ICTs for Poverty Alleviation:

Basic Tool and Enabling Sector

Alan Greenberg

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Foreword

With the start of the new millennium, the Swedish Parliament (Riksdag) set the goal that Sweden should become an information society for all. Our common goal is to create a free and truly inclusive global information society for all. This is why Sweden has taken an active part in promoting ICT for developing countries.

The rapid development of mobile telephony and the global expansion of the Internet shows that ICTs have a significant role to play in developing countries. Where these technologies have become available, their extensive use is evidence of the success that can come from providing a climate encouraging innovation and growth. It is of great importance to understand how we can bridge the digital divide and be able to use technology to benefit all levels of society. *ICTs for Poverty Alleviation: Basic Tool and Enabling Sector* confirms that it is possible, practical and affordable to use ICTs to the benefit of the poor. It also confirms the need for all countries to have a presence in the emerging technology-based economy.

ICTs have the potential to be effective instruments in support of poverty reduction. The flexible nature of ICTs allows them to help address problems in health, education and livelihoods. In addition, they can enable people's empowerment and ultimately strengthen human rights.

Anders Granlund
Head of Sida's ICT for Development Secretariat
Stockholm, November 2005

Acknowledgements

The literature on the use of ICTs in support of poverty alleviation is very rich. The sheer volume of the literature creates a challenge, but this report could not have existed without the many insights and pearls of wisdom found in these previous works.

The author wishes to express his gratitude to the many people who willingly took the time to openly share their knowledge, insights and opinions. Particular thanks must go to the staff of the Sida ICT for Development Secretariat.

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Alan Greenberg

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Executive Summary

Background and Objective: Over the last decade, there has been an ongoing debate regarding the role that Information and Communications Technologies (ICTs) should play in development cooperation programs in general, and more specifically in support of poverty alleviation. Strongly held opinions included:

- ICTs have proven useful in so many areas, they MUST be important here;
- Developing countries are lagging behind in technology (i.e., the *Digital Divide*), and that in itself is a problem that must be addressed;
- ICTs are useful only for addressing administrative business processes.

There has been abundant anecdotal evidence that ICTs could be applied to livelihood enhancement and thus directly address financial poverty, but it was not at all clear that these applications were reproducible, scaleable and sustainable.

Along with most cooperative development donors and partners, Sida felt that there was a need to consolidate the evidence and to start to understand how (or if) ICTs should be used in support of poverty reduction exercises. This present report was commissioned as the first step in that process.

Poverty, ICTs and Poverty Alleviation: The terms Poverty and ICTs are freely used, but the definitions vary, making comparisons difficult. Poverty alleviation is also defined in a number of ways, many difficult or impossible to measure. In this report, a broad view of poverty is used, encompassing lack of material resources, poor access to healthcare and education, and the lack of rights, freedom, empowerment and opportunity. Poverty alleviation is also broadly defined to include any change-for-the-better in these areas. Although measurement is good, difficult-to-measure benefits are accepted. ICTs refer to any electronic means of capturing, processing, storing and disseminating information.

The Challenge of ICTs: Even in the developed world, the successful use of ICTs involves many obstacles. ICT projects are often poorly designed and implemented, and even when successful, it can take decades to reap substantial benefits from them. For a number of years, the developing world's lack of readily accessible digital technology – the Digital Divide – was viewed as a core problem rather than one of the symptoms of overall deprivation. This misunderstanding of the problem resulted in a large number of poorly-directed programs. It is increasingly clear that ICTs must be subject to the same guidelines

as those applied to other development cooperation programs: they should be affordable, scalable, practically implementable and ultimately self-sustaining. As ICT-based projects are particularly risky, it is important that ICT practitioners be involved in the specification and design of projects in which ICT will be a component.

Can ICTs Help Address Poverty? The short answer is YES. There are increasing examples in multiple domains where ICTs can help address poverty. Moreover, there are a growing number of scenarios where aspects of poverty *will not be addressed without ICTs.*

The report addresses a number of areas where ICTs have demonstrably helped to alleviate poverty. The focus is on using ICT as a tool to help address some aspect of poverty, and not on finding interesting uses for the latest ICT fad. There may be benefits of introducing the latest ICTs into developing countries, but they are not likely poverty reduction benefits. There is no claim that the areas on which this report focuses are the *only* areas where poverty alleviation benefits are possible, but they do represent situations where major strides can be made in poverty alleviation while controlling the risks of failure or non-sustainability.

There is one characteristic that is common to most of the ICT-related poverty alleviation programs. The ICTs used are typically basic ones – telephone and radio are most common, and when computers or the Internet are involved, they are for restricted, targeted uses.

