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INFORMATION AND COMMUNICATION TECHNOLOGIES FOR RURAL AREAS

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Abstract- In this paper the term rural is applied to the countryside or anything related to it. Rural is often used in opposition to urban. However, this is not the case here. For the purpose of this Report, the expression “rural and remote” (or just “rural”) refers to rural, isolated and poorly served areas by telecommunication facilities, where various factors interact to make the establishment of telecommunication services difficult. A rural area exhibits 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 wire 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.)
Key words-

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Introduction

Traditionally, the term rural is applied to the countryside or anything related to it. Rural is often used in opposition to urban. However, this is not the case here. For the purpose of this Report, the expression “rural and remote” (or just “rural”) refers to rural, isolated and poorly served areas by telecommunication facilities, where various factors interact to make the establishment of telecommunication services difficult. A rural area may consist of scattered settlements, villages or small towns, and may be located several hundreds of kilometers away from an urban or city centre. However, in some cases a suburban area may also be considered as rural.

A rural area exhibits 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 wire 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 [1].

Information and communication are essential for rural areas: the availability of information and communication services reduces isolation, increases business viability, improves farming productivity, and improves access to educational and medical services. The quality of telecommunication services can encourage business activity to remain or develop in rural areas. On the other hand, some business activities, such as banking, may lessen their presence in rural communities as they take advantage of better telecommunications to consolidate more of their operations.

Information and communication services, however, have been changing rapidly due to transformations in technology and the regulatory environment. These changes are having profound effects on the cost, type, and availability of telecommunications. New technology and regulatory provisions are also creating a great deal of uncertainty. The new era in telecommunications will offer rural communities many new challenges and opportunities.

The Digital Divide

Despite these potential links between ICTs(Information & Communication Technologies) and poverty reduction, direct access by the poor to more advanced ICTs in particular is extremely limited. Radio is listened to every week by as much as 80 percent of the populations of many developing countries. Figure 1 suggests that even the poorest developing countries also have more televisions per capita than would be suggested by their income level. But citizens of poor countries have significantly less access to telephones and the Internet than those living in rich countries, while poorer people within countries are even further excluded.

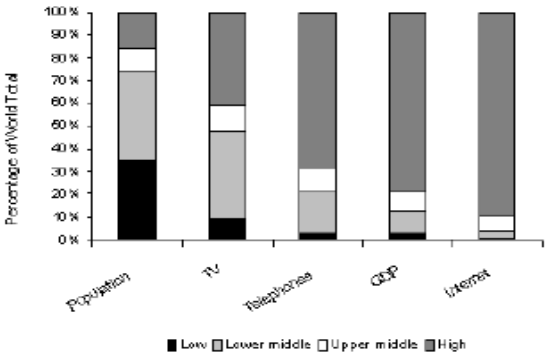


Fig. 1- Global Distribution of ICT's by Income Level Groups

Having said that, the mere existence of a gap in levels of ICT services between rich and poor across and within countries does not imply that ICTs should be a priority for government action; after all, poor countries also have fewer factories, fewer cars, fewer doctors and nurses, and lower calorie intakes per capita than wealthy countries. That said, there are number of reasons why a growing gap in the provision of advanced ICTs should be of concern:

- The gap in provision is already large, and for advanced ICTs it is much larger than income disparities. This represents a majority of people around the world-and especially the poor-having no access to modern networking technologies. And the gap is growing at a time when the trends in other determinants of development, such as levels of education, health, and access to transport, are converging
- Threshold effects are at work. Two linked economic features suggest that low provision could force people and countries into poverty traps-network externalities, where there are increasing benefits to a connection the more that others are connected, and bottlenecks. In the same way that a weak port infrastructure reduces the attractiveness of all merchandise trade with a country, it might be that a weak information infrastructure will reduce the competitiveness of an even wider range of goods and services. Weak information infrastructure might then act as a bottleneck to trade-led development. Evidence is growing that a range of ICTs is vital for taking part in trading, and the lack of such technology really does act as a bottleneck.
- Within-country gaps in service provision worsen existing inequities. If the opportunities for improved income generation and access to services provided by the new ICTs are limited to the wealthy, this will perpetuate and strengthen a number of disparities, including gender inequality and the inequalities faced by the disabled.

