Information and Communication Technologies and Poverty

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Outline

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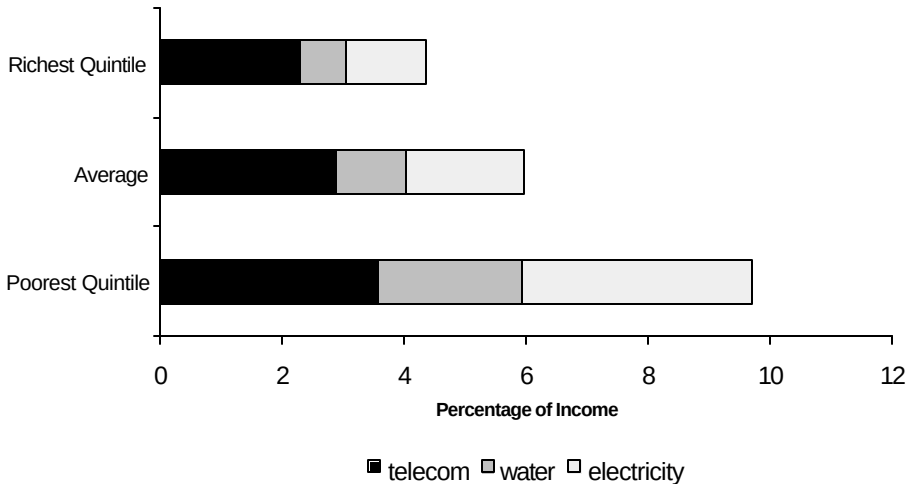
1. Introduction

Few would argue that lack of access to information and communications technologies (ICTs) is an element of poverty in the way that insufficient nutrition or inadequate shelter are. If being poor is defined as lacking access to the Internet, for example, no one in the world escaped poverty before 1969, when the first network was built.

But, ICTs are increasingly central in the effort to *escape* poverty. And the poor recognize this; if given the option, they are willing to spend over two percent of their income on telecommunications alone. As Figure 1.1 shows, the poor in Chile spend about the same amount on telecommunications as they do on electricity; the average consumer spends more of his or her income on telecommunications than on electricity and water combined. This expenditure excludes the numerous other communications tools accessed by the poor—including radio, television, and posts.

Figure 1.1. Percentage of Spending on Utilities in Chile



Source: deMelo 2000

ICTs provide access to information that can create earnings opportunities, improve access to basic services, or increase the impact of education and health interventions. ICTs also give the poor a voice to demand government support and reform. Recent advances in ICT can also provide people with sensory disabilities an effective channel to access information and communicate efficiently with the rest of society. Section 2 outlines some of the ways that the poor are using ICTs to improve their own lives, and some of the ways that governments can use ICTs to improve their service delivery, especially to the poorest.

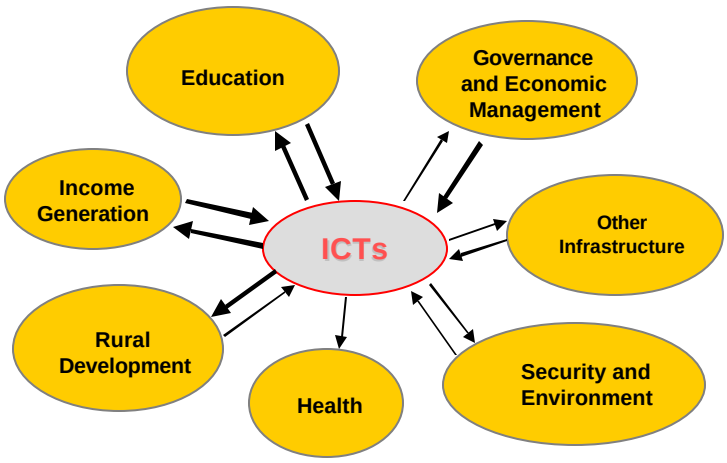
The examples in Section 2 suggest that the role of ICTs in poverty reduction is through their catalytic and leveraging effect on earnings opportunities, on educational services, and on welfare provision. But precisely because information exchange is part of nearly every element of an economy, the impact of improvements in the capacity for information exchange will depend critically on how the rest of the economy functions. This suggests the centrality of a holistic approach in evaluating the impact of ICT

development. For example, the impact of improved ICT access on farm earnings through increased knowledge of market prices will be muted if there are no roads to carry crops to markets, or no markets because of an unreformed agricultural sector. This lesson should be of particular concern to policymakers in the government services sector, as increased ICT use in government can only be successful as part of a larger reform effort.

Similarly, the level of provision of ICT services and efficient, affordable, and widespread ICT access are dependent on broader policy factors—rules governing FDI, for instance, the provision of reliable electricity, literacy (particularly for the Internet), and a range of other conditions.

ICTs can also benefit from complementarities across sectors. If done correctly, for example, rolling out telecommunications services to local government offices will greatly reduce the costs of servicing nearby community centers. Further, it is far cheaper to roll out service at the same time as other utilities are being rolled out. Wires and water pipes can be buried together, and roads and telephone poles built at the same time.

Figure 1.2. Potential Interlinkages Between ICTs and Broad-Based Development

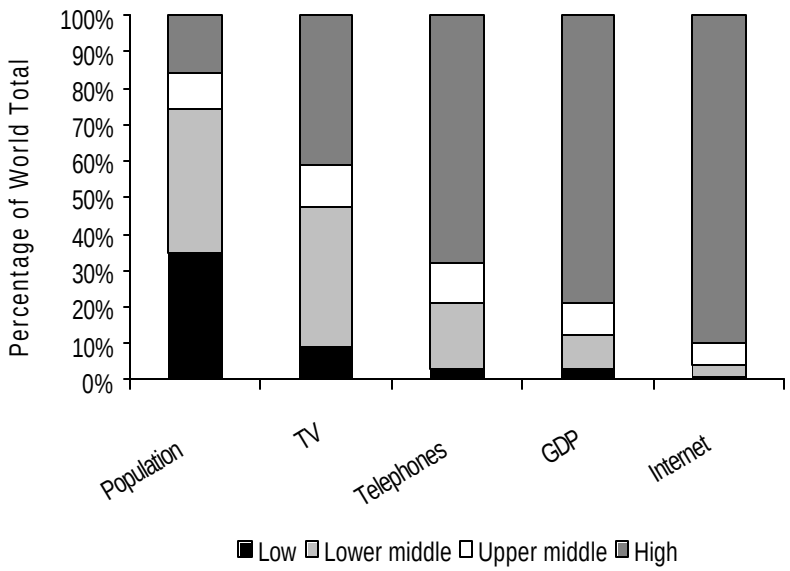


This range of bicausal relations helps to explain research that finds a strong link between telephone rollout and a number of measures of broad-based development. Allowing for income per capita, which is highly correlated with most measures of development, including telephones per capita, a highly significant and positive relationship remains between the number of telephones per capita and both literacy rates and life expectancy (Grace et. al. 2001). Figure 1.2 illustrates this bicausal relationship graphically. The thickness of the arrows suggests the strength of the causal relationship. The strength of interlinkages between a pro-poor ICT agenda and pro-poor agendas in other sectors should be paramount for policymakers as they develop poverty reduction strategies with an ICT component.

Despite these potential links between ICTs 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 (www.rfd.freeuk.com). Figure 1.3 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. For example, Rwanda has a population over 6.5 million. In 1998, it had 11,000 telephones—about half the number of telephones as Gibraltar, with a population of 27,000. Within Rwanda, these telephones were almost exclusively concentrated in Kigali. There were 4 telephones per hundred people in the capital city, compared to 4 per 10,000 in the rest of the country.

Figure 1.3. The Global Distribution of ICTs



Looking at the Internet, in 1998, Bangladesh had a population of 125 million, with just over 1,000 Internet users. The availability of local content on the Internet is a further pointer to the dominance of industrial countries. A recent host survey shows that Africa generates only 0.4 percent of global content. Excluding South Africa, the rest of Africa generates a mere 0.02 percent. [2]

And, especially for the Internet, use is dominated by a tiny educational elite. Ninety-eight percent of Ethiopian Internet users had a university degree—in a country where 65 percent of the adult population is illiterate. Finally, women have less access to ICTs than men. Only 38 percent of the population polled in urban Latin America who use a computer and Internet are women. The numbers are even more skewed in Africa: a survey of African users found that 86, 83, and 64 percent of Internet users in Ethiopia, Senegal, and Zambia, respectively, were male.

There are ways to rapidly increase access through aggregating the poor's demand for

[2] The statistics in this paragraph are drawn from Africa Internet Forum (1999), ITU (1999a), and Wilson and Rodriguez (1999).

services, however. There are also methods to intermediate access to the Internet using more widely available ICTs such as the radio. Section 3 discusses barriers to ICT rollout across countries, while Section 4 addresses methods for increased access, including sector reform, pro-poor regulatory policies, and universal access funds. Section 4 also discuss methods to maximize the poverty-reduction impact of government investment in ICTs.

Finally, this chapter will will not explore stand-alone computers in any detail–despite the fact that they have a long record of providing tools for education and public financial management, for example, in low-income countries. Nonetheless, it is important to recognize that any approach to ICT use in poverty reduction has to be broad-based in the tools used as well as in interlinkages.

2. ICTs and Broad-Based Development

Between 1995 and 1998, telecommunications markets worldwide connected 200 million telephone lines, 263 million mobile subscribers, and 10 million leased lines. And while only 15 million Internet connections were made in 1991–1994, this number exploded to 88 million in 1995–1998, nearly a sixfold increase in network growth. It took the telephone close to 75 years to reach 50 million users; it has taken the World Wide Web only 4 years to reach the same number (Pyramid Research 1999).

The technological and economic change underlying this transformation of the global communications network offers great opportunities for less-developed economies and for poverty reduction. Perhaps as important, especially in the poorest regions, there remain significant development opportunities resulting from better exploitation of older ICTs, including postal networks and the radio.

Indirectly, ICTs have an ever-increasing role in promoting sustainable economic growth through the promotion of exports, especially in services, through improving the function of markets and increasing the quality and efficiency of government services. But ICTs can also have an immense direct impact on the lives of the poorest. Provision of ICTs allows the poor to access markets, to demand services, to receive education, and to learn new skills. ICTs give a voice to the disadvantaged—a voice that enables the poor to use their own knowledge and strengths to escape poverty traps. In Columbia, for example, a relatively inexpensive and simple microwave-radio telephone system along with community access points was installed in the remote region of Tumaco in 1994. Within three years, residents of the region reported that the service had resulted in better trade and market opportunities; reduced unemployment; new business opportunities; improved health care delivery and information access; improvements in public safety and security; and an overall improvement in the level and quality of available government services (ITU1998).

By the same token, national or local exclusion from ICT provision results in increasing isolation. As the global economy and government services are increasingly networked, those who lack access will be marginalized. There is already evidence of this phenomenon with the telephone—the expansion of the Internet will only make the cost of ICT exclusion greater. This risk is perhaps particularly significant for the disabled poor in developing countries. This section explores the indirect and direct impact of ICT provision on poverty reduction in less-developed countries (LDCs).

2.1. Opportunities for the Poor

Economic Opportunities: We have forty years of evidence on the utility of broadcast media as a tool for development. For example, a survey of some of the 21,000 farmers enrolled in radio-backed farm forums in Zambia found that 90 percent found programs relevant and more than 50 percent credited the programs and forums with increasing their crop yields (Dodds, 1999). In the Philippines, a partnership program between UNESCO, the Danish International Development Agency, and the Philippine government is providing local radio equipment and training to a number of remote villages. The project is designed to ensure that programming initiative and content originate within the communities. According to UNESCO, the project has not only increased local business and agricultural productivity, but also resulted in the formation of civic organizations and more constructive dialog with local officials. (UNESCO Courier 1997)

Turning to telecommunications, recent econometric studies have found increasing evidence of a causal link between telecommunications development and economic development; others provide evidence of high returns on investment in telecommunications equipment and, more generally, in the telecommunications sector. Other studies have extended these correlations to other indicators, such as social development, cost savings for industry, and increased transport efficiency.[3]

The Internet, because it leverages the potential value of computers and a telephone connection, suggests that the economic effects of networking will be far greater in the future. At the micro level, the Internet provides an opportunity for firms, farms, and entrepreneurs to reduce costs, increase market coverage, and achieve economies of scale. Thus the Internet might have a dramatic impact on trade and investment in developing countries, spurring growth—provided complementary measures covering macro, financial, and educational policies are in place (see Box 2.1).

