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Information and Communication Technologies for Direct Poverty Alleviation: Costs and Benefits

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Information and communications technologies (ICTs) are powerful tools for empowerment and income generation in developing countries. The cost-effectiveness of different ICTs does vary between developed and less developed countries, however. This article reviews the potential efficacy of radio, telephony and the Internet as tools of direct poverty alleviation in the latter. While the requirements for their successful utilisation make radio and telephone far more suitable technologies for the poor, traditional ICTs can act as a sustainable intermediary for them to gain indirect access to the power of the Internet. Governments should concentrate on opening up private and community provision of broadcasting and widening access to telephone services, so that they can effectively play this intermediary role.

Radio and the telephone have a long history demonstrating their utility in developing countries. The Internet has also already proved itself useful in these countries, in increasing both the incomes and quality of services received by citizens. Using Internet-based systems to make phone calls has reduced the cost of international communication; the Internet is being used to ease the export and import of goods; and countries such as India are earning billions of dollars a year exporting IT services and software (see Grace et al., 2001).

Because of the many uses of information and communications technologies (ICTs) in a developing country context, many donors, governments and NGOs have long supported roll-out programmes for these technologies – providing radios to schools, community groups and refugees, and supporting the expansion of rural telephone services. Some of these same groups are now experimenting with community-based multi-purpose community telecentres (MCTs) that provide public Internet access, email and other computer applications.[1] Building on these first steps, there is a movement in the development community pushing for the widespread roll-out of community access points to the Internet as a tool for direct poverty relief.[2]

* Infrastructure Economist, World Bank. The views presented are those of the author, and do not necessarily represent the view of the World Bank, its executive directors, or the countries that they represent. He is grateful to Jeni Klugman for helpful comments on earlier drafts. The usual disclaimers apply.

1. A few multi- and bi-lateral donors with active programmes related to MCT development include: USAID's Leland Initiative (http://www.info.usaid.gov/regions/afr/leland); IDRC's Acacia Initiative (http://www.idrc.ca/acacia/index.html); the International Telecommunications Union (http://www.itu.int/ITU-D/index.html); UNESCO (http://www.unesco.org/webworld/iip/#funding); and the World Bank (http://www.worldbank.org/html/fpd/telecoms/subtelecom/selected_projects.htm).
2. See, for example, the ITU's Buenos Aires Action Plan (http://www.itu.int/ITU-D-UniversalAccess/BAAP09.htm).

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This article argues that, whilst there is a continued (perhaps growing) role for donors to improve access to a range of ICTs in developing countries, that role probably should not extend to the widespread provision of Internet access – at least in the poorer regions of the least developed countries. The nature of extreme poverty in developing countries – very low incomes, subsistence and unskilled wage labour as the dominant income source, food as the dominant consumption good, low education and high illiteracy, minority language group status and rural location – points to an unsustainably high cost and relatively low benefit of direct Internet service provision through telecentres to the very poor. This might suggest that the push for universal Internet access as a tool for poverty relief is misplaced. Instead, the article argues that access programmes focused on the telephone and radio might have a higher benefit-cost ratio and lower overall cost as alternatives to and intermediaries for the Internet in poverty alleviation programmes.

Characteristics of the poor

Taking as a cross-country definition of 'the poor' those living on less than $1a day,[3] we have information on the country location of a little over 1 billion such people. Approximately 40% live in India, a further 22% in China, 8% in Nigeria and a further 14% in Pakistan, Bangladesh, Ethiopia, Indonesia, Brazil, Mexico and Russia combined. The remaining 14% are spread throughout the rest of the world, primarily in Africa.

Table 1 looks at the average characteristics of a country weighted by the percentage of the global poor that reside there. In other words, it is a measure of the conditions prevalent in the average country occupied by poor people. This is compared with the global population-weighted average – the conditions prevalent in a country occupied by the average person, poor or not.

The table suggests certain features that poor people share, beyond their extreme poverty:

- Poor people are concentrated in countries and regions with low average income and higher than average poverty rates. The average poor person lives in a country with a little over one-third of the income of the average global citizen, and approximately double the population living under $1a day. There is also evidence that the poor are concentrated in particular regions within those countries.[4]
- About two-thirds of the population in countries where the poor reside are rural. The percentage of the poor that are rural dwellers is even higher,[5] and the rural poor frequently live in population-sparse environments.[6]

3. The $1 a day standard is an arguable definition, based only on absolute income, taking no account of the non-income dimensions of poverty, nor the depth of poverty below $1. Nonetheless, it is a widely accepted proxy measure of absolute deprivation.
4. In India, incidence of poverty by its 61 agro-climatic regions is immense, from 8.4% in UP Himalayan to 77% in Orissa Southern (World Bank, 1997a). For evidence from Brazil see World Bank (1995a).
5. 93% of the very poor in Bangladesh are rural (World Bank, 1999), as are 80% of the poor in Ghana, 74% in Zambia and 89% in Zimbabwe (World Bank, 2000 and author's calculations from data in WDI).
6. Two-thirds of households in the poorest quintile in Peru are in the mountain region, compared with less than a tenth in the densely populated coastal region (World Bank, 2000). In Ghana, 59% of the poor live in rural forest and savannah (World Bank, 1995b).

Table 1: Characteristics of countries of the poor

	Poverty-weighted global average	Population-weighted global average
Income		
GNP per capita (PPP)	2293	6200
Poor people % population	36.4	17.6
PCs/(1,000) per capita	7.4	58.4
Fixed telephone lines/(1,000) per capita	36.5	144
Mobile phones/(1,000) per capita	7.9	40
Radios/(1,000) per capita	196	380
Education and language		
Female adult illiteracy (%)	46	33
Male adult illiteracy (%)	27	18
Population not speaking the most widely used language (%)[a]	48	26
Population not speaking the official language (%)	53	36
Rural		
Rural population % total	67	54
Rural population density (per km2)	483	515
Fixed lines/(1,000) in largest city	171	231

Source: World Bank (2000) except for language.