Policies to Ensure Access for the Poorest

Telecommunication technology has changed rapidly in the last decade, with new developments in computers, switching devices, digital signal processing, wireless communication, satellite technology, and Internet services. These changes have blurred the line between what had been discrete services. Local telephone companies now have the technology to offer long-distance phone service. Cable TV corporations now have the technical capabilities to deliver voice and Internet services. Similarly, technology has improved so greatly for wireless service that high-end services, such as the Internet, can be offered to many subscribers. Demand for telecommunications services has increased rapidly, generated in part by new technology, and by lower costs from increased competition among major companies, such as AT&T, MCI, and Sprint. This created economic pressure to thoroughly revise the existing telecommunication laws. Of more than 3.5 billion inhabitants in the world's low income countries, approximately 72% live in rural areas [2]. Rural areas can generally be characterized by low population density and long distances between settlement areas. Due to unfavorable geographic and climatic conditions, access from urban centers to rural areas, and vice versa, is often difficult. The basic objectives to which telecommunications services have to contribute are to trigger and sustain structural and economic development, to minimize the above mentioned disadvantages and to generally improve the quality of life in rural and remote areas. New industries and other commercial operations are attracted only to places where telecommunications are at hand. Un-served rural areas will, therefore, develop only slowly, if at all, thus contributing to the acceleration of unwanted rural to urban migration. One of several preconditions to reverse this trend is the availability of telecommunication services and applications.

Other benefits of telecommunications concern security, the elimination of feelings of isolation and insecurity in rural villages as well as improvement of government administration. Public administration becomes more effective with telecommunications because it relies heavily on co-ordination between central headquarters, regional and local offices as well as individual government officers in outlying districts. It has turned out, though, that the full impact of improved telecommunications comes only to bear if road condi-

tions are also improved. Many of the most critical factors that enable rural areas to benefit from technology lie beyond the network and its elements. Sustainable business models, political will, skills training and education are just as critical – if not more so – than selecting the most appropriate technology from among a range of reasonable technology alternatives.

Information & Communication Appliances in Rural Areas

The use of TDMA-based point-to-point (PTP) or point-to-multipoint (PMP) radio systems with wireless local loop tails is a fairly recent phenomenon, having been introduced in rural areas over the past three to four years (Japan & Europe). The substitution of wireless systems for copper cables in the local loop helps reduce the maintenance costs associated with physical plant in rural areas. The focus group received reports describing the implementation of point-to-point and point-to-multipoint systems with one of two wireless local loop technologies: Personal Handy phone System (PHS) and Digital Enhanced Cordless Telephone (DECT).

According to the PHS MOU, the main features of PMP/PHS-WLL are as follows:

- end-to-end wireless access solution;
- large service area of up to 540 km in a chain of repeaters;
- flexible system capacity expandable to 1,400 subscribers per base station;
- high-quality service using 32 kbit/s ADPCM;
- robust against natural disasters;
- low implementation and maintenance cost;
- solar cells are available for repeater (80 W) and cell stations (40 W). The major specifications of PMP/PHS-WLL are summarized in Table 1