These technologies will also have a range of direct impacts—especially on entrepreneurial activities, employment, and access to credit, and especially in rural areas. Small manufacturers of traditional handicrafts are already discovering how ICTs can assist in the marketing and distribution of their wares to a worldwide client base, for example. In Kenya, the Naushad Trading Company (**http://www.ntclimited.com**), which sells local wood-carvings, pottery, and baskets, has seen revenue growth from US$ 10,000 to over US$ 2 million in the two years since it went online (Africa Business, 1999). Consumers and shopkeepers can access constantly updated color pictures of NTLimited's product line, place orders, and make inquiries of other types of handicrafts.

[3] See Analysis (2000) for a review.

Box 2.1. The Impact of ICTs on Trade and Investment

ICTs offer the opportunity to greatly reduce trade costs through their impact on costs and delays in transport services. For example, Singapore has dramatically reduced the costs of import and export through the networked information system Tradenet, with estimated savings of about 1 percent of the city-state's GDP (World Bank 1998).

And opportunities go far beyond increased exports of traditional merchandise. The free fall in the costs of information transfer has made a large segment of the service sector open to global competition. Indeed, many information-processing jobs are already carried out in countries far distant from the ultimate end user. India's software export industry is perhaps the best-known case of a low-income country leveraging the opportunities presented by the new networked economy. Analysts predicted that Indian software exports would reach US$ 6 billion in 2000 and total IT exports could equal US$ 50 billion by 2008, comprising up to 33 percent of the total export market. (*Business Week*, 3/6/00, p. 83). The new possibilities to expand 'weightless trade' present a particular opportunity to less-developed economies and regions—if there are the educational, financial, and institutional resources in place to leverage them.

The networking revolution also presents significant opportunities for increasing investment. The privatization of infrastructure services, in particular, has had a strong effect on the decisionmaking process of foreign investors. For each dollar a country raises through the privatization of infrastructure, an additional $2.42 is attracted in FDI (Sader 1995, p. 31). Finally, the process of privatizing state-owned telecom companies has also increased FDI into the sector itself. In Morocco, for example, a consortium of firms from Spain and Portugal recently acquired a US$ 1.1 billion license to build a new cellular network (WSJ, 3/1/00 p. A18).

New entrepreneurial activities will also generate job opportunities. Creating telephone centers, for example, is a significant means for creating jobs. In the Indian state of Punjab, for example, one study found over 10,000 staffed telecenters had sprung up by 1996—generating close to 9,000 USD in gross revenue per center, much of which went to salaries. Telecommunications can also offer rural populations increased opportunities for nonfarm business and job creation. An ITU study of factories in rural Bangladesh, for example, found that introducing a telephone line reduced the amount of management travel, thus cutting associated travel costs, such as gasoline and salaries, by a factor 13 times the cost of installing the line (ITU1999). Finally, the increasingly tradable data entry sector also offers significant possibilities for employment in less-developed countries. There are some 10 million people performing data entry tasks in North America; many of these tasks could be competitively provided by literate workers in low-income countries (Schware and Hume 1996).

Within countries, new ICTs also offer the opportunity to provide investment resources to groups previously denied them—assuming that the fundamentals of a sound financial system are in place. In South Africa, for example, "AutoBank E" has developed a fully automated savings system aimed at the poorest depositors. Customers can open an account with a deposit equivalent to only US$ 8 and benefit from a wide range of electronic banking services. Since all transactions are completed through ATMs, paperwork and transaction costs are kept to a minimum. Also, the bank has used the data collected on depositors to analyze creditworthiness, resulting in much better credit access for the country's poorest citizens. The system is highly popular, with 2.6 million depositors and 50,000 more being added each month (*Economist*, 3/25/00, p. 81). Such mechanisms can be combined with postal financial services to significantly expand access to financial intermediaries country-wide.

It should be noted that expanding ICT access around the world does pose an economic threat to some existing groups and companies in developing countries. Information and communications technologies reduce barriers to the flow of information and goods across borders. In this way, they have similar effects to reducing trade barriers between nations. Reduced barriers to trade—whether induced by new technologies or shifts in policy—can negatively affect some regions or groups within a country (see the **Trade** chapter).

By improving purchasers' access to price information, for example, ICTs can reduce the prices that suppliers can charge for their goods. ICTs can also reduce the competitive advantage of location, allowing a foreign company to underprice a local competitor. While importers and internationally competitive companies in home markets will benefit from these changes, exporters and weaker domestic companies may well suffer.

The solution here is not to close off access to ICTs. The losses of such a maneuver would outweigh the gains. However, the networked revolution certainly increases the importance of social protection and training programs to ensure that displaced workers find new employment in more competitive sectors as fast and as painlessly as possible.

Security: ICTs have a major role in reducing vulnerability–especially to natural disasters (see Box 2.2)—and powerlessness. One of the reasons for this is the part that ICTs can play in amplifying the voices of the poor. ICTs bridge the distance between remote communities and service providers–markets, government departments, and aid agencies. They can allow the opinions of the poor and the needs of the poor to be heard. For example, in India, the women's rights NGO 'Sakashi' had faced difficulties in lobbying for sexual harassment legislation. With help from international women's networks provided over the Internet, Sakashi was able to receive advice and technical assistance on legal issues surrounding sexual harassment. As a result, the group succeeded in convincing the Supreme Court to establish sexual harassment guidelines in workplaces and brought the issue within the purview of human rights violations.

Box 2.2. ICTs and Security

ICTs can have a major role in reducing the impact of natural disasters on the poor in low-income countries. Between June and December 1996, a total of 1,689 people died in Andhra Pradesh (AP), India, in heavy rains, floods, and cyclones. The total economic loss caused by the 1996 disasters in AP is estimated at US$2 billion. The following year, a World Bank–backed project was implemented, designed to help set up a hazard management program in high- risk areas and improve warning capacity. Both elements involved a significant ICT component—especially in cyclone warning, communication and response, awareness raising, education and community involvement in hazard reduction activities, (from Recommendation of the President to the World Bank Board 1997).

2.2. Governance

There are four main types of formal information areas for which ICTs are relevant to governance (Heeks 1998):

- Information to support internal management, including staffing and budgeting accounts.
- Information to support policy and regulatory decisionmaking, including population, economic, financial, and other data.
- Information made publicly available, including laws, statistics, health information.
- Information to support public services such as education, health, and transport.

Public financial management (PFM) is one of government's most important responsibilities, with functions that cover all four of these areas. For many years, an important part of PFM programs has been developing and implementing un-networked computerized information systems to support associated business processes. For example, stand-alone computer-based information systems assist developing countries in: macrofiscal planning; budget preparation; monitoring and control; management of the public-sector work program; debt management; revenue administration; human resource management; government accounting; and auditing. (See Box 2.3 and the chapter on **Public Spending.**)

Box 2.3. Computers to Improve Governance

In Morocco, the government is using information and communications technology to enhance intermediary coordination, tax administration, auditing, public investment planning and monitoring, and spending management. These tools have cut in half the time required to prepare the budget (World Bank 1998). Other countries such as China, Lebanon, and the Philippines have successfully launched projects, with the support of the World Bank, to reform their tax or computerized customs systems (Forestier 1998).

ICTs can improve the efficiency of government through public finance processes by reducing opportunities for graft. The Automated Systems for Customs Data (Asycuda), developed by UNCTAD, is now used by over 70 developing countries to manage tariff collection and reduce frontier corruption. The system speeds up goods movement, reduces transport expenses, and costs US$ 2 million to install.

ICTs can also increase the efficiency and equity of taxation. In Mirzapur, India, the local government computerized property assessment and tax records as well as tax billing and collection. The results have been impressive: a 44 percent increase in properties registered, a systematic and more equitable property tax analysis system, property tax bills actually issued for the first time in 17 years, and a 42 percent increase in total tax revenues (Gibbons 1999).

In several developing cities and regions, networked computers are being used to improve governance systems that have a particularly significant effect on the lives of the poor—for example, through speeding delivery and reducing corruption in the issuing of permits or improving the operation of welfare systems. In Andhra Pradesh, India, for example, networked computers have been used in the reform of processes to register deeds and stamp duties. Using traditional methods, this took 13 cumbersome steps in a highly opaque process that invited bureaucratic delay and corruption. It took from three to as many as 15 days—and the process involved the registration of over 120 million

documents a year. Using a new networked system, the same task can be accomplished in just over two hours, with far less opportunity for graft. Again in Andhra Pradesh, a program to computerize the issuance of caste certificates, essential for obtaining government services and access to educational scholarships, managed to decrease the time for certificate issuance from 20 to 30 days to only 10 minutes (Grace and others 2000).

However, there are also risks. Not least is the complexity of introducing both stand-alone and networked ICTs into local government systems. RPWeb, an initiative to provide Internet connection to the more than 8,000 government offices in the Philippines, shows some of this complexity in action. It has faced problems such as lack of funding and lack of interest from involved parties. Although the RPWeb initiative had been a mandated priority since 1997, most government agencies apparently do not see the advantages of being electronically linked to other agencies. Plans were scaled back to linking one third of offices by 2000.[4]

And the record of ICT introduction in government is patchy worldwide. More than 80 percent of information system projects in South Africa are not delivered on time, or within budget, or are not fully implemented (Khan and Swanborough 1999), and there are a range of stories of failed ICT projects in India, failures due to factors including misuse, user opposition, and inappropriate design (Heeks 1999). For example, a program established by the Indian National Informatics Center to provide ICT rollout and support to local governments for the storage of land records and monitoring of Ministry of Agriculture programs found that, after 15 years, the program had only marginal impacts because the task of changing administrative cultures linked with the processes that the new ICTs affected had never been properly tackled. The lessons of experience suggest, then, that ICTs have to be introduced within the context of a broader reform program. They cannot act as a substitute for that reform. [5]

There are a range of potential obstacles to reform using ICTs. One mentioned above is bureaucratic resistance, due to lack of incentives to co-operate or ignorance of potential gains. Another common problem is poor design—frequently, technically sound systems are completely unusable in the real world. A third is a lack of resources—including technically skilled operators and hardware. As a result of these problems, applications fail to meet the needs of agencies and resources are wasted.

Perhaps most seriously, ICT-based reforms backfire if those who need services are excluded by the technology. For example, Singapore and New York have begun providing government services directly to customers online. If this type of service provision became a substitute rather than a complement to more traditional methods of receiving government support, those without access to the Internet would be excluded. Again, this requires more than physical access to ICTs. The introduction of an Intranet system providing information on property to staff and clients of the Johannesburg Metropolitan Council remained unused because its introduction had been technology focused, rather than needs focused, and training was inadequate (Africa Development Forum 1999). This suggests that training and acceptance are as vital as access.

[4] See *Metropolitan Computer Times* 07/07/99
[5] Bhatnagar, 2000, p.1.

Furthermore, the potential audience and the usability of Internet-based information is low if it is packaged in complicated graphic formats requiring powerful computers and fast connections. Web design for public access should (but frequently does not) involve specific requirements for technology and contents to enable access with old browser versions, less efficient CPUs, slow connections, as well as the use of different aids for the disabled including screen readers, voice output and Braille displays.[6]

Adding greater complexity to the introduction of the Internet is the issue of complementarities between government departments and services. Normally, a wide variety of computer-based systems support different government activities. However, these systems are usually implemented as components of separate projects responding to specific needs, with little appreciation of requirements in other areas, and little thought given to critical interrelationships. As a result, the information systems are often disparate and segmented with little or no capacity for sharing data. They have overlapping and sometimes conflicting functionality and provide incomplete coverage, particularly for managerial information requirements that normally span several functional areas.