Note: a) Source for language variables is Easterly and Levine (1997). The language variable poverty figure is calculated from data on India, China, Nigeria, Bangladesh, Ethiopia, Indonesia, Brazil and Mexico alone, the global figure is an unweighted average.

- A third feature of the global poor (not immediately apparent from the table) is that most are self-employed (and) subsistence farmers or unskilled agricultural labourers.[7] Linked to this, in percentage terms the poor buy fewer services and more physical goods (especially food) than the average consumer. Much of this 'commerce' is carried out on an in-kind basis.[8]
- Related to their unskilled labourer status, the average poor person is illiterate. Average literacy rates in the countries occupied by the poor are 54 and 73% for women and men respectively. Within countries, the poorest are much more likely to be illiterate (and vice versa).[9] Unsurprisingly, the same is also true of

7. In Tanzania, producing for subsistence is one of the best correlates with low income, and 83.5% of the poorest are crop producers – much of that for subsistence (World Bank, 1996). For evidence from India, Peru and Ghana, see World Bank (1997a), Harrell et al. (1989) and World Bank (1995b) respectively.
8. In Cote d'Ivoire and Peru in 1985, about 70% of the expenditure of poor households went towards food (World Bank, 1990), and 56% of food expenditures for the poorest in Tanzania (rural and urban) are in kind rather than cash (World Bank, 1996).
9. Compared with a national average of 35% headcount poverty in India as a whole in 1994, poverty rates were 45% for households where all were illiterate (World Bank, 1997a).

education rates, both past education amongst adults and current education of children.[10] Even those in school see very low per-student expenditure.[11]

- Poverty is also frequently correlated with minority language status. The average poor person lives in a country where half the population (and doubtless a greater percentage of the poor) do not speak the official or most popular language. In the great majority of cases, the languages the poor speak are minority, not global, languages.

Finally, it should be noted that the majority of the poor share the majority of these features.[12] The following sections will discuss what these correlated characteristics imply for the costs, benefits and sustainability of various ICT programmes.

The cost of providing ICTs to the poor

Poor people have very low potential expenditure on ICTs. The poorest quintile in Chile (living on considerably more than $1 a day) are willing to spend approximately 2-3% of their income on communications (de Melo, 1999). This appears to be the high end of expenditure worldwide. Assuming the same holds true for people on $1 a day, it suggests maximum yearly communications expenditures of approximately $10. What does this mean for the affordability and sustainability of various ICTs?

The radio is by far the cheapest electronic communications technology. Receivers cost perhaps $10 plus the cost of batteries (or a wind-up model, which does not need batteries, can be purchased for $70 to $100). They do not require an electrical connection and (unlike fixed line telephony or the Internet, for example), they are stand-alone appliances. This helps to explain why 40% of rural households in the low-income countries of sub-Saharan Africa and Asia already own a radio. On the transmission side, programming and broadcasting are also relatively inexpensive; a low-power transmission system can cost as little as $1,000 (www.nlgcdc.org/articles/cdcnews-695.html). Digital sound recordings can be made on equipment that costs $800 or less.

10. There are at least 12 countries in the world where the average number of years of schooling in the 15-19 age group is zero for the poorest 40% of households (World Bank, 2000). For evidence from Bangladesh, Vietnam and Sri Lanka, see World Bank (1999), World Bank (1995c) and Datt and Gunewardena (1997).
11. In Ghana in 1992, educational spending per capita in the poorest population quintile was approximately US$26.50, and in the richest quintile, approximately $41.50 (calculated from World Bank, 1995b).
12. In Panama, for example, indigenous populations, primarily rural, make up 41% of the extreme poor, 29% of the poor and 3% of the non-poor. A significant proportion (approximately one-sixth) are monolingual in their indigenous language, and virtually all of them are poor. Close to one-third are illiterate, with four years less schooling than the non-indigenous, and credit access is approximately half (Vakis and Lindert, 2000). For evidence from Vietnam, see van de Walle and Gunewardena (1999). It should be noted that the majority of poor in most countries are also women (although this is not always the case at the country level – see Datt and Gunewardena, 1997, World Bank, 1996, World Bank, 1999). The gap in school enrolment rates and health data would suggest that women constitute a majority of the poor (World Bank, 2000). This is not a problem *per se*, except to note that, because women also face lower literacy and education levels as well as a range of other features of poverty, without specific efforts to overcome these barriers the Internet will be a poor tool to promote gender equality. Another important minority group over-represented amongst the poor are the disabled. Disabled people are estimated to make up 15-20% of the poor in developing countries – compared to perhaps 10% of the population at large (Elwan, 1999). To the extent that the disabled poor have conditions that affect their motor skills or vision, their ability to access the Internet will be impaired.

In central Mali, a station supported by Oxfam is broadcasting information to 92,500 people a year at a cost of just US 40 cents per person (www.oneworld.com). This translates into affordable access for the poor.

Because community radio fulfils a role as a 'community telephone' it has a major source of income (www.commons.somewhere.com/rre/2000/RRE.Radio.and.the.Intern.html), and allows radio stations even in poorer areas to become sustainable. Even in a country as poor as Liberia, local stations have achieved profitability through advertising; people are willing to pay $1 to have an obituary read on the radio, for example.

Providing telephone access is considerably more expensive, especially in rural areas. The average cost of building out a telephone line used to be estimated at about $1,000. Recent advances in mobile telephony and wireless local loop have cut these average costs dramatically. James (2000) reports that wireless local loop technologies might cut costs of roll-out by a factor of between two and six over conventional technologies in (population-dense) India. Nonetheless, costs in rural areas where the majority of the poor live remain higher, because providing networked services to low population-density rural areas – and especially to mountain and forest regions – is significantly more complex and expensive than providing those services in urban areas.

