New Technologies
for Rural Applications

Final Report of ITU-D Focus Group 7

EXECUTIVE SUMMARY

More than 2.5 billion people - over 40% of the planet's population - live in rural and remote areas of developing countries. Of the small fraction that has any access to telecommunications, radio broadcasts and voice telephony have traditionally been the main services provided. Today, a wide variety of new telecommunication applications such as e-mail, e-commerce, tele-education, telehealth, and telemedicine, among others, have made access to interactive multimedia services as important for rural and remote communities as voice connectivity alone. Since each rural district or community requires a different mix of voice, text, image, video and audio communications to best meet its needs, today's telecommunication network operators must be able to support a wide range of services, applications, and bandwidth levels at a reasonable cost.

The Valetta Action Plan (VAP), formulated at the second ITU World Telecommunication Development Conference in March 1998, sought to promote universal access to basic telecommunication, broadcasting and Internet as tools for development in rural and remote areas. Focus Group 7 has spent a year researching technological developments that have the potential to support telecommunication applications which are commercially viable, or sustainable through other transparent financing mechanisms, in rural and remote areas of developing countries.

Rural and remote (or just "rural") areas exhibit one or more of the following characteristics:

- scarcity or absence of public facilities such as reliable electricity supply, water, access roads and regular transport;
- scarcity of technical personnel;
- difficult topographical conditions, e.g. lakes, rivers, hills, mountains or deserts, which render the construction of wireline telecommunication networks very costly;
- severe climatic conditions that make critical demands on the equipment;
- low level of economic activity mainly based on agriculture, fishing, handicrafts, etc.;
- low per capita income;
- underdeveloped social infrastructures (health, education, etc.);
- low population density;
- very high calling rates per telephone line, reflecting the scarcity of telephone service and the fact that large numbers of people rely on a single telephone line.

These characteristics make it difficult to provide public telecommunication services of acceptable quality by traditional means at affordable prices, while also achieving commercial viability for the service provider.

Focus Group 7 Findings on Applications

Focus Group 7 found that the Internet is the most widely used platform adopted to deliver multimedia applications in rural areas of developing countries. While much negative attention in developing countries has been focused on the use of the Internet as an illegal bypass mechanism in the international traffic arena, the long-term importance of the Internet for developing countries lies in its potential to improve the domestic

flow of economic and educational resources between isolated rural communities and urban centres. Areas of application for Internet- and other communication-based applications include tele-medicine and public health education, coordinating regional food security efforts, making government-sponsored agricultural extension services more effective and accessible to rural farmers, and enabling more rural children, adolescents and post-secondary students to receive an education, among others.

Applications development: Communication-based applications are being designed and implemented in rural areas of developing countries by a wide variety of actors in addition to public telecommunication operators (PTOs). A significant portion of the expertise required to develop sustainable, connectivity-enabled applications for rural areas is located within the professional, academic, business and agricultural sectors, among others. Not only do schools, universities, government departments, international organizations and NGOs routinely design and implement customized applications, they also independently purchase and set up information technology (IT) equipment. As a result, public telecommunication operators are increasingly required to support a heterogeneous mixture of networks, protocols and bandwidth requirements away from urban centres.

The need for basic literacy, computers skills and training in the use of ICT applications remains a significant challenge for rural areas. Language barriers and the complexity of personal computer (PC) operation have been shown to hinder Internet diffusion. Many innovative schemes have been devised in rural areas to overcome these barriers. Although not widely utilized, techniques such as voice mail, translation of content, and icon-based telephones indicate that foreign languages and illiteracy are not necessarily barriers to the use of communications services, if the end user's needs are comprehended and addressed. Relevant content is extremely critical to the success of any rural application.

Community and business development: A great deal of progress is being made in rural community and business development through the introduction of telephony, telecenters, e-mail, and radio broadcasts. For example, PeopLink, an organization sponsored by *infoDev* (the Information for Development Programme of the World Bank) has established an e-commerce program allowing local artisans in developing countries to bypass middlemen and market their products directly to first world consumers. Two of the key requirements for the success of community and business development applications were found to be local language support and the availability of relevant content.

Telemedicine: The motivation and commitment to telemedicine in developing countries is very strong. This motivation is often backed by a willingness to pay for systems which are expected to improve health outcomes and lower medical costs in the long run. Telemedicine services may be perceived as more of a necessity in developing countries than they are in the industrialized countries, resulting in a greater willingness among the former to change established methods of doctor-patient interaction and health care administration.

Telemedicine and telehealth applications are not limited exclusively to expensive, high bandwidth services. As long as the local medical community remains motivated and committed to implementing telemedicine and telehealth programs, there are a wide range of health benefits that can be achieved through remote patient monitoring and diagnosis, multimedia communication links between urban and remote facilities, and broadcast of health information over radio and television.

Distance Education: Unsurprisingly, the focus group found that university-level distance education programs lend themselves to cross-border implementation. Using distribution by satellite or Internet, the administrative costs of running distance education courses can be spread over a very wide potential student base. A number of existing programs, such as the African Virtual University (AVU) and the distance education network of the University of the South Pacific (USPNet), are already based on the concept of cross-border educational access.

Focus Group 7 Findings on Technologies

Problems with installation and maintenance of wire plant have prompted the widespread use of wireless systems in rural areas. Ten types of wireless access systems were identified through the case studies and ITU activities, illustrating existing and emerging access options for reaching rural communities. Given the trend

toward shared facilities such as telecenters, university extension centers, post office kiosks, etc., as well as the variety of revenue models associated with social services in the health, educational and e-commerce fields, the focus group considered technologies which expanded the number of supportable applications as well as those which demonstrated lower per-line costs.