Finally, networking government is very expensive. A recent World Bank–supported project in one Indian state (AP), designed to computerize revenue offices, involves training 5,000 staff members and installing 4,500 computers in 1,124 sites over a quarter of a million square miles to handle a database containing over 80 million records. Multiplying this up to the national level in a country as large as India and across a wider range of functions, the scale of the process becomes clear. All of this suggests that, although a range of high-return investments is possible in low-income countries to improve government performance through advanced ICTs, programs to use them should be carefully evaluated—an issue returned to in Section 4, and discussed in greater detail below.

2.3. Education

In education, at the primary and secondary levels, radio and television are an increasingly important means of reaching the rural poor. In Mexico, over 700,000 secondary-school students in remote villages now have access to the *Telesecundaria* program, which provides televised classes and a comprehensive curriculum through closed-circuit television, satellite transmissions, and teleconferencing between students and teachers. Studies have found that the program is only 16 percent more expensive per pupil served than normal urban secondary schools, while students benefit from much smaller student- to-teacher ratios. Rural students enter the program with substantially lower mathematics and language test scores than their counterparts at traditional urban schools, but by graduation, they have equaled their math scores and cut the language-score deficit in half. (Source: de Moura and others 1999). Educational radio has been utilized in:

- Mexico and Mali, for literacy training;
- Thailand, to teach mathematics to school children, and for teacher training and other curricula;
- The Dominion Republic and Paraguay, in support of primary education;

[6] The WAI guidelines (http://www.w3.org/WAI/) have been adopted in the European Union member states to guarantee accessible design of websites.

Programs can be broadcast in a range of local languages, (Nwaerondu and Thompson, 1987),[7] and they can be part of a multimedia campaign, designed with classroom activities linked to the topics raised. Adkins' (1999) survey of seven educational intervention cost effectiveness studies suggest that, in terms of incremental improvement, the impact of a dollar spent on interactive radio instruction is nearly seventy percent higher than a dollar spent on purchasing textbooks and over eleven times higher than a dollar spent on teacher training.[8] In part because of its cost effectiveness, radio is by far the most widely used electronic media in developing world distance learning programs.[9]

Studies from industrial countries also find that the Internet can be a valuable pedagogical tool (CAST 1997, p . 4). E-mail allows students with similar interests and ideas to share knowledge and collaborate with other students around the globe. Online databases maintained by governments, private companies, and universities contain enormous amounts of readily accessible information. This also allows ICTs to play an important role in cultural preservation; see Box 2.-4. Network technologies have the potential to transform the nature and reach of education.

Box 2.4. ICTs and Cultural Preservation

Advanced ICTs can play an important role in preserving and providing access to cultural resources. The Egyptian Ministry of Tourism, for example, hosts the Egyptian Antiquities Information sight (**http://wwwtouregypt.net/antiq.htm)**. Visitors can access pictures of archaeological artifacts, read articles on Egyptian history and mythology, and access information ranging from how the pyramids were constructed to the complete contents of the "Book of the Dead" in several languages. ICTs have also played an important role in preserving and identifying threatened or marginalized cultural artifacts and traditions. Visitors to **http://maori.culture.co.nz** can read histories of the Maori people, view images of cultural artifacts and the unique tattoo patterns common among Maori men, obtain Maori recipes, and order cultural products from an online shop.

This impact of the Internet is not limited to higher education or wealthier students, however. In Brazil's urban slums, the Committee to Democratize Information Technology (CDI) has created 110 sustainable and self-managed community-based "Computer Science and Citizenship Schools," using recycled technology, volunteer assistance, and very limited funds. CDI schools train more than 25,000 young students per year in ICT skills that give them better opportunities for jobs, education, and life changes. CDI also provides social education on human rights, nonviolence, environmental issues, health, and sexuality. CDI cites many cases in which participants have developed renewed interest in formal schooling, resisted the lure to join drug gangs, and greatly increased their self-esteem. Also, many of the program's "graduates" are putting their computer skills to work in various community activities, including health education and AIDS awareness campaigns. Most teachers in CDI's schools are

[7] Nwaerondu, Ndubuisi Goodluck, and Gordon Thompson. 1987. "The Use of Educational Radio in Developing Countries: Lessons from the Past." *Journal of Distance Education* 2(2): 43-54.

[8] Adkins, D. (1999) Cost and Finance in A. Dock and J. Helwig (ed.s) *Interactive Radio Instruction: Impact, Sustainability and Future Directions* Washington DC: The World Bank.

[9] Tony Dodds' 1996 50-country survey and 1999 update found that 55 percent of distance education programs surveyed used radio compared to 37% using audiocassette, 15% video, 7% TV and under 3% using computers (Dodds, T. (1999) Non-Formal and Adult Basic Education through Open and Distance Learning in Africa mimeo, Centre for External Studies, University of Namibia).

themselves graduates of the program who have embraced technology and want to continue CDI's good work in their own communities.[10]

Advanced ICT-enabled education has a particularly important role in empowering poor people with disabilities. Disabled people have, on average, lower enrollment and educational attainment levels than the rest of the population. Even standard ICTs can make it possible for disabled people to utilize mainstream educational opportunities, provided that they are designed to be better accessible to people with functional limitations. Furthermore, assistive devices can revolutionize the learning opportunities for people with visual or hearing impairments as well as of those who have dexterity problems.

Further, the judicious use of advanced ICTs, complimenting the role of broadcast technologies, can help alleviate shortages in teachers and physical materials and can be cost-effective when compared to building new physical infrastructures. In Taiwan, for example, one study found that the distance-based National Open University was able to reach 30 percent more students than the National Taiwan University while spending less than one third of the National Taiwan University's budget (UNESCO 1999). The African Virtual University (**http://www.avu.org)** hopes to emulate or surpass such efficiencies while providing more equitable access to tertiary education on the continent. To date, courses have been offered on computer technology, economics, language, and remedial coursework (Diagne 2000).

Finally, providing skills to develop a technologically competent work force will facilitate a country's ability to compete in the global economy. In the presence of a basic education system that provides the vital tools of literacy and numeracy, access to ICTs at an early age can ensure that populations—and especially the poorest—are able to adapt to new technologies and remain competitive (Blurton 1999).

As is true in the use of other government services, ICT use presents several potential problems in education. First, neither the radio nor the Internet cannot substitute for quality teachers, nor can the Internet in particular operate in an environment where school buildings are unsafe or inadequate, or there is no electricity, or there is not enough technical support to ensure sustainability. As one observer notes, "Care should be taken to avoid allowing the novelty of technology to drive decisions regarding the most appropriate delivery mode. . . If a country's conventional education or teacher training program is not effective, using a new technology to deliver that education or training will not make it any more effective." (Potashnik and Capper 1998, p. 45) Second, unlike radio instruction, the Internet is a comparatively expensive tool. To get an idea of the cost, the government of Singapore is spending $1.2 billion over five years to bring computers and broadband access into all schools.[11] Singapore has a population of about three million. If spending per capita on connecting schools in China were the same, the cost would be about $491 billion—or a little over 50 percent of the country's GDP. To justify equipping schools with computers, it is important to ensure that the benefits outweigh those of spending the same money on textbooks, more teachers, building repair or more basic ICT-based education such as interactive radio instruction.

[10] Information from the *info*Dev stories project—see www.infodev.org.
[11] *Forbes* January 11, 1999

While there are cases from wealthier developing countries where ICTs are in fact the most cost-efficient delivery tool for certain educational programs, it is likely that these cases will be rarer in poorer low-income countries. Section 4 discusses methods to ensure the maximum return to needed ICT investments in education.

2.4. Health

Information technology also has a role in improving the quality of health services. Radio has been utilized in:

- Nicaragua and Swaziland, for general public health education;
- South Korea and Sri Lanka, to support family planning initiatives;
- Trinidad and Tobago, to promote knowledge about breastfeeding;
- The Phillipines, for nutrition education (Nwaerondu and Thompson, 1987).[12]

A significant percentage of health workers in Uganda (54%) and Kenya (20% percent/year) have taken part in radio-backed training courses and there are consistent reports and surveys suggesting that these result in improved knowledge, attitudes and practices (Dodds, 1999).

Networked computers have played a vital role in controlling Onchocerciasis, or river blindness, in West Africa. Data collected by sensors along 50,000 km of rivers were fed into computers by local inhabitants. From the computers the information was beamed to a network of entomologists by satellite radio, and used to calculate the optimum time to spray against disease-carrying blackfly. River blindness has now been eliminated in seven countries, protecting 30 million rural people from the disease and opening up 25 million hectares of land to settlement and cultivation (World Bank 1998). Networked computers have a range of other roles in the health sector, including administration and management, storage and transmission of data and publication, and dissemination of medical findings.

Again, and as with education, a serious problem facing continued growth in the use of the Internet in health is cost. These costs include telecommunication infrastructure rollout, computers and digital imaging equipment, salaries for training of practitioners and laboratory staff, and the development of related support infrastructure. Governments and donors must weigh the varying needs of national systems in relation to available resources. Many health problems can be addressed through basic infrastructure improvements such as clean water and sanitation facilities rather than expensive technical solutions. As one study notes, “although information and education can raise people's awareness of the problems. . . information in itself is an insufficient remedy if people lack the means to implement what they learn” (Uimonen1997). Further, and again as with education, low cost ICTs such as radio frequently provide a suitable alternative to advanced ICTs.

[12] Nwaerondu, Ndubuisi Goodluck, and Gordon Thompson. 1987. "The Use of Educational Radio in Developing Countries: Lessons from the Past." *Journal of Distance Education* 2(2): 43-54.

2.5. Environment

Environmental monitoring is data intensive. Identifying and monitoring the enormously complex web of inputs and relationships within an ecosystem requires the capacity to track large volumes of data and build databases that can analyze and sort information. Geographic Information Systems, which use computer applications to store, integrate, and analyze data collected from remote imaging and other sources, are increasingly powerful tools in designing sustainable management plans and forecasting environmental threats.[13]

But environmental management requires more than the analysis and publication of environmental threats. Communication among governments, business, and citizens is vital if environmental remediation programs are to meet their objectives in an efficient and equitable way. ICTs can benefit this process by encouraging communication and knowledge sharing between the public and private sectors and between concerned citizens and scientific experts. Used in this way, ICTs can help to include people in the decisionmaking process, ensure that traditional forms of environmental knowledge are communicated to a broader audience, and allow citizen monitoring and enforcement of environmental threats.

In Indonesia, for example, government officials discouraged by the weak enforcement of water pollution standards developed a public access information database rating the degree of firm compliance with pollution discharges. Even before the information was made public, firms hurried to improve their ratings. Regulators, meanwhile, could focus their limited enforcement resources on the worst offenders. In the first 15 months of the program, roughly a third of the unsatisfactory performers came into compliance with the regulations (World Bank 1998, p.13)

2.6. The Threat of Exclusion

The mere existence of a gap in levels of ICT services between rich and poor across and within countries does not imply that ICTs are a priority; 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, the previous discussion suggests a 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.[14]

[13] GIS systems in environmental management generally refer to three distinct technologies used in combination. Global Positioning Systems (GPS) is a satellite-based navigation system that can identify longitudinal and latitudinal coordinates and altitude measurements. Remote sensing is generated by satellite or aerial advanced resolution photography, and monitoring can depict ecosystem diversity, vegetation density, and plant chemistry. GIS is a separate application that often incorporates the use of the previous two applications through computer applications and database management (Brodnig and Mayer-Schonberger, 1998). The above discussion uses GIS as a generic term incorporating some or all of these applications.

[14] See Easterly (1996).

- *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. For example, surveys in Botswana and Zimbabwe suggest that areas lacking telephone access see significantly less entrepreneurial activity than those with access.

- *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 (see Box 2.5) and the inequalities faced by the disabled.

Box 2.5. Gender and ICTs

A range of ICTs has been used to support the empowerment of women around the world. In Africa, groups such as the African Women's Network of the Association for Progressive Communications (APC) have conducted training workshops to support electronic networking among women's groups. In Uganda, the Forum for Women in Democracy uses the Internet and e-mail to research issues for the country's female MPs, and Women's Net is a similar initiative in South Africa.