Communications and Community Access: In addition to its role in helping to improve livelihoods, healthcare and education, communications can address a number of other aspects of poverty. Humans are social creatures and communications in all forms can help foster feelings of well-being and empowerment. Radio, telephone and Internet-based communications all have applicable uses. Unidirectional broadcast communications address many needs, and radio, despite being an 85 year old technology, is inexpensive, accessible and effective. With the advent of low-cost mobile telephone technology, accessibility has been revolutionized. In many rural areas, over 80% of households make regular use of the telephone, whereas five years ago, the figure was less than 5%. Such accessible communications can now be used for family contact, reducing the necessity for trips, access to government services, and much more. Both radio and telephone can operate regardless of the language spoken and do not require literacy, which helps explain the exceedingly high utility and utilization of both. Internet-based communications can be at least as effective, but the resource thresholds are far higher, typically requiring higher-quality communications, electricity, technology infrastructure, and literacy in a computer-supported language. Currently and in the foreseeable future, the number of developing-country people using Internet-based communications will be a shadow of those using telephone or radio, but there are selected areas where it will be important to utilize this newer technology.

Education: Virtually all forms of education, from primary school to university to vocational training address poverty issues – some short term, and some long term. In developed countries, computers and the Internet have been shown to be useful in all aspects of education, from hands-on learning to research to administration. There are two prime keys to success. The first is to ensure that pre-requisite resources are deployed – installing computers in schools makes no sense without teachers who know how to teach with them and without technical support to keep them working. The second is to deploy them widely enough to substantially benefit the country. This is an expensive and long-term commitment.

Livelihoods: At the core of every definition of poverty is the inability to provide food and shelter for one's family. Enhancing livelihood opportunities is thus a key requirement

in relieving poverty. ICTs have been shown to be effective at both enhancing traditional livelihoods and at allowing the creation of new ones. Simple examples of enhancements include providing farmers with weather forecasts or crop information. New livelihoods enabled by ICTs include web-based businesses and telephone access resellers. The income improvements can range from a few percent to very substantial, depending on the specific details. The "details" are what makes the use for livelihoods so challenging – there are so many variables that it is hard to apply general rules. However, there are sufficient anecdotal and replicated examples that there is no question that ICTs will be one of the factors which help to improve incomes.

Healthcare: The lack of adequate healthcare is one of the most onerous aspects of poverty. There has been significant focus on using ICTs to actually deliver healthcare (telemedicine) and as a way of educating people on health issues. Both are valid and important mechanisms to improve healthcare. However, there are other uses of technology which have the potential for revolutionary improvements in the delivery of healthcare. In most cases, the technology is being used in its simplest forms, to aid in the collection, storing and retrieval of data and information. Despite this low-tech approach to using ICT, pilot projects have shown improvements such as a 50% reduction in mortality or 25–50% improvement in productivity.

Government: Most interest regarding the use of ICTs by government has been focused on "computerizing" government operations and processes – that is, using computers in their traditional roles as data-processors. Presuming that the government is willing and able to make the structural changes that are required to effectively use the new technologies, there is great potential for streamlining the operation of government, and even making it more transparent and open. However, it is unclear that there is a direct and relatively short-term impact on poverty. There is one aspect of government responsibility where ICTs can play a very significant role. This is in the collection, processing and retrieval of demographic data along with other related information (water, roads, electricity, telephone coverage, etc.). Once data is available, Geographic Information Systems (GIS) can be used to manipulate and graphically display the data. It is intuitive that you cannot fix a problem if you don't know about it and understand it. Data collection and display systems can allow governments to understand poverty issues and ultimately address them.

ICT as a Sector: Although ICT can be thought of as a tool in the fight against poverty, it is also an industrial sector in its own right. If the poverty alleviation efforts are to successfully use ICT, it is essential that there be a local ICT industry that can support the effort. Moreover, in many countries, the ultimate integration of ICT into industry and government as well as poverty alleviation will be dependent on computers using local languages and character sets. For languages with limited commercial market value, the development will need to be done locally.

ICT applications for poverty alleviation may largely focus on basic technologies, but to become robust and sustainable, the ICT sector must encompass all modern ICTs and be on a par with those in developed countries.

Summary of Findings: ICTs can, and in fact must, be used as tools in the fight against poverty. Looking at successful projects, one can note common trends in many of them:

- The focus is on poverty alleviation and not on ICT use;
- ICT components are kept as simple as practical;
- ICT practitioners are involved in the design of the ICT components;

- There is significant community involvement;
- There is a focus on training to ensure success and sustainability;
- There is consideration of a plan for success – how to replicate and scale project if it is successful.

In parallel with the basic level of ICTs used in most poverty alleviation programs, developing countries must also develop robust ICT sectors to enable (among other things) the support of ICT components in their poverty alleviation programs.

This dual-path approach to the use of ICTs is critical. For poverty alleviation, the focus must be on poverty issues, with ICTs simply being tools and enablers. But to allow this flexible ICT use, a country must build a strong ICT sector focusing on all aspects of ICT.