Indeed, the market feasibility of networked service provision is even more dependent on geography and population density than it is on income. Because density varies across regions within a country more than income per capita, it tends to have a larger effect on income per unit area – perhaps the most important variable in determining the feasibility of public network access.

Chile's universal access scheme provides evidence to this effect. Chile supported the provision of telephone access to unserved areas by providing subsidies through a reverse auction to private companies; the lowest bidder received the bid subsidy in return for building out the service. The amount of subsidy bid for was dependent on the companies' calculation of costs and revenues, looking at potential usage (a function of demand density) and cost of service provision (a function of geography and, again, demand density). Subsidies demanded were highest in rural and remote (rather than particularly poor) neighbourhoods. The five districts of the country requiring the highest subsidies per locality were those with the lowest population densities, ranging from one to seven people per square kilometre.[13] These were not the poorest regions; indeed, incomes per capita were above the median national average.

Again, the importance of population density, feeding through to demand density, on the sustainability and cost of service provision suggests that poor people, many of whom live in population-sparse environments, will face particular challenges in obtaining access. Table 2 makes it clear that, whilst in aggregate South Asia and China are both population- (and so income-) dense, countries in sub-Saharan Africa, as well as the population-sparse regions of Brazil, China and India, will frequently find it difficult

13. The average subsidy per population was approximately $9.7 per capita ($3,550 per locality), although this rose to as high as $100 per person in the more inaccessible communities. Sources: localities, subsidies, estimated from Intven (2000), income per capita World Bank (1997), population, area http://www.ine.cl/chile_cifras/chile_cifras.htm (Chile en Cifras: Sintesis Geografica de Regiones). A similar programme in rural Peru provided access at an average cost of $19 per person, or $5,674 per locality (estimated from Intven, 2000).

to sustain telecommunications services in the absence of significant subsidies (Chile's GDP/km^2, for comparison, averages about $155,529).[14]

Table 2: 1996 GDP density: Selected regions and income levels

Region	Average GDP/km^2
Sub-Saharan Africa	39,046
South Asia	498,086
Poverty-weighted (top ten)	486,503
Low-income	175,437
Low-income, excl. China and India	64,337
Middle-income	154,675
High-income	658,367
World	280,005

Source: World Bank (2000).

The difficulty of providing telephone access in the remote areas of poor countries explains why teledensity in the rural areas of poor countries is so strikingly lower than in urban areas. The data in Table 1 suggest that in the countries of the poor the total telephone gap between the whole country and the largest city is 44 phones per thousand compared with 202 phones per thousand – or approximately a fivefold difference. The average global difference in access is 171 phones in the country as a whole compared with just 231 in the largest city, or a 26% difference. We have seen that 40% (approximately) of rural households in low-income Africa and Asia have a radio. Pigato (2001) notes that only around 0.18% of those same households have a telephone, compared with 5.22% of urban households.

In turn, this helps to explain the huge difference in telephone access by income group within countries. Poor people, predominantly rural, face the linked access barriers of low income and low density of demand. In South Africa, 75% of households in the richest income quintile have a telephone, compared with 0.6% in the poorest quintile (the same numbers are 11% and zero in Nepal and 73.8% and 1.7% in Panama) (World Bank, 2000). We have seen that providing rural telephony is becoming more straightforward with technological advance. Nonetheless, cost factors alone will still make access prohibitive for the poorest in rural areas.

What are the additional average costs of Internet access, above the requirement for access to telephony? A recent estimate for the cost of Internet access in Mozambique (based on Africa Internet Forum, 1999) suggests that the annualised fixed costs of access to one Internet-enabled computer (excluding telephone installation and rental but including equipment costs plus yearly Internet fee for unlimited use) were $1,172.[15]

14. The Grameen telecom model has been impressive in rolling out services to peri-urban Bangladesh, but even in one of the most population-dense and flat countries in the world, with a strong micro-credit institution providing loans to rural villagers to buy phones and supporting the collection of phone bills, service has yet to expand far beyond the major cities (see http://www.telecommons.com/villagephone/section1.html for a map of present and planned roll-out).

15. Based on a 20% cost of capital, four-year depreciation for a computer costing $1,300 and a modem costing $175, $500 cost of connection to a telephone line and a $10 one-time and $600 annual fee for Internet

Services of a part-time technician to support users are likely to add at least another $2,000. On top of these costs are those for electricity, call charges and housing, which can be very significant in rural areas. Shakeel et al. (2001) estimate off-grid power costs per Internet-enabled computer at about $4,000 fixed and $200 recurrent costs, for example. Providing Internet access is made more complex if technicians have to travel long distances to maintain remote facilities or there are no roads on which to travel; again, this is frequently the case in poor rural areas.

A simple model may help to illustrate the economics of telephony and Internet provision in sparsely populated areas. The model calculates the fixed costs of provision per capita for a population receiving public telephony or Internet access, depending on the cost of installation and the population density.

The economic fixed cost of providing telephone service is allowed to vary. The model assumes that the fixed cost of Internet access and technical support (above telephony costs) is $3,172 per year (which excludes electricity costs). In order to come up with a yearly fixed cost, these figures are discounted at 20%. It is assumed that each telephone or Internet-enabled computer has a potential catchment area of 80km^2, or approximately a 5km. radius.[16] The fixed costs of telephone and the Internet are assumed to fall equally on this population within that radius. This is unrealistically favourable, given that, even with access, much of the rural population will not use the Internet because of the barriers of need, interest, age, language, literacy, skills and disability. The fixed costs of service provision per capita are shown in Tables 3 and 4.

At a line installation cost of $10,000 and a population density of 10/km^2, the annual per capita fixed costs of telephony are approximately $2.50 – or 25% of the estimated $10 annual expenditure on communications of a person living on $1 a day. The costs of the Internet are significantly higher – about 65% of annual expenditure. Even at a relatively low cost of rural telephone installation, about $2,500 for the first line, fixed Internet costs at a population density of 10/km^2 are still 46% of total expenditure (compared with 6.3% for the telephone).