At the same time, as mentioned earlier, the great majority of users in low-income countries, especially users of advanced ICTs, are men. Even with radios, men tend to control access – frequently by taking possession of radio batteries. This raises the fear that ICTs could be one more element in the exclusion of women from opportunities. This in turn suggests the need for programs that specifically target women. Wind-up radios increase women's access to radio programming. Grameen Phone targets women's access to telephony, and perhaps a similar model could be used for the Internet. Access points should also be made available near places where women work. The fact that women make up the majority of farm labor in poorer countries suggests that rural access is particularly important. Education programs should also ensure at least a gender balance in their classes.

The risks of economic exclusion presented by a lack of ICTs suggest that countries *should* be concerned with the level of ICT provision–and with enabling access for the poor. The challenge is to maximize the returns to spending and investment in the sector by ensuring access to appropriate ICTs. For most low-income countries, this will mean moving toward a well-regulated competitive environment for ICT services. It will mean a focus not only on telephony and the Internet, but on broadcast and postal services as well. It will mean a program of universal access provision–a public phone, perhaps with an Internet-enabled computer, within walking distance–rather than universal service–a phone in every household. It will mean government use of ICTs in priority 'back office' functions, such as tax records, rather than attempts to put the entire gamut of government services online. It will mean selective use of the Internet in schools and hospitals, along with training and a focus on technical literacy. The rest of this chapter

discusses methods and guidelines such as these to maximize the benefit to the poor of investments in ICTs.

3. Barriers to Access

To enhance the potential poverty impact of ICT investments, it is important to understand the current market and government failures that are denying access to the poor and reducing the quality of service provision that they should be able to expect. Section 3 discusses these barriers, while Section 4 explores remedies.

3.1. Supply Constraints

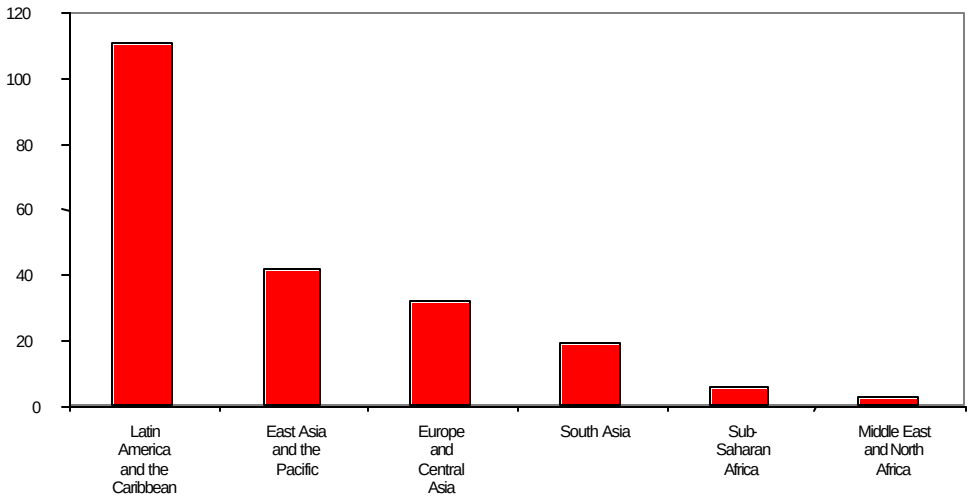
Policy failures: The advantages of liberalization—privatization and competition—will be discussed later, in turn demonstrating the disadvantages of monopoly public provision. By and large, monopoly provision has been found an inefficient tool with which to increase access and improve the quality of services around the world. Investment by public companies has been too low to rapidly expand access and management and organizational structures have been inefficient, reducing both rollout and quality of services.

Appropriate regulation after the introduction of private competition is also critical. A lack of an independent regulator can have particularly damaging effects on the poor. In the Northwest region of Ghana, for example, one study found that political criteria had dictated the placement of lines and pay phones, resulting in lower telephone use and revenues than had been initially predicted (Richardson 1998). This also emphasizes the importance of local participation in designing and managing rural telephone systems. A vibrant broadcasting sector also requires private and community access to the radio spectrum and regulatory institutions to ensure that signals can be received.

Population density and geography: While policy failures undoubtedly constrain supply, there are a number of other constraints to public access as well. Geography is still a key determinant of communications costs and functionality. A user in an area of low demand density because of sparse population will still tend to have proportionately higher communications costs and lower available functionality. This phenomenon is firmly rooted in the economics of networks. For example, telephones in rural areas, requiring smaller exchanges, cost significantly more per line, not only because each connection is further from the next, but also because economies of scale in switching cannot be achieved.

Lack of private financing: The distribution of foreign direct investment in ICTs is skewed —and flows to the rural areas of poorer economies are very limited. For example, 81 percent of telecommunications investments in projects with private participation went to just ten developing countries in 1998, 52 percent of the investments were in Latin America, while under 3 percent were in Sub-Saharan Africa during 1990–98 (see Figure 3.1). These figures in part reflect the relative economic weight and degree of liberalization of different markets. But they also reflect broader market and government failures in developing countries and the fact that few international ICT companies know about the opportunities present in low-income economies.

Figure 3.1. Telecommunications Projects With Private Participation in Developing Countries (1998, US$ billions)



Source: PPI Database, the World Bank

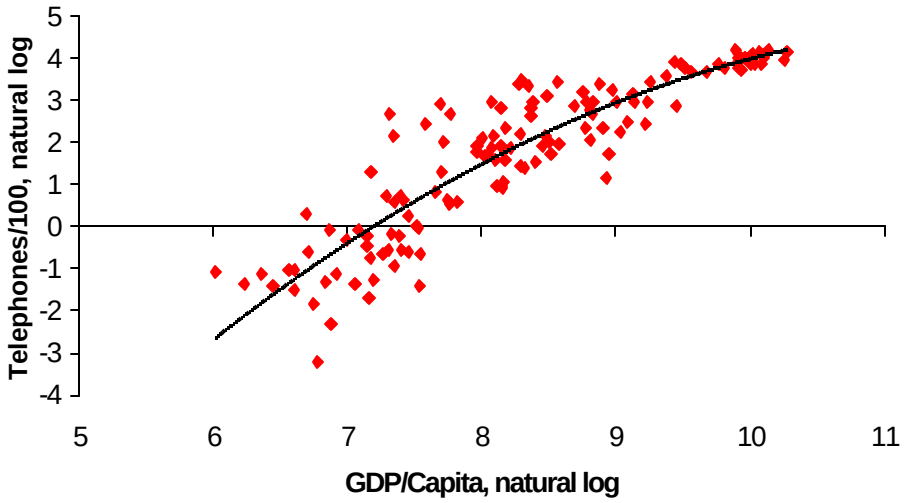
Less-developed countries also have the problem of finding the financing to support "lumpy" investments, such as satellites. Indeed, for two decades the only satellite services in the developing world were supplied by treaty organizations such as Intelsat. Such information and credit constraints also apply at the local level—the poor have limited access to credit, and the institutions are not always in place to assist in the aggregation of demand for lumpy investments such as a computer or the first telephone line into a village.

Poverty traps, including the undersupply of pro-poor local content: The development of the Internet has been associated with a range of network and scale economies of its own. For example, a larger online community makes the development of Internet content a more attractive commercial and social proposition, while the development of more attractive Internet content encourages the growth of a larger Internet community. But while scale economies suggest the opportunity for substantial growth, they also suggest the risk of poverty traps. A consistent finding of surveys of Internet users and providers in developing countries is that the lack of local language and locally relevant content is a major barrier to increased use. Unless there is a concerted effort to overcome these constraints, Internet growth in many developing countries could be stuck in a low-use equilibrium.

3.2. Demand Constraints

Poverty and aggregation problems: Income alone explains 78 percent of the variation in the number of telephone lines and a similar percentage in the variation of access to the Internet per capita across countries (see Figure 3.3.). This remains by far the best predictor of the comparative level of ICT rollout across and within countries. Even with further reform and technological advance, this suggests that the cost of services means that most of the people in developing countries could not afford a telephone in their home—let alone an Internet connection.

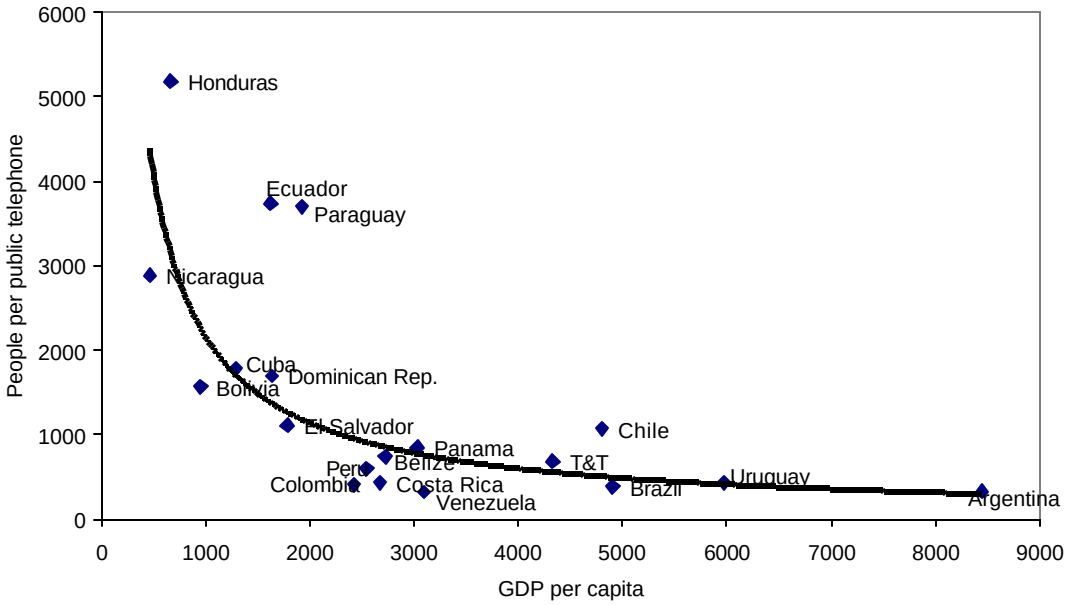
Figure 3.2. Telephones per 100 People Against GDP per Capita



The basic solution to this problem is not complex. It is to provide public access, which allows multiple individuals to share the fixed cost of ICT provision. Basic sector reform alone, however, is not enough to ensure access to public call centers—let alone the Internet. Figure 3.3 suggests that competitive market environments alone do not necessarily support a much higher level of demand aggregation than unreformed sectors. In some reformed markets, such as in the Dominican Republic, there are fewer public pay phones than would be expected from their income level. This is not to say that basic reform is not supportive of universal access goals, but that basic reform must be complemented by regulatory and other policy initiatives if those goals are to be achieved.

Education and Training: A second demand constraint that limits access to the Internet in particular is the level of digital literacy. Most advanced ICT users in developing countries come from an educated elite. This is not surprising. Illiterate adults face significant—often insurmountable—barriers to computer and Internet use. E-commerce in particular is computer and network intensive, requiring skilled programmers and applications-development personnel. Furthermore, as most of Internet content and programming languages are English-based, absent intensive language training the utility of the Internet is reduced.

Figure 3.3. People per Public Phone Against GDP per Capita



Government Use: Finally, while there are many areas of government activities that could benefit from the greater use of ICTs, the lack of knowledge about opportunities, the lack of credit, and a range of institutional barriers can stand in the way of efficient use. Again, incorporating ICTs into government operations is a difficult task.

4. Strategies to Enhance the Impact of ICTs in Reducing Poverty

The previous section outlined barriers to ICT rollout to benefit the poor. This section offers potential responses. Overcoming demand constraints, as already mentioned, is partly a function of income, training and education, but it will also take a regulatory environment that encourages demand aggregation. Supply constraints can be overcome in part through policy reform to open up the sector, regulation that encourages rollout and support for universal access goals. But to know which ICTs are demanded, it is vital to start the process of pro-poor ICT reform with a significant effort to listen to the needs of the poor themselves.