Demand for Internet-based telecommunication applications in rural areas, particularly e-mail, has resulted in new applications of old technologies, such as VHF radio systems and meteor burst communications, for non-real time services. In addition, new combinations of existing technologies are extending the reach and flexibility of wireless access systems, as well as reducing total costs through the integration of shared systems and components. In particular, many rural operators are deploying very small aperture terminals (VSATs) and point-to-multipoint terrestrial radio systems integrated with wireless local loop systems based on standards such as PHS and DECT.

Access options on the horizon for rural areas include a number of technologies that are new to the rural marketplace or still under development.

- Cdma450 and GSM400 cellular base stations implemented in the 450 MHz range are scheduled for commercial introduction in 2001. The use of the lower frequency bands will enable each base station to cover approximately double the area achieved by existing digital cellular base stations operating in the 800-900 MHz frequency range.

- Third generation cellular systems, known as IMT-2000, are designed to deliver a wide range of traffic types and volumes more efficiently and inexpensively than the current generation of wired and cellular telephony networks.

- Gateways based on ITU-T Recommendation H.323 support real-time, two-way communications between local area networks (LANs) and the PSTN. Such gateways offer developing countries the option of constructing local and wide area networks to deliver telephony and other services in rural areas, without undermining existing investments in the PSTN.

- Wireless router networks, integrated with IP telephony software, have the potential to provide significant cost savings and social benefits as multi-service application platforms for telecenters, government offices, schools and other organizations in rural areas. Since these technologies are largely untested in rural areas, Focus Group 7 recommends that BDT conduct pilot projects aimed at confirming the technologies' robustness in rural environments and effectiveness in dealing with multimedia applications such as telemedicine, distance learning and so forth.

Information technology and multimedia terminals: It is of the utmost importance that ITU-D strives to raise awareness of the rural information and communication needs of developing countries within the computing and information technology industry. Unlike the telecommunications industry, which has been doing business in underdeveloped rural areas for several decades, companies in the IT sector are generally unfamiliar with the environmental and social requirements of rural areas of developing countries. Multimedia systems profiled by Focus Group 7, some of which were only launched during the period in which the report was written between June and August 2000, demonstrate many features with potential lifetime cost savings for rural areas. For example, information appliances supporting e-mail, World Wide Web (WWW) browsing and e-commerce applications provide simplified user interfaces in packages with fewer maintenance requirements than traditional PCs. Internet client network solutions can offer Internet service providers (ISPs) the ability to upgrade their rural customers' browser and applications software remotely, reducing the skills requirements for telecenter operators and rural schools. Finally, technical institutes and R&D organizations in developing countries such as India and Indonesia are developing their own custom, low cost IT terminals and devices.

Renewable energy solutions: The lack of mains energy supply in many rural and remote areas is a major obstacle to deploying telecommunication infrastructure. Many governments, agencies, and NGOs are currently working to support broader or massive use of telecommunications and IT systems in unelectrified rural areas As a result, Focus Group 7 recommends that governments, administrations and recognized operating agencies consider closely linking renewable energy specialists with rural telecommunication and ICT initiatives.

In the past two decades, the most important use of renewable energy and hybrid systems in telecommunications has been for off-grid telecom repeaters. Due to the high cost of the repeater equipment, the critical role the repeaters play in the larger telecom networks, and the unattended nature of the systems, these power systems have been very carefully sized and designed using highly capable and experienced engineers. In contrast, the power requirements for user-side installations -- such as wireless local loop terminals, PCs and cellular handsets -- are relatively small. For such user-side equipment it will generally not be possible to rely upon the same approach to power system design as has been used for telecom repeater systems. Therefore, Focus Group 7 recommends that ITU-D support the efforts of the international renewable energy community by disseminating practical and useful information on small power systems for rural telecommunication installations to ITU-D members, project partners and other organizations.

Conclusions and Recommendations

The report of the Maitland Commission, issued sixteen years ago, set a goal to bring telephone services within easy reach of all humankind before the 21st century. In order to remain consistent with this goal after a decade of tremendous expansion in the social applications of information and communication technologies, an update of the target proposed by the Maitland Commission is recommended.

In support of the goal of promoting the development of new telecommunication technologies for rural applications, FG7 offers the following six recommendations:

1) Promote the development of low-cost information appliances for rural use.

2) Create a renewable energy handbook on small-scale power systems for rural ICTs.

3) Increase collaboration with micro-finance organizations to help develop communication-based rural businesses and applications.

4) Conduct pilot projects of packet-based wireless access infrastructure for multimedia applications.

5) Maintain and expand the FG7 Web site.

6) Hold a symposium on new technologies for rural applications.

The Focus Group 7 also proposed the creation of a Task Force, consisting of a small group of volunteers among the ITU-D Study Group members to assist the BDT Director with the implementation of FG7 recommendations. The mandate of the Task Force may include:

- Monitor implementation progress of all FG7 recommendations;

- Formulate suggested criteria for the establishment and location of pilot projects;

- Contribute to cross-communication and coordination efforts among all parties.

Based on extensive research by Focus Group 7, this report concludes that there is a need for robust telecommunication systems combining low-cost, wireless access technologies with packet-based networks for the possible delivery of Internet in rural and remote areas. Such systems are deemed likely to hold various advantages for the provision of information-based applications in rural areas. As the concept of universal access expands to include services that are more complex than traditional voice and fax telephony, the development of shared-use, easily maintained multimedia terminals for community centers must be explored in order to find socially effective solutions for providing Internet in rural areas.