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connection. We will see later that costs of access might fall below this level with policy and technological advance. These costs might already be considered too high. The Sustainable Access in Rural India Project (SARI: http://www.tenet.res.in/rural/sari.html) hopes to provide access to a simple Internet-enabled computer and a public telephone over wireless local loop in the Madurai district of India for around $1,000 in fixed costs and $360 annual recurrent costs. The computer for the system uses so little electricity that it might be feasible to create a wind-up model. The programme is still in development, and cannot offer the type of technical support that would allow for extensive support of poor people's Internet use, but might suggest the potential for Internet-enabled technologies to support a considerably larger percentage of the world's poorest. Proenza (2002) reports costs in urban (connected) telecentres in Peru, Hungary and Jamaica which carry annualised costs (including technical support) of between $1,496 and $4,440 per computer – larger centres carrying significantly lower per computer costs. Looking at an operational rural system, however, suggests the above estimates might be too low. LINCOS' solar powered telecentre in Costa Rica cost approximately $20,000 per computer in an area without grid electricity and $18,000 in an area with grid electricity for a six-computer centre. Ongoing costs excluding manpower were approximately $5,000 per computer (Shakeel et al., 2001).

16. Few areas of the world have rural population densities as low as one person per sq. km., but country *average* rural population per sq. km. of arable land is frequently below 50, and we have seen that in some areas of Chile, for example, population densities do fall this low. For example, average rural population density is below 50 in Argentina, Belarus, Kazakhstan, the Russian Federation, Ukraine and Uruguay.

Table 3: Fixed costs of telephony provision per capita, varying installation cost and population density

Cost of line installation ($)	Population density/km^2			
	1	5	19	50
	fixed costs of provision/capital/year			
2,500	6.25	1.25	0.63	0.13
5,000	12.50	2.50	1.25	0.25
10,000	25.00	5.00	2.50	0.50
25,000	62.50	12.50	6.25	1.25
50,000	125.00	25.00	12.50	2.50
Served population	80	400	800	4000

Table 4: Fixed costs of Internet and telephony provision per capita, varying installation cost and population density

Cost of line installation ($)	Population density/km^2			
	1	5	19	50
	fixed costs of provision/capital/year			
2,500	45.90	9.18	4.59	0.92
5,000	52.15	10.43	5.22	1.04
10,000	64.65	12.93	6.47	1.29
25,000	102.15	20.43	10.22	2.04
50,000	164.65	32.93	16.47	3.29
Served population	80	400	800	4000

The numbers in Table 4 suggest that the fixed costs of Internet provision are high enough to pose a significant sustainability challenge for poor populations even at higher population densities. With 400 people sharing the same telephone and computer, access per person would be limited to around 11 hours a year if the terminal or telephone were available (and used) 12 hours a day. Under these circumstances, the utility of the Internet would be severely diminished by long waiting periods and short access times. If a user-base per computer of 400 is considered a fair maximum, it is unlikely that the fixed costs of Internet provision would be under 80% of total expenditures for a poor community if strong technical support (one technician per three terminals) is considered a necessity, or under 40% even in the absence of such support.

The approximate cost per hour of accessing different ICTs at different levels of total usage per year can be estimated, based on a number of simplifying assumptions.[17] Low values are used for the fixed cost of telephone access. At a usage rate of 2,000

17. The fixed costs per year of Internet (excluding telephone) are assumed, as above, to be $3,172. The fixed costs of telephony per year are assumed to be $300, and of radio (a wind-up version) $21. The marginal cost of Internet and telephony is $3 an hour for a regional connection, $1 for a local connection. There are no marginal costs for listening to the (wind-up) radio.

hours per year (about 6 hours per day) the cost per hour of radio is about 1 US cent, as compared with $1.15 per hour for local telephone and $2.69 for local Internet access. The poor (spending under $10/year on communications) could afford perhaps 2 hours per year at an actively used facility offering Internet access provided through a regional (rather than local) connection, and about 40 minutes a year if the Internet connection was rarely used (compared with about 5 hours a year in local calls or 100 hours for a radio).[18] These figures will be one reason why Internet use and access are currently even more concentrated within and across countries than telephone access (see Heeks and Kenny, 2002).

Overall, then, the low income of the poor combined with their location in rural areas makes the use of the Internet, in particular, a financially disadvantageous method for information access for many people in poverty, even if the necessary inputs are available. Evidence from South Africa, where the telecentre movement is fairly well developed, suggests that these potential problems do translate into significant financial difficulties. Even in this fairly rich (upper middle-income) country, almost all Internet-enabled telecentres rely on government, donor or NGO funding to remain viable (Pigato, 2001).

Requirements for use

The Internet presents straightforward affordability questions when it comes to increasing access. There are reasons to suggest that the requirements for their succesful utilisation make radio and telephone far more suitable technologies for the poor.

Neither the telephone nor radio faces significant language barriers. For the radio, programming is cheap enough to be produced locally and in a range of languages. For example, in Latin America most radio (as opposed to television or Internet content) is produced locally or nationally (http://commons.somewhere.com/rre/2000/RRE.Radio.and.the.Intern.html). In Peru alone an estimated 180 radio stations offer programmes in Quecha, a language spoken by only 10 million people in the whole Latin American region (and one that is almost completely absent from the Internet) (http://commons.somewhere.com/rre/2000/RRE.Radio.and.the.Intern.html). Telephone and radio signals can also provide information access to the illiterate and those with no training in ICT use.