4.1. Overcoming Supply Constraints to Service Provision

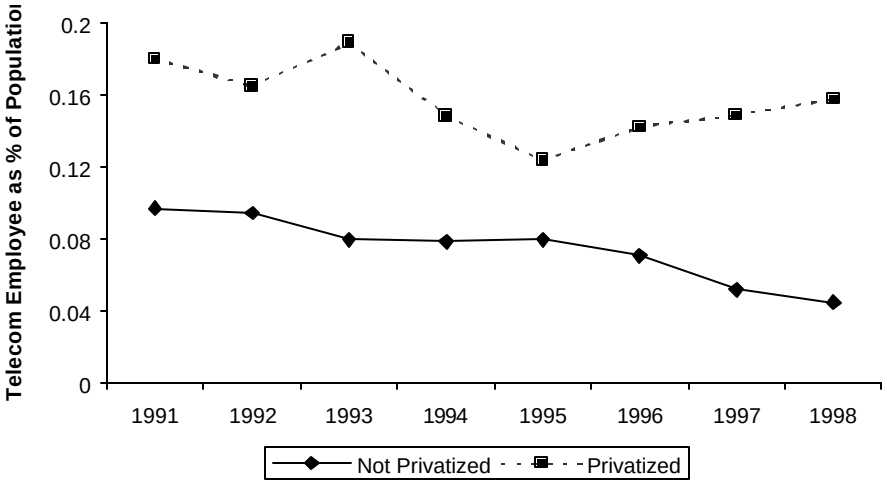
The first step to begin fulfilling the communications needs of the poor is to leverage the full potential of market mechanisms in reaching out to poor communities, by allowing the establishment of a competitive, private sector–led market. A range of studies suggest that there can be dramatic increases in access to telephone and Internet services, through a telecommunications-sector reform program based on three pillars: privatization, competition, and independent regulation.

Privatization in the telecommunications sector improves teledensity and revenue generation. Countries with private provision also see a higher level of employment in the sector, despite a widespread belief that privatization may trigger significant unemployment. For the 100 countries presented in Figure 412, the main findings were:

- Countries with privatized incumbents have a higher share of employment in the telecom sector than those not yet privatized;

- Compared with levels at the beginning of the 1990s, the share of employment in telecom sectors with and without privatization was lower in 1998. However, since 1996, the trend has been upward in privatized markets, while it has continued to fall where the incumbent is not privatized.

Figure 4.1. Telecom Employment



Source: Grace and others 2000

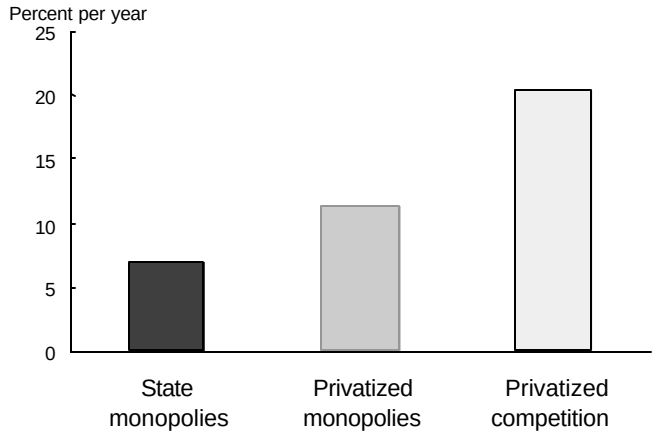
Similarly, in the postal sector, the benefits of greater private involvement can be impressive. In Trinidad and Tobago, the postal system has undergone an ambitious modernization process, transforming itself from a government department into a new postal corporation. A management contract was granted to a private operator selected by an internationally competitive process, which has had a major impact on quality of service: mail delivery at or near private homes has reached 62 percent of households within one year, with plans for a 96 percent coverage by 2004.

Major beneficiaries of the postal modernization process are rural and low-income communities that used to have hardly any access to communication and delivery networks. Along with letter and parcel mail, money orders can also be provided to more areas in a more dependable way. Wider coverage of the country with more reliable services has also helped those residents, often elderly, who depend on remittances from family members abroad. These services also support local small businesses that are in need of more secure and rapid means of communication, financial payment, and order fulfillment.

Competition further improves performance. Figure 4.2, based on evidence from a set of Latin American countries, shows that privatized open telecommunications markets in that region also saw basic line rollout approximately three times as fast as countries with a state monopoly and twice as fast than those with private monopolies.[15] A liberalized telecommunications sector is also vital to make access to advanced information technology more affordable, because a large part of the costs of Internet access are accounted for by telecommunications. A recent study of African Internet service providers suggests that countries with a highly liberalized telecommunications network had costs of Internet access eight times lower than those with a completely closed market. Countries with more open telecommunications sectors also had more host sites, lower monthly Internet charges, a greater number of providers, and higher rates of Internet penetration (Africa Internet Forum 1999).

Opening the broadcast sector to independent operators can also have a dramatic impact on the range and quality of programming. In Columbia, for example, over 1,000 new licenses were issued to community stations in 1995. This should be part of a broader move to issue spectrum licenses to local and national stations, which can dramatically increase listener choice and information flow. (This is a process ongoing worldwide. For example, in 1999, the FCC introduced a new low-power FM radio licences (100 watts) and requested comment on introducing a microradio class at 1-10 watts.)[16]

Figure 4.2. Basic Line Growth in Different Regulatory Environments in Latin America



Source: Wellenius 1997a.

Regulation: Gaining full benefit from private-sector participation and liberalization requires the regulatory environment of the communications industry to be conducive to a well-functioning competitive market. In the telecommunications sector, this can be achieved through legal and regulatory mechanisms that promote, among other things: fair interconnection and revenue-sharing arrangements between telecommunications operators; moving toward cost-oriented tariffs and the elimination of internal cross-subsidies, with the limited exception of carefully designed subsidies to ensure access

[15] A recent study (Wallsten, 1999) also suggests that privatization, good regulation, and a competitive mobile market (with say, three mobile companies) could double the number of lines per capita in some of the poorer markets in Africa.
[16] http://commons.somewhere.com/rre/2000/RRE.Radio.and.the.Intern.html

and use for the poor; as well as recourse to a strong and truly independent regulatory agency, capable of enforcing rules.

But gaining full benefit in rollout, revenues, and employment from ICT liberalization requires going beyond the boundaries of the sector itself. It is important that the country be attractive to foreign investment in its rules and regulations on such issues as repatriation of profits. It is also important that education systems and labor laws enable recruitment of skilled local staff as well as the opportunity to bring in specialists where none are available locally.

4.2. Overcoming Demand Constraints: Pro-Poor Access Policies

Despite the clear advantages of well-regulated private competition over government monopoly provision, the experience of Eastern Europe suggests that liberalization does not always increase household access to telephones (see Box 4.2). And the example of access to public phone boxes in Latin America suggests that basic reform alone is not sufficient to guarantee public access. To guarantee significant and equitable returns to the basic reform program, a wider policy approach is needed along two dimensions—first, pro-poor regulation and policy within the sector and, second, complementary reforms outside the sector in areas including investment policy and education.

Box 4.1. Eastern European Telecoms Reform and the Cost of Access

Basic service provision has been traditionally subsidized in East Europe and Central Asia (ECA). For example, monthly subscription charges in Turkmenistan, in 1995, were just US 50 cents. This compares to a world average of $7.1 per month. Cheap connectivity has stirred large demand for lines. But the low cost of connection makes installing a telephone a severe drain on income for the region's telephone companies, one which they have become increasingly unable to afford, leading to very long waiting lists. To recoup losses made on connection, and to cover the expenses of broader inefficiencies, telecommunications companies in the region have set very high rates for calling charges, limiting usage and resulting in very low revenues per line in the region. Latvia, with the highest revenues per line in the region, manages to earn a little under $180 per line per year. In contrast, the world average is $859 per main line and the African average is $718 per line.

Reform in the region is causing a painful rebalancing of prices toward the actual cost of service provision. While this is necessary to increase telephone use and to make the region's companies financially viable, one result is an increase in rental charges, putting a private line out of the reach of many people. The challenge in the region is to move from an unsustainable and unreachable goal of universal service—with high call pricing and long waiting lists for service—to a model of ensuring universal access through the rollout of public telephone and Internet terminals.

Telecommunications-sector reforms can promote economic efficiency, but governments may need to employ additional complementary mechanisms to close the 'access gap' in challenging, uneconomic areas or to reach uneconomic customers. These mechanisms include adopting programs that focus on public access through use of service requirements, access funds, and low-interest loans—along with supporting pro-poor applications and content and a broader reform agenda.

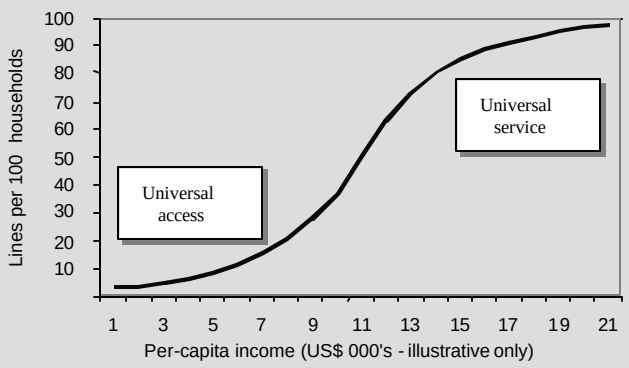
Focussing on Access: Policies and institutions to promote public access to telecommunications services are a central part of what has come to be known as "universal service" or "universal access" policies. These have different meaning in

different countries, as shown in Box 4.3. But by focusing on providing public access, be it to a telephone line, to a radio, TV screen, or to an Internet terminal, countries can aggregate demand so that a large number of people benefit from one or a few connections. This allows sustainable provision of ICT services even where incomes are low. In Senegal, for example, more than 6,000 privately operated and highly profitable telecenters have come into existence since the early 1990s.[17] Public access to a telephone has more than doubled. India, Peru, South Africa, and Thailand have also seen dramatic growth in privately owned and operated telecenters providing rural inhabitants with new information sources and opportunities (Ernberg 1998).

Box 4.2. Universal Service and Universal Access

Figure 4.4 offers an approximate view of typical household telephone penetration from low- to high-income countries. Similar diagrams can be produced for other services, such as Internet access. The diagram also introduces the concepts of ”universal service” and ”universal access.”’ Broadly speaking, in high-income countries, with residential telephone penetration typically above 75 percent, households without a telephone are considered to be disadvantaged. Advanced country governments and regulators, then, are concerned with policy instruments for achieving universal telephone service—meaning service to every home.

Figure 4.4



In low-income countries, however, the focus should be on providing public access to services. The only realistic objective in the short term is therefore to achieve ‘universal access,’ where everyone would be able to access a public booth in every town, village, or vicinity or within “reasonable” distance. What reasonable distance actually means, what services are to be provided at every public booth—telephone, e-mail, real-time Internet, and which of these services are appropriate at what level in the hierarchy of towns and villages, will very much vary from one country to another, depending on potential demand and ability to pay for these services. The scale at present runs from access to 2 mbps high-speed Internet lines for every home in Korea to a telephone within walking distance in some African countries.

[17] For more information on telecenters in Senegal, see **http://www.idrc.ca/acacia/engine/eng_6.htm; http://www.telecom-plus.sn/observatoire/Obtcp.htm;** and **http://www.sonatel.sn/c-telece.htm** .

Public access policies do not have to limit themselves to improving access to telephones. Indeed, many countries are using similar principles to support the provision of more advanced ICTs, ranging from fax to Internet access. A model that is receiving increasing attention is the multipurpose community telecenter (MCT). An MCT is a facility that provides public access to a variety of information and communication technologies and services. These centers may vary from single rooms with a telephone or two-way radio to facilities with full Internet access and other value-added services. MCTs can also provide indirect access to technologies through an intermediary such as a telecenter worker who understands the equipment and can read and write. This can expand the possibilities of Internet access beyond an educated and skilled minority.

An increasing number of MCT services are commercial. South Africa, for example, has shown that for-profit public Internet access can work outside the Internet cafes present in many African capitals. Zokode Distributors, a multipurpose information center owned by a local entrepreneur in Daveyton township, Gauteng province, serves between 16,500 and 18,000 people per month (CSIR 1998).