Table 1- Technical specifications of PMP/PHS-WLL

PMP TDMA System	Typical parameters and values
Frequency band	1.5/2.4/3.5 GHz
Voice coding	32 kbit/s ADPCM (ITU-T G.726)
Access method (modulation)	TDM/TDMA (QPSK)
Interface with local exchange	2-wire analogue or V5.2 digital
Transmission capacity	4 Mbit/s, 120 Time slots
Number of subscriber lines per base Station	Up to 1,400 subscribers (for call rate of 0.07 Erlang/sub.)
Subscriber unit	1/2/16/64 lines
Radio hop distance	Max. 45 km (Max. 12 hops)
Voice band data rate	9.6-14.4 kbit/s
User data rate	Up to 384 kbit/s
PHS-WLL System	
Frequency band *	1,895-1,918 MHz
Voice coding	32 kbit/s ADPCM (ITU-T G.726)
Access method (modulation)	TDMA/TDD (π/4 shift QPSK)
Transmission capacity	* 4 Time slots/RF (4RF/Cell station) 15 Traffic Channels/Cell station
Number of subscriber lines per base station	Max. 128 Lines
Subscriber unit	1 line
Cell Range *	Up to 5 km with 8 dBi directional antenna; Up to 15 km with adaptive array antenna
Voice band data rate *	Up to 14.4 kbit/s

Source: PHS MoU Group

A PMP/PHS-WLL system generally comprises base stations (BS), repeater units (RU), subscriber units (SU), cell stations (CS), and 2-wire fixed terminals (2W-FT), as illustrated in Figure 2.

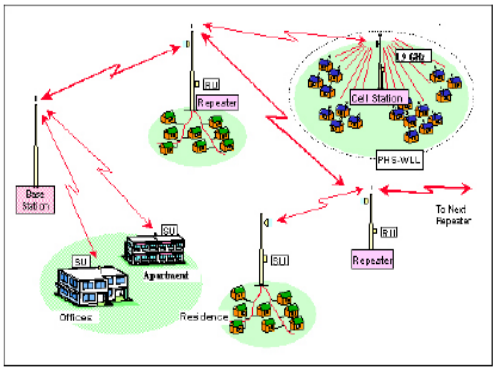
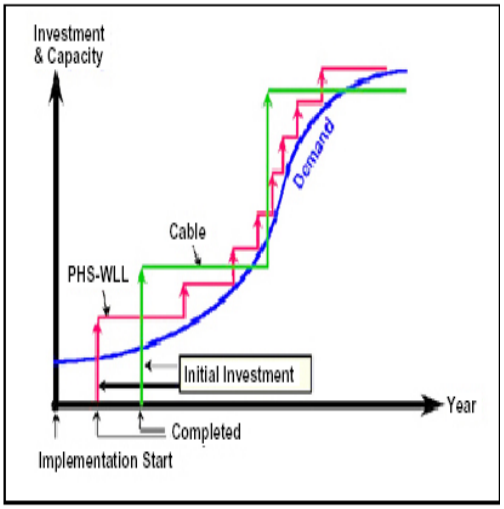


Fig. 2- Network Configuration of PMP/PHS-WLL System

As shown in the figure before, the BS can directly access offices and apartments in suburban areas and the RU also accommodates subscribers in small villages. The combination of PMP and PHS-WLL allows flexibility in the formation of the access network to serve the requirements of suburban areas, towns and villages. The time required for installing PHS-WLL systems is short compared with conventional copper cable networks, and the cost is relatively low (provided reasonable fees for the wireless spectrum). PHS and other wireless local loop systems have been shown to correspond with more efficient investment patterns as compared with regular cable plant see Figure 3 because the modularity of the system allows for smaller increments of additional investment as the network is expanded.



Conclusion

Dramatic advances in the technology of telecommunications are taking place at a time when the role telecommunications can play in economic and social development throughout the world is more important than ever. It is our considered view that henceforward no development programme of any country should be regarded as balanced, properly integrated or likely to be effective unless it includes a full and appropriate role for telecommunications, and accords a corresponding priority to the improvement and expansion of telecommunications.

Given the vital role telecommunications play not only in such obvious fields as emergency, health and other social services, admin-

istration and commerce, but also in stimulating economic growth and enhancing the quality of life, creating effective networks world wide will bring immense benefits… The increased flow of trade and information will contribute to better international relationships… We look to governments of industrialized and developing countries alike to give fuller recognition to this common interest and to join their efforts to redress the present imbalance in the distribution of telecommunications which the entire international community should deplore".[4]

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