Compare these features with those of the Internet, a tool that requires a fairly high level of education and computer literacy to be used constructively. For example, a recent study of Capacity Building for Electronic Communication in Africa (CABECA, 1998) found that 87% of Zimbabwean and 98% of Ethiopian Internet users had a university degree (Ethiopia is a country where 64% of the population is illiterate). Indeed, the Internet is part of a cluster of IT technologies that is widening the gap between the incomes of those with a university degree and those without.[19] This is not a

18. Because of low demand for ISPs in poor rural areas, it is likely that the connection would be regional – although some countries cross-subsidise calls to ISPs by offering local-cost connection country-wide.
19. Skill-upgrading and growing premia for education in the US, for example, have been widespread, but particularly rapid in computer-intensive industries (Autor et al., 1998). The poor, who cannot afford access or training, and the majority of whom are not even literate, will suffer from growing wage inequality. While it is possible to design Internet applications for illiterate populations, their cost-effectiveness over

situation that is likely to change quickly, because low expenditure on education makes the Internet an unaffordable tool for general education or for IT technical training in the primary schools attended by poor children (see below).

Even those of the poor who find access, who are literate, and who acquire basic computing skills face the significant barrier to use of language. Along with training, language skills are vital to utilise the Internet's resources fully, because minority languages are dramatically under-represented on the World Wide Web. Igbo (Ibo), a language spoken by 17 million people in Nigeria, is all but completely absent from the Internet.[20] Conversely, English – a language spoken by very few of the world's poorest – remains overwhelmingly dominant. A 1999 survey found that 72% of sites were in English. Japanese and German added another 12%, and French, Chinese and Spanish all had between 1 and 2% (Nunberg, 2000).[21] The effect of English dominance on the efficacy of the web for non-English speakers can be estimated by looking at a recent study conducted in Tokyo, Beijing, Seoul, Bangkok, Singapore and Jakarta. This study found that English speakers were two to four times more likely to use the Internet than the non-English speaking population.[22]

Poor people's use of more advanced Internet operations, such as e-commerce, faces an even greater number of barriers. Poor people do not have the requisite credit facilities, they are far from logistics services that could deliver goods, and the types of goods they would want to buy or sell have limited outlets on line. It is for this wide range of reasons that UNCTAD's survey of e-commerce use in least developed countries, in the 2001 *E-Commerce and Development Report*, was able to find only a few examples of e-commerce, largely serving niche markets, limited to sales of between $2,000 and $30,000 per year, and employing a maximum of 50 people (UNCTAD, 2001).

Benefits of utilisation

There is ample evidence of the benefits of utilisation for a range of ICTs. Radio, in addition to being the only accessible mass medium, is a trusted source of information. In Nepal 71% of rural people surveyed used the radio as a source for information and found it effective. Friends, family and political leaders were the only information sources ranked as more effective, and the radio was judged far better than schools, newspapers (used and found effective by 24% of the population), television, telephone

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other technologies has yet to be demonstrated, and the range of such applications remains very limited, suggesting that illiterates will (at the very least) garner less utility from the new technology.

20. The only documents that could be found in Igbo after an extensive (two-hour) search were translations of the Universal Declaration of Human Rights, of something called the four spiritual laws, and of the food pyramid, a two-page Igbo phrase book and a prayer manual. Another example is Quecha, a language spoken by some 10 million people in Bolivia, Ecuador and Peru, which is completely absent from the Internet (http://commons.somewhere.com/rre/2000/RRE.Radio.and.the.Intern.html). Internet search found no web sites in Quecha, but one site, in Spanish, run by Peru's Red Scientifica, that discussed the Quecha language.
21. While 8% of websites could be classed as multilingual, all such sites had English as one of their languages, compared to the next highest (31%) with French or German as one of their languages (Lavoie and O'Neill, 1999).
22. Translation programmes are only a partial solution –being created only for languages spoken by many millions (http://www.feedmag.com/daily/dy070799.html).

(used by 19%, but found effective by only 1%) and the computer (also used and found effective by only 1%) (Pigato, 2001).

Unsurprisingly, the radio has shown itself to be a powerful tool for development. In the Philippines, for example, one development programme is providing local radio equipment and training to a number of remote villages. The project has not only increased local business and agricultural productivity, but also resulted in the formation of civic organisations and more constructive dialogue with local officials (UNESCO, 1996). At the cross-country level, the availability of independent radio broadcasting services has been found to be positively and significantly correlated with a range of development outcomes including life expectancy, lower infant mortality, schooling outcomes and better functioning markets (Djankov et al., 2001).

The radio has a particularly important role in extension and education. A survey of some of the 21,000 farmers enrolled in radio-backed farm forums in Zambia found that 90% of respondents thought the programmes were relevant and more than 50% credited them with increasing their crop yields (Dodds, 1999). In another study sponsored by UNESCO, Paul Neurath studied the effects of a Farm Radio Forum project at Poona, India. According to Neurath (as reported in Nwaerondu and Thompson, 1987: 105):

> Radio farm forum as an agent for transmission of knowledge has proved to be a success beyond expectation. Increase in knowledge in the forum villages between pre- and post-broadcasts was spectacular, whereas in the non-forum villages it was negligible. What little gain there was occurred mostly in the non-forum villages with radio.

Dodds (1999) also notes that a significant percentage of health workers in Uganda (54%) and Kenya (20%/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. Looking at education more generally, Adkins' (1999) survey of seven studies of the cost-effectiveness of educational intervention suggests that, in terms of incremental improvement, the impact of a dollar spent on interactive radio instruction (IRI) is nearly 70% greater than $1 spent on purchasing textbooks and over 11 times more than $1 spent on teacher training.

Turning to telephony, a recent study found that in rural Thailand the introduction of telephones which enabled farmers to check prices regularly had as much as doubled farm income (ITU, 1999). In Colombia, community telephone access in Tumaco in 1994 increased trade, employment and government service delivery (ITU, 1998). Access to telephony has improved opportunities in the rural non-farm sector, thereby increasing incomes in rural Ecuador (Elbers and Lanjouw, 2001). Operating public call centres is in itself a major source of rural employment and income; in the Indian state of Punjab, for example, there were 10,000 telecentres, each generating an average of $9,000 in revenue in 1996 (Grace et al., 2001). The strong link between telephone roll-out and income growth has also been found in numerous cross-country studies. Cross-country evidence further suggests that limited access to telephony within a country is a powerful force behind growth in income inequality; those with access benefit, whilst the incomes of those unconnected to the telephone network stagnate (Forestier et al., 2001).