A reformed telecommunications sector is a key determinant of the sustainability of any mode of public access to ICTs. Indeed, the liberalization of at least the retail segment of the market and nonprohibition of reseller activity is a precondition for the emergence of entrepreneurs willing to establish payphone operations or MCTs. But it is still likely that more advanced ICT provision in rural areas will usually require some form of public support. Methods of efficient provision of such support are discussed later. Many successful models have relied on some level of external support, at least to cover initial costs, and on collaborative and participatory assessment programs before and during the creation of MCTs. In South Africa, for example, the Universal Service Agency is test-piloting a project to bring about 80 MCTs online within the next few years. The program relies on local input and management to ensure that services rendered are appropriate to community needs.

The MCT movement is still in its early stages in low-income countries, and it has faced some setbacks. One study of a pilot program of the Ministry of Environment, Natural Resources, and Fisheries in Mexico, for example, found that of 23 telecenters set up in rural areas around the country, only 5 remained functional after two years. Problems encountered included insufficient maintenance funding, inadequate political interest and will, and cultural constraints that hampered community interest in the projects (Robinson 2000). Again, this suggests the importance of participatory design and continued government support. Further, given the cost and skills demands of Internet access, it is likely that direct access by the poor in developing countries will remain limited. Through the intermediary of the radio, however, some of the benefits of Internet access can be provided to those without direct access (See Box 4.3).

Box 4.3: Rural Radio as An Internet Intermediary

Rural radio as a method of information delivery has several advantages. First, both the radio unit and programming and delivery mechanisms are among the cheapest forms of mass media. Second, radio signals can penetrate remote geographic regions, and any individual with access to a radio set can receive information, regardless of literacy or educational level. Finally, rural radio provides region-specific information, easily incorporates local concerns and feedback, and can operate in local languages. Radio programs have been used widely in education, but also to support gender training, as part of drought mitigation programs, and to promote a range of health issues and practices.

Rural radio can also benefit from the presence of the Internet. In Kothmale, Sri Lanka, a joint project between UNESCO, the Ministry of Posts, Telecommunications and the Media, the Sri Lanka Broadcasting Corporation, and the Sri Lanka Telecommunication Regulatory Commission uses radio as an interface between rural people and the Internet. A daily one hour live radio program in which an announcer and a panel of resource persons browse the Internet at the requests of listeners, has proven to be capable of overcoming linguistic barriers in using the Internet by non-English speakers. The radio station adds value to the information by interpreting it into a local context, by broadcasting it in vernacular languages, and by providing a platform for feedback through local discussion and networks of local correspondents. In addition to the radio program, the Kothmale Community radio station is developing a rural database (**http://www.kirana.lk**), primarily by packaging public domain information often requested by listeners for off-line use.

Use of service requirements: Service requirements are a simple method used by regulatory agencies to ensure a certain minimum level or distribution of telecommunications development within a country. They are primarily written as conditions into the license of an operator. They can involve teledensity or rollout targets for public and private lines, along with conditions on the quality and speed of service. Regulations can also support access by the disabled, supporting enhanced accessibility features to allow use by the visually and hearing-impaired. Service requirements should be set bearing in mind their commercial feasibility: requirements that are unrealistically ambitious may jeopardize financial performance and thus operators' ability to meet the targets and improve access.

In license-tendering processes, build-out targets are increasingly used as an important, sometimes primary, bid evaluation criterion, alongside the bid price. This approach, if preceded by careful analysis of the target users' capacity to pay, ensures that the rollout targets are indeed feasible. For example, in both Uganda and India, bid evaluations included rollout or coverage criteria.

If license conditions are to be met, enforcement procedures to follow up on the accomplishment of committed targets and a plan of sanctions for failure are essential. To make licenses with rollout conditions more attractive, a range of options are available, including bundling, packaging areas, and free choice of technology (see Table 4.1).

Rural and universal access funds: In a competitive environment the costs of providing universal access, including rural expansion, can be financed through special funds. These funds are set up as a transitory mechanism to help partially defray the initial investment costs of network expansion in rural and poor areas.

A prime regulatory objective in setting up universal access funds is to maximize the impact of the subsidies awarded, which is why the funds should be allocated to operators in a competitive way. The introduction of competition through a bidding process for the use of funds encourages operators to look for the best technology and other cost-savings practices. This tends to minimize the need for subsidies, if they are required at all. The choice of a funding strategy can also support a level playing field among operators so that none of the operators is overly compensated or unfairly burdened by the funding mechanism.

In such a competitive bidding process, the fund administrator determines the target areas to be served, normally based on socioeconomic studies and on consultation with the local authorities and population. New entrants and sometimes existing operators compete for subsidies for network build-out in these areas. The subsidy is then awarded to the operator with the lowest required subsidy or the highest service rollout commitment, or a combination of both.

In Chile, for example, just over $2 million in public funds leveraged $40 million in private investment to install telephones in 1,000 localities, at about ten percent of the costs of direct public provision (Wellenius 1997). Very few areas received no bids and thus remained unserved, although under-bidding for subsidies has caused financial problems for some operators, affecting roll-out schedules and causing service delays. To avoid this problem, since 1999 the regulatory agency has started to evaluate bids based on delivery time as well as on the bid price.

Table 4.1. Lessons Learned From Rural and Regional Licensing Processes

Approach	Process	Good/Bad Practices
Multiple concessions and bundling of services	Multiple services bundled under one license or the license could provide an opportunity to expand operations to other areas in return for enhancing coverage.	In Venezuela, the rural licenses allow mobile and multimedia services in addition to fixed access, long-distance, and international services. In Uganda, the second national operator license allows the operator to offer mobile services, and it is meeting the roll-out commitments using GSM rather than fixed lines.
Packaging lucrative areas with higher-cost areas	Packaging lucrative areas with less profitable ones within the same license area as a way to ensure balanced network expansion between regions.	Tanzania was divided into four zones with plans to issue two mobile licenses for each area. Currently, only the Coastal Zone has attracted operators. The other regions are seen as unprofitable, as there are no large urban centers in them. A packaging of the coastal zone with other areas might have expanded access more rapidly.
Freedom to choose technology in rural concessions	Rural operator licenses may include permission to install wireless local loop (WLL) lines and to offer other services in addition to the pure fixed network.	Ghana has licensed a WLL operator to provide coverage in rural areas.

Source: Dyamond et. Al. 2000

Although the initial focus of these types of universal access funds was to support the provision of public telephones by telecommunications operators, some countries are using this approach to support the establishment of public Internet access points, notably through telecenters. This has been the approach followed in South Africa, where the Universal Service Agency has used the fund to franchise telecenters around the country. Peru has recently started using a similar mechanism to support the public provision of telecenters and Internet terminals in poor city neighborhoods. Table 4.2 lays out various options for financing mechanisms for universal access programs.

Table 4.2. Possible Sources of Revenues for Universal Access Funds

Source of Revenues	Definition/Description		Characteristics/Examples
Interconnect levies	Incumbent operator carries a universal service or access obligation	Access levies can be raised as incremental interconnection charges by the incumbent operator, so that operators providing universal access are compensated directly through the use of their network by competitors.	The interconnection surcharge is opaque, and the operator has no incentive to reduce its costs. Both these factors reduce competitive pressures on universal access costs. Especially in the least developed countries where the incumbent is far from providing universal access services, open auction subsidies supported by license fees, transparent levies on all telecom companies, or government budgets are preferable.
"Virtual fund" transfers		'Virtual funds' support universal access providers on the basis of a regulator-prescribed costing methodology, with the money being provided by other operators.	
Operator revenue contribution	All operators charged a percentage of revenue	Most funds to date have been created using this model—a levy on telecommunications operators.	The levy generally varies between 1 and 2 percent, as illustrated by Peru and the Dominican Republic, for instance. In Guatemala, 70 percent of the revenues from spectrum auctions go to the fund.
Government budget	Funds for UA provided by treasury	In poorer low-income countries in particular, funding universal access purely from a revenue or spectrum levy alone is unlikely to be practical in the short run, and the use of government budgetary resources may become necessary.	This was the approach used in Chile; see details in text.
Seed finance by development bank or agency	Funds for UA come from international organizations	Sometimes, especially in the poorer developing countries, a development bank or agency could play a crucial role in financing the government rollout.	The World Bank's recent telecommunications project in Nicaragua includes a small portion of seed financing for the rural development fund. Similar schemes are under discussion in Nepal and Nigeria.

Low-interest loans and microcredit: Other financing mechanisms to speed rollout include low-interest operator loans to encourage operators' network build-out in less profitable regions. High-cost areas typically involve large up-front costs for the operators. Loans to help finance the initial capital investment costs can be useful, especially as domestic

capital markets in developing countries tend to be weak. Loans can be provided by governments or bilateral and multilateral aid agencies.

In Bangladesh, Grameen Phone, an operator offering traditional cellular services in urban areas, gives loans to low-income women entrepreneurs in rural areas to provide payphone services based on cellular technology. Building on its experience in providing micro-credit loans to the rural poor, Grameen Bank has provided over 1,100 telephones to rural poor women through loans averaging US$ 350 to cover equipment and start-up costs. The operators make a profit by reselling airtime to others in the village. Villagers report that the introduction of the service has allowed rural farmers to check livestock prices and coordinate medical needs, and has challenged the traditional power that wealthy landowners and intermediaries have held over rural economies and politics. Also, the phones themselves have become an important new business sector in the villages, generating jobs and income where none previously existed[18]. The average income per village telephone operator has been estimated at $700 per annum.

Micro loans for phone shops or other retailers can also support retail services extension. The traditional approach is to franchise a telephone line to private individuals or small businesses and to pay a certain percentage of commission to the franchisee. This way, operators can often secure higher revenues than from a public phone because the private incentive tends to keep lines working well.

Micro loans can also be used to finance phone shop and small telecenter operators to expand from basic telephone and fax into the Internet and ICT arena, as the market potential permits. In Delhi, India, the state government has taken this broad approach by starting a program to offer subsidized loans, at a 13.5 percent interest rate, to upgrade existing public call offices to cyber cafes providing Internet access. Micro loans or grants could also be used to support start-up costs for rural radio stations and provide those stations with access to the Internet. Again, community radio stations can benefit greatly from Internet access –it can provide news, information and programming resources. There might be a role to replicate the RadioNet project, supported by IDRC, which hopes to bring the Internet to some thirty regional stations within the next two years, opening up communication channels and facilitating the exchange of programs. [19]

Pro-poor applications and content: Provision of infrastructure is only the first step in exploiting ICTs for development. Without appropriate content, for example, the Internet will not be relevant to the poor in developing countries. There is also a large role for government to support the creation of appropriate content in broadcasting media. Same-language subtitling for television broadcasts supports language and literacy goals, and radio-based educational programming across a range of subjects and topics (math, language, health, agriculture) have been found to be highly cost-effective.

Governments often can and do assist the private sector in overcoming initial barriers to creating software for local use and for export. Support of ”incubators” would be one way to help overcome such barriers with Internet applications in particular. There are a range of private-sector Internet incubators emerging in industrial countries; examples include **CMGI Inc.** of Boston, **Garage.com** in Silicon Valley **Idealab.com** in Pasadena,

[18] More of information can be found on GrameenPhone at **http://newciv.org//GIB/crespec/CS-162.html; http://infoasis.com/people/stevetwt/heroes/muhammed_Yunnus.html;** and **http://www.rdc.com.au/grameen/impact.html**.

[19] http://www.idrc.ca/telecentre/evaluation/html/main.html

and **Incubasia** in Hong Kong. These incubators provide a full range of resources to infuse startup companies with the development strategies and financial support needed to rapidly introduce innovative products and services. Resources include office space and the accompanying network infrastructure, consulting and services relating to development and technology, graphic design, marketing, competitive research, and legal, accounting, and business development support and services. Incubators also provide advice on strategy, branding, and corporate structure. Social applications incubators, subsidized by the government, might be able to support the development of Internet firms and projects that promised a high social return for the poor, for the excluded, or for the environment. Such sites or projects might include local language and content sites, portals with exchanges or information on income generation for the excluded, or environmental monitoring sites. Assuming a throughput of ten incubates per year, initial costs might be as low as $500,000. A similar approach could be used for the development of local radio content.

Listening to the Poor: Central to any efforts to expand useful ICT access to the poor is knowledge of their needs and current degree of access. This is especially true for publicly supported subsidy programs designed specifically to assist the poor. Examples include the following:

- Data on users and their needs, including comprehensive information on excluded areas and groups, along with nationwide user surveys on needs and priorities;
- An audit of infrastructure in place, including physical, educational, and institutional resources; and
- A survey of business services and electronic commerce experience and practices, including existing electronic commerce and banking initiatives.

