rural applications, equipment recommendations, institutional approaches, and other essential elements. In some cases, there is a need for best practices to be conceptualized, tested, and documented, before they can become solid recommendations or standardized equipment packages. It appears that the OAS/IACD Rural Connectivity Initiative can play an important role in this process of testing and documenting such “best practices,” so that they can become effective tools for streamlined program implementation.