The Internet is a more powerful ICT than either the radio or telephony, not least combining the 'broadcast' features of the radio with the interactive features of the telephone. As such, it has a range of capabilities that cannot be matched by the two

more basic ICTs. And direct access to Internet-enabled computers has also made a difference to many poorer people in developing countries. For example, in Chile, the national agricultural extension service created an Internet-based rural information service for farmers' groups, local authorities and NGOs. Transmitting price and market information through the Internet cost 40% less than using a printed bulletin, and was also almost instant, rather than taking 45 days (Balit, 1998: 4).

Having said that, the scale of the additional utility of the Internet to the poorest, above and beyond that which can be garnered through more basic ICTs, has yet to be conclusively demonstrated. For example, with regard to the transmission of crop-price data via the Internet, both the telephone and the radio have been used for this purpose for many years, with a significant impact on the price received by rural farmers for their crops.

Regarding e-commerce opportunities, even if we ignore the multiple barriers to the poor's use of such technology, a recent study estimates that transactions savings from e-commerce on food ingredients in the US would be of the order of 3-5%, compared with 29-39% for electronic components, for example (Goldman Sachs, 1999). In turn, this might suggest that the poor as consumers will not see dramatically lower prices for their largest consumption item (food), and the poor as producers (even those with access to the Internet) will not see dramatically increased demand for their products because of lower prices.

The Internet is also not a particularly efficient tool for the utilisation of unskilled labour (the type of labour that most of the poor have to offer). It might have some use as an information tool for connecting unskilled workers with employers who have a demand for them, but, as a direct source of income-generating activities, the Internet is a tool for skilled (at least computer-literate) employees, as we have seen.

Finally, direct provision of government services to the poor through the Internet would be both impractical (excluding those who are illiterate, and lack access, language or computing skills) and unsustainable. Taking the example of education services, the discretionary budget in primary schools in poorer developing countries (that left over after teachers' salaries have been paid) can be as low as about $5 per student per year. For comparison, estimates from a recent World Bank project in Turkey suggest that costs per student for IT classrooms being set up in that country, excluding training, housing and recurrent costs, are approximately $141. Even if the resources for Internet-enhanced educational services could be found, evidence on the cost-effectiveness of the technology is far weaker than that for interactive radio instruction, for example (Grace and Kenny, 2001).

In contrast to the case of radio and telephone, then, the poor face multiple barriers both to Internet utilisation and to benefiting from that use. They have little to spend on communications, live in areas where the Internet is costly and complex to provide, have low rates of education and speak languages ill-represented on the World Wide Web.

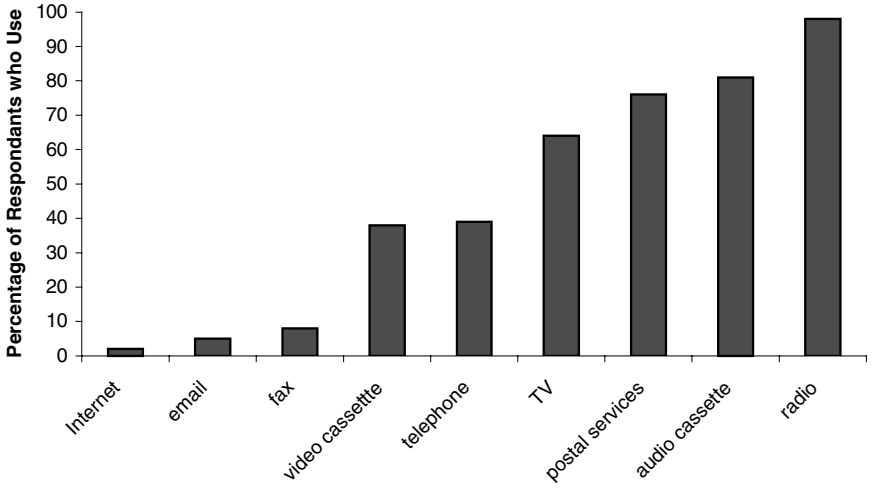
The multiple factors behind the low utility of the Internet compared with more traditional ICTs is also suggested by two recent studies that have found low Internet usage rates even in rural areas with access to the technology. Figure 1 is based on a survey of two villages in Uganda carried out by Samuel Kyabwe and Richard Kibombo (see http://www.idrc.ca/telecentre/evaluation/nn/22_Buw.html) at the time when Internet-enabled telecentres were being set up in the villages. It suggests that even

villages with Internet access may see usage rates as low as 5% – compared with close to 30% telephone and almost 100% radio usage.[23]

If providing Internet access would be very expensive, and yet providing that access might be of limited additional benefit beyond access to radio and telephony, this must raise questions as to the advisability of embarking on large-scale Internet direct access programmes as a tool of poverty relief, especially as compared with access programmes focusing on the more 'suitable' technologies of radio and telephony.

Nonetheless, there is a potentially important role for the Internet to support poverty alleviation efforts indirectly, through the more efficient functioning of governments and expanded export opportunities, for example. The Internet is a very powerful tool for information transfer; switching from fax to email can reduce the costs of sending 10,000 pages of text from Mozambique to the US over the course of a year by 83% (Africa Internet Forum, 1999). The CARD project in Andhra Pradesh, India is but one example of networked computer use in developing country government operations that help the poor. The Computer-aided Administration of Registration Department system has significantly reduced the time needed to register property and reduced corruption in the process, making the security of registration much more accessible to the poor.