Household or community surveys are key, either stand-alone surveys or 'piggy-backing' on other poverty research efforts. Unfortunately, household use of and access to infrastructure services have not been a primary topic of interest in Lining Standards Measurement Surveys (see Chapter 4). As a result, most surveys collect only basic information about how households supply themselves with communication services. The surveys rarely contain information about the sources available to households or about the quality of the service they receive.

For the ICT sector, useful additional information might include:

- Whether the household has a radio, telephone, Internet-enabled computer, and if so, what type);
- If not, why not;
- Whether the household has *access* to a radio, public phone, telecenter, or post office;
- Distance to public communications services;
- What households spend on radio, telephone, and Internet per month;
- What the household spends in total on communication.

A good example is the Guatemalan LSMS survey, conducted in 2000.

Rapid market appraisal should be the second step in any publicly supported ICT rollout effort. This uses a package of participatory, community-based approaches to measure

demand for information and community technologies. The technique uses a detailed survey carried out in the area where expansion of ICT services is planned. The survey covers:

- Demographic and economic data to measure vital indicators such as approximate income, literacy, and population density.
- Potential business and government establishment users; these are likely early adopters.
- Geographic and other factors that might affect the technical complexity of providing services.

In addition to data collection through surveys and demand studies local communities need to be involved in the design of universal access programs by participating in decisions about particular information access outlets. Indeed, most studies find that the most effective way of ensuring the economic success of ICTs in rural areas is to encourage local participation and create social institutions in support of the new technologies (Richardson, 1999, Hudson, 1995—see also the **Community-Driven Development** chapter). This can be achieved through a participatory approach, to complement technical and economic calculations of telephone placement.

4.3. Public Governance and Provision of Services to the Poor

Governments can use ICTs to improve the quality and efficiency of public services, to strengthen government information flows internally, to promote accountability and transparency, to procure goods and services fairly and efficiently, and to raise quality standards for information technology suppliers. At the same time, there are significant risks: institutional failure, expense, poor design, and low levels of consumer access. A number of lessons should be kept in mind:

Incorporating ICTs must be seen as secondary to a broader reform agenda considered on its own merits (see also the **Governance** chapter). Broadly, this suggests a four-stage process in introducing ICTs (Heeks 1998):

- Acceptance by key stakeholders of the need to reform
- Identification of the agenda for reform
- Identification of the information systems requirements of the reform
- Identification of the role of ICTs, if any, in meeting these requirements

Evolutionary approaches should be preferred over revolutionary reforms. Introduction is complex and expensive—training and support costs, such as operations and maintenance, for computers can add up to as much as five times the cost of equipment, and this does not allow for the wider institutional reforms that are a necessary part of computer introduction (see below). Demands on scarce technical capacity are also high. This suggests that the costs of failure are very high—and the risk and cost of failure grow with the increasingly radical nature of reform.

Prioritization is vital, given the difficulty, cost, and time taken to introduce new systems. Priority should be given to the government sectors where better information processing has the highest return, and the risks of exclusion are lowest. This is likely to be in back office functions such as the processing of tax and land records rather than use in direct contact with service consumers, who might not yet have access or the knowledge to use that access (see Tables 4.3 and 4.4).

Widespread consultation and participation of users and stakeholders is necessary during the design process. While a senior champion is undoubtedly vital to the process as well, if the everyday system users are not involved in reform efforts and ICT rollout, they are far less likely to accept the new methods of service provision.

Access should precede service rollout, especially as governments begin to move toward directly providing services to citizens online. This suggests an ambitious program of MCT rollout. It also suggests implementing the technologically most simple and robust systems that will not become immediately obsolete. Microdesign issues become important here—using Word 2.0 rather than Word 2000, and avoiding large graphics in Web sites.

Low-technology solutions should be examined before high technology Because the complexity, cost and access difficulties of introducing ICTs tend to increase with their advanced nature, the simplest (radio or telephone) based solutions should be examined for cost effectiveness before more radical and expensive reforms involving newer technologies such as the Internet are tried.

Following such lessons, and allowing for the peculiarities of different sectors—see Box 4.4--, the benefits of ICT introduction in government services can far outweigh the costs.

Table 4.3. Priority Areas for Advanced ICT Use in Pro-Poor Government Services

Government Sector	*High Priority*	*Lower Priority*
Education	Tertiary and technical ICT training, teacher support, education-sector administration, distance education, selected use in secondary education	Direct and widespread use across school curriculum
Health	Epidemiological data collection and processing, administration, electronic health care data	Real-time online consultations
Tax, Fines and Fees	Records, instructions, databases	Online payment systems
Finance	Debt management systems, regulatory data	
Environment	Data collection, processing and monitoring	Support for telecommuting
Governance	Records dissemination, consultation	Online voting
Welfare	Records, databases, information	Electronic payment systems

Box 4.4. Issues with ICTs in Education and Health

While the benefits of moving to computer-based learning and universal student access to the Internet are clear, the cost-effectiveness and sustainability of these programs have yet to be fully judged. As with use in government services more generally, broad-based ICT use in education should accompany reform designed to maximize the technology's benefits, its rollout should be carefully weighted against other needs in the education sector, and introduction should be phased. The maximum benefit available from cheaper and more widespread ICTs, such as radio, should also be fully leveraged in conjunction with, or before, mass rollout of more advanced technologies.

This said, it is important to ensure that the next generation of graduates includes enough students with the skills to ensure that ICTs can be used effectively, and more broadly, in the economy. This suggests that there is the need to expand computer use, at least in a limited way, through the secondary education system. Argentina provides one model for the method of maximizing returns on this expenditure. The country rolled out an initially very small number of computers to each school. These first computers should have the maximum marginal benefit for schools, allowing for managerial data monitoring and transfer, for example. The ministry then monitored computer use. Where the equipment was fully leveraged, suggesting the presence of a receptive staff, the ministry rolled out a second set of computers—concentrating investment where the returns were likely to be greatest. While such a program raises equity issues, and so should be accompanied with an active support program for schools in rural and disadvantaged areas, it does allow for the maximum return to be garnered from a significant investment.

Similar lessons apply to health as to education, with a need for a careful balancing of priorities as well as integration with wider reform programs. Health use of the Internet also raises a number of important privacy and safety issues

- First, it is difficult to know from whom services are being bought over the Internet. One possible model is the Malaysian Telemedicine Act of 1997, which restricts the practice of telemedicine to either certified local practitioners or to outside practitioners who register and are granted a certificate to practice telemedicine.[20]
- Second, the electronic transmission of patient data leads to an increased potential for breaches in the confidentiality of doctor-patient relationships. This is particularly problematic where information crosses national borders with differing regulatory requirements and capacities. Multilateral rules and agreements have yet to address this issue, but as the use of telemedicine grows, problems in this area can be expected to increase.
- Third, as current medical technologies tend to be proprietary, they use a variety of different formats, technologies, and input languages. As telemedicine increasingly reaches across national borders, attention will need to be focused on the standardization of platforms to reduce medical errors and wasted resources.

[20] An unlicensed practitioner faces a sentence of imprisonment of up to five years and a fine of up to RM 500,000. Telemedicine is defined as "the practice of medicine using audio, visual, and data communications." (Siddiqi, 1999)

Table 4.4. ICT Use in Major Social Sectors

Potential Areas of Advantage	Potential Problems	Solutions and Objectives	Monitoring Indicators
Education			
• Offsets remoteness • Helps alleviate shortages in teachers and physical materials—cost effective • Expands distance learning opportunities • Enhances ICT skills and ensures population is able to adapt to new technologies • Links teachers and students across countries	• Uncertainty of the outcome of networking primary and secondary schools • No trained employees to handle software or networking problems • Sustainability not yet fully judged—recurrent costs, cost of updating equipment	• Weigh investments against existing infrastructure requirements and other needs in the education sector • Pilot rollout as a method of selecting targeted rollout • Increase funding for teacher training in Internet and information technology • Leverage benefits from cheaper and more widespread ICTs, such as radio	• No. of schools with computers • No. of schools offering computer-based education • No. of new teachers trained every year • No. of training seminars delivered • Regions and areas covered • Test scores, pupils trained • Cost-effectiveness analysis results
Health			
• Administration and management • Storage and transmission of data • Surveillance and monitoring • Publication and dissemination of medical findings • Doctor-patient consultation • Physician collaborations, especially in remote areas	• Patient protection and privacy • Medical errors and wasted resources • Payment and reimbursement mechanisms for online medical services • Misleading or fraudulent product information, lack of individual counseling for patients • Long-term sustainability of telehealth projects—recurrent costs	• Participatory assessments of local needs • Pilot program rollout • Standards and criteria for licensing and certification of medical practitioners and products • Standardization of platforms • Authorization before marketing medical products • Vocabulary and terminology work	• Percent of clinics, hospitals with ICT access • Percent of registered or certified practitioners to practice telemedicine

Potential Areas	Potential Problems	Solutions and Objectives	Monitoring Indicators
Environment			
▪ Compile data and build public access databases that can analyze and sort ▪ environmental information ▪ Encourage communication and knowledge sharing between public and private sectors to meet the objectives efficiently ▪ Gain environmental benefits through the reduction in factor and resource inputs	▪ Technical staff not available ▪ Users not familiar with, not able to access, or unaware of environmental information ▪ ICT use not encouraged over commuting	▪ Build a core of effective users ▪ Provide continuous training for data providers and users ▪ Develop guidelines and policies for management of geographic information ▪ Advertise available information ▪ Support telecommuting with education and transfer benefits	▪ Public involvement in environmental monitoring—no. of violations reported ▪ Extent of environmental information available online ▪ Percent of workers telecommuting
Welfare			
▪ Decentralization of welfare services provision ▪ Records, databases and information sorting ▪ Job vacancies and job opportunities information	▪ Interoperability of welfare information systems ▪ Access	▪ Provide public access terminals at the local government level ▪ Harmonize and standardize information and data systems used in welfare services	▪ Documented standards and classifications ▪ No. of jobs and resumes posted on the Web ▪ Percent of people searching for or finding their jobs through Web site

4.4. A Broader Reform Agenda

Outside the field of ICT itself, there may be a need for reforms in investment policies and trade controls to encourage investment in and use of basic infrastructure and of advanced services. Infrastructure rollout and Internet commerce are affected by policies on taxation, tariffs, currency convertibility, dispute resolution/jurisdiction, intellectual property rights, particularly for informational goods, and privacy and consumer protection. The political climate and security are also important.

A number of countries have embarked on creating national "knowledge economy strategies" to respond to the challenge of the new networked economy—examples include Thailand, China, Korea, and Ireland. Such strategies, if they are not viewed as fixed five year plans, and if they are designed with a clear focus on consultation, participation, and poverty reduction, can play an important role in prioritizing pro-poor reforms to ensure equitable advantage from the new ICTs. Such strategies should focus on:

- *A preliminary assessment of the knowledge economy*. This should include a comparative review of the educational and infrastructural underpinnings of ICT use (who has access to which ICTs, and where? What is the skill base for using and maintaining ICTs?). It should also study broader educational resources, such as language skills, and the legal environment for investment, labor, and e-commerce. Finally, the assessment should review current uses of ICT in the private and government sectors. The assessment should help policymakers determine where the country could learn from global best practices, and what opportunities are available to the country from the networking revolution.

- *Improving access to the tools of the knowledge economy.* There is a need to roll out the physical and intellectual requirements for ICT use. This includes a reform agenda to widen access to the range of ICTs, from community radio and posts to broadband Internet. It suggests regulatory and subsidy programs to ensure access to the poorest. It also includes a widespread program of reform in education to focus on training in literacy, language, and technical skills, especially for the excluded.

- *Identifying priority areas for broad-based economic and institutional reform to increase competitiveness*. The effective use of ICTs is dependent on a raft of policies and institutions outside the sector. A broad strategy would cover areas such as opening up the economy and promoting competition and e-commerce, developing and deepening financial markets—and, especially, improving access for the poor, enhancing flexibility in the labor market, and strengthening social safety nets.

- *Expanding e-government.* It is important to set priorities in the use of ICTs in government. These are needed in areas such as tax, education, health, and the improvement of governance transparency. Access of officials to ICTs that will have the greatest marginal impact, including in online government contract bidding, needs to be ensured. Further, the bureaucratic framework to ensure maximum returns needs to be put in place.

E-commerce in particular requires a supportive legal framework in the banking and industrial sectors, as well as legal and judical changes in response to challenges that

have emerged in tandem with the new technologies. These include standards and protection of digital signatures, the liability of value-added networks, regulation of certification authority, protection of intellectual property, and computer crime and data protection. The complexity of these issues is a major obstacle for countries that lack the technical capacity to design and implement needed reforms. In response, the United Nations Commission on International Trade Law (UNCITRAL) has developed a standardized e-commerce "model law" designed to be easily integrated into most country's legal systems. The law is based on developing equivalencies for paper-based concepts such as writing, signature, and original. Also, the model law provides specific guidance for the design of laws regulating legal coverage of electronic communication and the transmission of goods and services through the Internet.[21]

The financial systems in many countries also require significant upgrading and regulatory changes to meet the demands of e-commerce. Business and consumer trust in electronic forms of payment needs to be enhanced through effective supervision and technical capacity. In particular, national banking systems will need to upgrade their infrastructure to accommodate electronic payments and settlements. The postal network is also central to e-commerce as a major delivery tool for purchased items. This reconfirms the importance of following a broad-based ICT reform program involving posts. The goal of widespread access to postal services provides an opportunity to leverage linkages. In South Africa, for example, Winterveld Post Office is being used to host a rural telecenter. Combining the functions of a rural post office, which frequently involve services such as banking, with that of a telecenter might offer significant savings over providing the two separately.

Technical expertise is also a central requirement in rolling out access to ICTs. These skills are needed not just in cities or exchanges, but in every telecenter. This technical expertise is frequently rare in low-income countries, and therefore expensive. If costs are to be reduced and necessary skills made available, the government should support a significant expansion in technical training for the use and support of telecommunications and the Internet.

4.5. Monitoring and Evaluation

As discussed in-depth in the **Monitoring and Evaluation** chapter, both monitoring and evaluation are important activities to measure performance, identify and correct potential problems early on, and improve the understanding of the relationship between different poverty outcomes and ICT policies. However, these are two different activities: monitoring involves tracking the progress in achieving goals (i.e. a comparison of the level achieved with a pre-determined target) while impact evaluation involves assessing the changes in individuals well-being that can be attributed to a particular program or policy. Although many of the concepts and some methodologies are the same, there are important differences between monitoring and evaluation, at both the project level and at the level of a national strategy.

Monitoring issues in ICT

[21] The model law covers legal recognition of data messages, digital signatures, originality, admissibility and evidential weight of data messages, the formation and validity of contracts, recognition by parties of data messages, attribution of data messages, acknowledgement of receipt, and time and place of dispatch and receipt of data messages. See **http://www.uncitral.org/en-index.htm** for the complete text.

Selecting indicators

There is no general rule about the optimal number of indicators that need to be selected for monitoring as long as they are relevant to goals agreed on the poverty reduction strategy. However, as time and resources are limited there is a tradeoff between the number and the quality of indicators that can be measured well on a timely basis and provide useful information for decision-making. As discussed in the **Monitoring and Evaluation** chapter, the selection process would generally consider three broad types of complementary indicators: impact, outcome and intermediate (input/output) indicators.

Impact indicators:
Impact indicators measure the final effect of ICT interventions on different poverty dimensions. In particular, they are used to track progress on achieving goals related to improving economic opportunities for the population, promoting private sector development and improving services in social sectors, especially for the poor.

Outcome indicators:
The outcome indicators are intended to capture 'midway' effects that are generally considered as necessary but not sufficient conditions to achieve final impacts. Ideally, the monitoring system should include a combination of measures of use/access, quality and and user satisfaction with ICT services.

Ideal indicators may not be good indicators, if they are too difficult or costly to measure well. It may be better to use a proxy, such as a measure of access to ICTs, rather than the usage of ICTs. In fact**,** most countries experience large variations in access to ICT across rural and urban areas. Monitoring indicators – particularly outcome indicators -- should be disaggregated at least at the rural and urban level to allow tracking progress in closing the digital divide.

Variables measured by impact and outcome indicators depend on a multitude of cross-sectoral factors. Many, such as household behavioral responses, are outside government control. Moreover, changes in these variables may occur only in the medium to long run. Thus, it is important to complement impact and outcome indicators with intermediate indicators.

Intermediate (input/output) indicators:
Intermediate indicators provide information on actions taken and their efficiency level in improving the coverage and quality of ICT services. They measure things that reflect policy changes and are relevant inputs to achieving the agreed goals. Since it is difficult to find all these attributes in just one indicator, generally the monitoring system would include a combination of measures of investment or expenditure levels in ICT that are pro-poor, some measure of the services generated, and the efficiency of their production as intermediate indicators.

Data sources

Monitoring requires a combination of data sources including household surveys and survey data from operators and other agents engaged in the provision of services. Qualitative data from participatory poverty assessments or other similar studies may also be required. The main sources of data relevant for ICT monitoring are summarized in Table 4.5.

Table 4.5. Main Data Sources for Monitoring ICT Interventions

Data source	Relevant data for ICT monitoring	Remarks
International Telecommunications Union (ITU)	ITU data are compiled through annual questionnaires sent to telecommunications authorities and operating companies and are supplemented by annual reports and statistical yearbooks of telecommunications ministries, regulators, operators and industry associations. The quality of data varies among reporting countries as a result of differences in regulatory obligations for the provision of data.	• Nationally representative data on ICTs (both outcome and intermediate indicators) • Covering most countries • No consumption or detailed income information (thus difficult for micro-level analysis)
Pyramid Information Infrastructure (II) Indicators Database	Very detailed data on II performance indicators; ❑ Circuit and Packet Switching and Transmission ❑ Wired Access ❑ Wireless Access ❑ Customer Premises Equipment On II investments and revenues. Pyramid Research, the telecom division of the Economist Intelligence Unit, created this database.	• A comprehensive set of indicators (mainly outcome indicators) • Updated annually • Covering only 60 countries
World Development Indicators (WDI)	Drawing on ITU, Telegraphy, UNESCO, Internet Software Consortium, Netcraft, Digital Planet and WITSA, WDI includes indicators that measure the penetration of the information economy and some common performance indicators for telecom, including measures of supply and demand, service performance, and tariffs.	• A good summary of data from various sources • Updated annually • Indicators covered are limited: do not capture elements of the information disseminated, such as its quality
LSMS/Household Surveys	Record detailed data on household expenditures to construct consumption aggregates and to measure people's access, utilization and satisfaction with selected social and economic services. For ICT use, they generally ask how much the household has spent on ICT services; whether there is an Internet connection and the average number of hours a day spent on Internet, etc.	• Comprehensive, nationally representative household survey; allows simultaneous measurement and analysis of various poverty dimensions • Collection and analysis of information is very time consuming and expensive • In the older LSMS surveys the ICT coverage was very limited. In the Guatemala 2000 LSMS, the information was collected through an expanded module which will also be used for later LSMS surveys.
Qualitative (Case) Studies	Can provide information on user satisfaction with ICT services	• Sample size generally too small

It requires a great deal of coordination and collaboration to ensure timely availability of all necessary data and makes more difficult to ensure quality control. The lack of household data on access to ICT has prompted a number of initiatives to:

- Ensure national surveys include questions about telephone/Internet/postal access, cost, quality in the next three years.
- Support the compilation of international data on access, cost, quality to Internet/telephone/postal/broadcast.
- Undertake collection on qualitative information such as postal sector reform, broadcast technology reform, and universal access, etc.

Monitoring indicators at-a-glance

Table 4.6 provides some guidance and examples on the choice of indicators. However, the final selection of indicators should be driven by the specific poverty reduction goals, policy choices, monitoring capacity and the views expressed in the participatory processes of each country.

Table 4.6. Indicators for Monitoring ICT-Related PRSP Goals

Indicator	**Definition**
Impact indicators	
Goal: To improve economic opportunities of the population	
Macro stability	• % of contribution by ICTs to GDP
Job creation	• # if ICT-related jobs created
Private sector development	• % of private sector with access to affordable ICTs (notably SMEs)
Governance	• % of government agencies online central government local government • % of government services that can be delivered through ICTs (phone, email and web sites)
Goal: To improve services in social sectors	
See **Table 4.4** for more detailed ICT impacts on major social sectors	
Outcome indicators	
Access/Connectivity	• # and % of households with access to radio, telephone (fixed/mobile), PC, fax machine, TV, Internet, post office public private • # and % of households with service coverage in rural areas/among the poorest
Quality of services	• % of successful calls • % of hh reporting satisfaction with the services
Intermediate (input/output) indicators	

Indicator	Definition
Enabling environment	• privatization: whether the incumbent is privatized • regulation: independent regulator and its responsibilities (qualitative) • liberalization: competition rating
Efficiency in the provision of services	• Waiting list for mainlines (# of people on the waiting list and /or waiting period) • Telecom staff per 1000 connections
Expenditures/ Investment level	• US$m /% of GDP invested in ICT infrastructure • US$m in financing mobilized • Profitability of investments
Goods/Services generated	• number of lines/users/subscribers added
Training/Human capacity building	• US$m invested in training • US$m invested in R&D • # of IT specialists trained annually

Assessing ICT policies, programs and projects

Regular monitoring can be complemented with more in-depth assessments of particular policies and programs. Depending on the methodology applied, these studies can answer different questions of interest such as which social groups are benefiting most from investments in ICTs and to what extent changes in wellbeing indicators can be attributed to a particular ICT policy or program.

In the ICT context, evaluations have focused mostly on establishing the causality between changes in ICT performance indicators and improvements in economic growth. Recent econometric studies have confirmed evidence of high returns on investment in the telecommunications sector. The privatization of infrastructure services, in particular, has had a strong effect on the decision making process of foreign investors. For each dollar a country raises through the privatization of infrastructure, an additional $2.42 is attracted in FDI (Sader, 1995 p. 31).

Other studies have extended these correlations to other indicators, such as social development, cost savings for industry, and increased transport efficiency.[22] As the FAO reports: "It was estimated that transmitting price and market information through the Internet-based rural information service cost 40% less than using traditional methods. These studies are useful and have reasonable costs as they piggy backed on existing or ongoing large household surveys, saving much of the costs of creating and implementing a whole new data collection instrument.

For some projects, the quantitative measures of sector progress should be complimented with qualitative estimates:

- *Status of reform:* movement toward a well-regulated competitive environment in the sector with strong provision for universal access.

[22] See Analysys (2000) for a review.

- *E-readiness:* passage of electronic signature laws, financial reforms for Internet-based transactions, improvements in service delivery.
- *Improvements in entrepreneurial environment*: more businesspeople ready to utilize opportunities presented by the new technology.
- *Quality of content:* content sites that overcome market barriers and are suitable for developing nations.
- *Improvements in knowledge:* Well-disseminated studies and reports, with focus on developing economies, on best practices in telecommunications/Internet/postal/broadcast areas.

For projects expected to involve large transactions (such as privatization of the state monopoly) macro targets need to be set. For others aimed at improving rural access to ICT services, income and non-income impacts of that access will be measured. However, it is difficult to clearly establish the link between project outcome and development impact. Therefore, macro, income or quality of life indicators should be chosen (a) on a case by case basis (b) only in large projects where the impact is expected to be significant and (c) only where resources have been planned and dedicated at the outset to carry out such an evaluation.

Some of the above monitoring indicators (percentage of population with postal access for example) are not easily available at the country level. For the indicators to have contextual meaning for individual projects, this would need to change. It requires at the least a project-specific approach to collect data both in the project host country and a range of comparator countries at the time of project implementation. This will involve the inclusion in project agreements of support for gathering suitable project monitoring data not already available. A more general effort to collect such data across countries in a globally consistent way would be more efficient and provide a global public good, although budget realities might push against this. Given the rapidly changing and expanding nature of the sector, the priority of evaluations of ICT projects will be increased.

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