Figure 1: ICT use in Nabweru and Buwama, Uganda



Furthermore, traditional ICTs can act as a sustainable intermediary for the poor to access the power of the Internet indirectly. Rural radio, in particular, can 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

23. A recent study of a pilot programme of the Ministry of Environment, Natural Resources, and Fisheries in Mexico also found limited demand for Internet use. Of 23 telecentres set up in rural areas around the country, only 5 remained functional after two years (Robinson, 2000). These findings are echoed by surveys in India, Nepal, Tanzania and Uganda reported in Pigato (2001) that suggest low Internet use amongst small-scale entrepreneurs with access because available content is not relevant, and a general low level of trust in the use of modern ICTs as a tool of information exchange.

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 programme in which an announcer and a panel of resource persons browse the Internet at the request of listeners, has proved capable of overcoming linguistic barriers in using the Internet for non-English speakers. The radio station adds value to the information by interpreting it for the local context, by broadcasting it in vernacular languages and by providing a platform for feedback through local discussion and networks of local correspondents.

The Internet can also act as a distribution network among independent broadcasters. The Panos Institute's Banque de Programmes On Line (www.oneworld.org/panos_audio/), located in Mali, has correspondents in 20 francophone African countries, and Latin America's Agencia Informativa Pulsar is a similar initiative for Spanish-language programming (http://commons.somewhere.com/rre/2000/RRE.Radio.and.the.Intern.html, www.pulsar.org.ec). Both these projects provide radio content accessible by community stations worldwide for broadcast.

Conclusion and policy recommendations

Radio is a powerful, sustainable technology for meeting many of the information needs of the poor. A policy that promotes access to as wide a range of radio (and television) broadcast options as possible is clearly important for the development of opportunities for the poor. Opportunities for private, competitive provision of radio content will expand choices and development impact. Governments should therefore legalise the private provision of national and local radio and issue spectrum licences for broadcasters. In Colombia, for example, over 1,000 new licences were issued to community stations in 1995, dramatically increasing listener choice and information flow. Even in poorer countries, opening the airwaves increases choice and information flow. There are 19 independent rural or community radio stations in Mali alone; Mauritania now boasts at least four such stations; and South Africa has over 80 (Vogt, 2001).

In addition to opening up to private and community provision, there also remains a significant role for government in the broadcast sector, especially in the delivery of public service content in areas such as education, health and disaster preparedness. Furthermore, there might be a role in providing access to receivers. Radio sets are already fairly ubiquitous in developing countries. Nonetheless, there might be an argument for providing wind-up sets to schools and community centres to ensure wider access amongst the poorest people. Donors, including the World Bank and the UK's Department for International Development, have supported carefully designed programmes of providing communities with radios.

The case of telephones is slightly different. Because of the historical concentration of access amongst wealthy urban populations, we have seen that telephone roll-out has traditionally been a force for divergence in incomes both between rich and poor countries and within poor countries. However, technological change, policy reform and innovative universal access programmes such as that in Chile have made the goal of extending telephone access to the majority of the poor an increasingly feasible idea.

It is clear that the first step remains a programme of reform towards well-regulated private, competitive markets, which have repeatedly delivered expanded network access

at lower cost (see Kenny, 2001, for a review of the cross-country evidence). To extend access beyond the market, subsidy auctions to provide lowest-cost, privately-provided public access in unserved areas (the model used to achieve universal access in Chile) have proved affordable and sustainable (Wellenius, 1997). It is hoped that this will turn telecommunications roll-out from a force for divergence into a force for convergence.

It will be a while before the same can be said of the Internet. Again, this does not mean that the technology is irrelevant to developing countries. It will have a range of uses in production, trade and the provision of government services that should increase incomes and improve the quality of life of the poorest. Via intermediary technologies including radio and telephony, the Internet might also have a significant impact on information flows directly to and from the poorest people.

However, at least until technological advance has made Internet access less expensive and more straightforward for the illiterate and minority-language speaker to use – and until education has become more widespread – the use of traditional computers hooked up to the Internet as a tool for poverty alleviation should probably not involve programmes for universal access. Even the cost of universal access to simple telephony would be a large burden on government and aid budgets. If we assume that service can be provided to the great bulk of the poor who currently lack access at the same cost as in Chile ($10 per head), this cost is equal to half of the annual per capita expenditure on health in low-income countries. Adding the Internet to universal access goals would greatly increase that cost. As we have seen, such programmes are likely to be complex and very expensive, and quite possibly of limited benefit. Instead, the Internet should be used as an indirect supporting tool in efforts to improve information and communications flows that do benefit poor people.

References

Adkins, D. (1999) 'Cost and Finance' in A. Dock and J. Helwig (eds), *Interactive Radio Instruction: Impact, Sustainability and Future Directions*. Washington, DC: World Bank.

Africa Internet Forum (1999) 'Economic Toolkit for African Policy Makers'. Available at http://www.worldbank.org/infodev/projects/finafcon.htm.

Autor, D. Katz, L. and Kreuger, A. (1998) 'Computing Inequality: Have Computers Changed the Labor Market?', *Quarterly Journal of Economics* 113 (4): 1169-1214.

Balit, Silvia (1998) 'Listening to Farmers: Communication for Participation and Change in Latin America'. Available at http://www.fao.org/WAICENT/FAOINFO/SSTDEV/CDdirect/Cdan0018.htm.

CABECA (1998) (Menou, M.J.) *Connectivity in Africa: Use, Benefits and Constraints of Electronic Communication – Synthesis Report. Part 2: Overview of the Findings of the Project*. Study carried out under the CABECA project of Padis as part of the IDRC-sponsored research programme on the Impact of Information on Development. Addis Ababa: UNECA/PADIS, May.

Datt, G. and Gunewardena, D. (1997) *Some Aspects of Poverty in Sri Lanka: 1985-90*. World Bank Policy Research Working Paper 1738. Washington, DC: World Bank.

de Melo, J. (2000) *Telecommunications and the Poor*. Internal World Bank Report. Washington, DC: World Bank.

Djankov, S., McLiesh, C., Nenova, T. and Shleifer, A. (2001) 'Who Owns the Media', Background paper for World Bank *World Development Report 2002*. Washington, DC: World Bank.

Dodds, T. (1999) 'Non-Formal and Adult Basic Education through Open and Distance Learning in Africa'. University of Namibia: Centre for External Studies (mimeo).

Easterly, W. and Levine, R. (1997) 'Africa's Growth Tragedy: Policies and Ethnic Divisions', *Quarterly Journal of Economics* 112: 1203-50.

Elbers, C. and Lanjouw, P. (2001) 'Intersectoral Transfer, Growth, and Inequality in Rural Ecuador', *World Development* 29 (3): 481-96.

Elwan, A. (1999) 'Poverty and Disability: A Survey of the Literature', Background Paper for World Bank *World Development Report 2000/*1. Washington, DC: World Bank.

Forestier, Emmanuel, Grace, Jeremy and Kenny, Charles (2001) 'Can Information and Telecommunications Technologies be Pro-Poor?' Paper presented at World Bank Economists' Forum, 3-4 May.

Goldman Sachs (1999) 'B2B – Just How Big is the Opportunity?'. Available at http://www.gs.com/hightech/research.

Grace, Jeremy, Kenny, Charles and Zhen-wei Qiang, Christine (2001) 'ICTs and Broad-Based Development'. Washington, DC: World Bank (mimeo).

Grace, Jeremy and Kenny, Charles (2001) 'A Short Review of Information and Communications Technologies and Basic Education in LDCs'. Washington, DC: World Bank (mimeo).

Harrell, M., Parillon, C. and Franklin, R. (1989) 'Nutritional Classification Study of Peru: Who and Where are the Poor?', *Food Policy* 14 (4): 313-29.

Heeks, R. and Kenny, C. (2002) 'Is The Internet a Technology of Convergence or Divergence?' Washington, DC: World Bank (mimeo).

Intven, H. (2000) *Telecommunications Regulation Handbook*. Washington, DC: World Bank.

ITU (1998) 'Rural Telecommunications in Colombia – Lessons Learned'. Paper given at World Telecommunication Development Conference (WTDC-98), Valletta, Malta, 23 March – 1 April.

ITU (International Telecommunications Union) (1999) 'General Principles: Particularities of Rural Environments and Their Implications for Telecommunications', in *Handbook on New Developments in Rural Telecommunications*. Geneva: ITU.

James, J. (2000) 'Bridging the Digital Divide with Low-Cost Technologies'. Tilburg University (mimeo).

Kenny, C (2001) 'Prioritizing Countries for Assistance to Overcome the Digital Divide', *Communications and Strategies* 41: 17-36.

Lavoie, B. and O'Neill, E. (1999) 'How World Wide is the Web?', *Annual Review of OCLC Research*. Available at http://www.oclc.org/oclc/research/publications/review99.

Nunberg, Peter (2000) 'Will the Internet Always Speak English?', *The American Prospect*, 10 March p.27.

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

Pigato, M. (2001) 'Information and Communication Technology, Poverty and Development in Sub-Saharan Africa and South Asia'. Washington, DC: World Bank (mimeo).

Proenza, F. (2002) 'Telecenter Sustainability – Myths and Opportunities', *Journal of Development Communications* 13 (1) (forthcoming).

Robinson, Scott S. (2000) 'Telecentres in Mexico: Learning the Hard Way'. Paper presented at the 'Partnerships and Participation in Telecommunications for Rural Development: Exploring What Works and Why' conference at University of Guelph, Guelph, Ontario, Canada, 26 and 27 October. Available at http://www.devmedia.org/documents/robinson.htm.

Shakeel, H., Best, M., Miller, B. and Weber, S. (2001) 'Comparing Urban and Rural Telecenters' Cost', *The Electronic Journal on Information Systems in Developing Countries* 4 (2): 1-13.

UNCTAD (2001) *E-Commerce and Development Report*. New York: United Nations.

UNESCO (1996) 'Information and Communication Technologies in Development: A UNESCO Perspective'. Submission to the UNCSTD Working Group on Information Technology for Development and the ITU Development Study Group 1, Inter-Agency Project on Universal Access to Basic Communication and Information Services, CII-96/WS/6, September. (Available at http://www.itu.int/acc/rtc/unesco.htm.)

Vakis, Renos and Lindert, K. (2000) *Poverty in Indigenous Populations in Panama: A Study Using LSMS Data*. World Bank LCSHD Paper Series. Washington, DC: World Bank, January.

van de Walle, D. and Gunewardena, D. (1999) *Sources of Ethnic Inequality in Viet Nam*. World Bank Poverty Research Working Paper No.2297 Washington, DC: World Bank.

Vogt, E. (2001) 'Community Media and the Digital Divide – The Radio Model' Bonn: FES (mimeo).

Wellenius, B. (1997) 'Extending Telecommunications Service to Rural Areas – The Chilean Experience', *World Bank Viewpoint Note* No.105. Washington, DC: World Bank.

World Bank (1990) *World Development Report, 1990: Poverty*. New York: Oxford University Press.

World Bank (1995a) *Brazil: A Poverty Assessment*. Washington, DC: World Bank.

World Bank (1995b) *Ghana: Poverty Past, Present and Future*. Washington, DC: World Bank.

World Bank (1995c) *Vietnam: Poverty Assessment and Strategy*. Washington, DC: World Bank.

World Bank (1996) *Tanzania: The Challenge of Reforms, Growth Income and Welfare*. Washington, DC: World Bank.

World Bank (1997a) *India: Achievements and Challenges in Reducing Poverty*. Washington, DC: World Bank.

World Bank (1997b) *Chile: Poverty and Income Distribution in a High-Growth Economy, 1987-95*. Washington, DC: World Bank.

World Bank (1999) *Bangladesh: From Counting the Poor to Making the Poor Count*. Washington, DC: World Bank.

World Bank (2000) *World Development Indicators*. Washington, DC: World Bank.