Part I: Introduction

Throughout the developing world and development cooperation partners, there is a strong focus on improving the destiny of the poor. In parallel with this, many believe that the use of Information and Communications Technology is a key to helping to address poverty. Part I of this report reviews the issues of poverty and poverty reduction; provides an overview of the important aspects of Information and Communications Technology; and investigates the linkages between the two.

1. Study Basics

1.1 Background

For approximately ten years, there has been a strong belief in some parts of the development community that Information and Communications Technology (ICT) can be effective tools and enablers to help alleviate poverty. Despite this strong belief, large investments, and encouraging anecdotal evidence, there has been little readily discernable, hard evidence that the use of ICT could be a significant contributor to poverty alleviation. In the cases where there has been some evidence of benefits from the use of ICT, there has been little indication that it could be cost-effective and scaleable. Moreover, even when there is a good case for using technology, there is the background worry that funds could be better used satisfying some more basic need.

Other development practitioners have felt that ICT is purely a tool for "computerizing" processes and has no relevance to poverty alleviation.

Regardless of one's point of view, we cannot ignore the growing importance of ICTs in the developing world, clearly signalled by the existence of the 2003/2005 World Summits on the Information Society in Geneva/Tunis organized by the United Nations.

Over the past year Sida, along with most donor and development agencies, has recognized that the time has come to better assess the connection (or lack of one) between the use of ICT and success in poverty alleviation activities.

This report was commissioned as the first step in the discovery process. Although commissioned by Sida, this report is not limited to Sida's specific areas of focus, and will hopefully be of use to the development and donor community in general. It may also be of value to ICT professionals who have no prior development experience.

The report is not intended to be an in-depth review of the ICT/Poverty experience over the last decade, nor is it intended to be a proscriptive cookbook on how to carry out development in the next decade. Rather it is meant as:

- a high level review of the ICT/Poverty landscape; and
- a general guide on where ICTs have the real possibility helping in poverty alleviation exercises.

1.2   Study Parameters

The intent of the study was to investigate the connection between the use of ICT and the alleviation of poverty. The initial focus of the study was a thorough literature survey coupled with reviews and discussions both inside Sida and in the development community in general.

Early in the literature review, several things became apparent:

* there is no generally accepted definition of poverty[1];
* there is no adequate and generally accepted way to measure poverty alleviation;
* there is no generally accepted definition of ICT.

Moreover, even in a single report, it was common to find a definition of poverty reduction which did not correspond to its own definition of poverty. The lack of standardized terminology makes it very difficult to extrapolate or generalize results.

1.3   Definition of Poverty

Sida takes a broad view of poverty:

> *"Sida defines poverty as lack of power, choice and material resources." [2]*

> *"A multidimensional definition of poverty acts as a guide for Swedish developmental cooperation. Poverty is not just a case of low income, but also a lack of access to health care, schools and social security. Other factors include exposure to violence, injustice, and powerlessness and uncertainty in the face of unexpected situations like sickness, accidents and natural catastrophes." [3]*

This view of poverty supports and is linked to the definitions and metrics in the United Nations Millennium Development Goals and the OECD DAC Guidelines on Poverty Reduction (see section 1.4-Poverty Alleviation).

The present study follows this broad view of poverty, and it is supported by the definitions used in many critical reviews of poverty and poverty reduction. One good example is:

> *"Poverty has multiple and complex causes. The poor are not just deprived of basic resources. They lack access to information that is vital to their lives and livelihoods: information about market prices for the goods they produce, about health, about the structure and services of public institutions, and about their rights. They lack political visibility and voice in the institutions and power relations that shape their lives. They lack access to knowledge, education and skills development that could improve their livelihoods. They often lack access to markets and institutions, both governmental and societal, that could provide them with needed resources and services. They lack access to, and information about, income-earning opportunities." [4]*

Unfortunately, despite this seemingly clear approach, the literature and many projects take a different and often much narrower approach to poverty. Poverty shows itself in a number of different, but related ways.

* Money: Poverty is often expressed in financial terms such as income less than US$1 per day. Despite the general acceptance of this threshold level, it is often a misleading

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[1] This is not to say that there is no definition of poverty. There are many, with different groups each using their own version.

[2] Sharpening the poverty focus in programmes and projects supported by Sida – preliminary guidelines from POM, Sida, March 2005;

[3] Sida web site: http://www.sida.se/Sida/jsp/polopoly.jsp?d=174

[4] The significance of information and communication technologies for reducing poverty, P. Marker, K. McNamara and L. Wallace, DFID, January 2002

definition, since a large percentage of the world's poor do not actually earn or spend money, but rather rely on, for example, subsistence farming and local trading.

- Sustenance: Insufficient access to the basic necessities of life such as food, clean water, shelter and health.

- Future: Lack of education, opportunity.

- Social: Lack of rights, freedom, empowerment and the ability to be heard and to affect outcomes.

Only the first definition lends itself to quantitative analysis and thus to measurement. As a result, many studies and metrics focus on this one aspect. *Sustenance* and *Future* are more difficult to measure, and when monitored, often have significant time-lags associated with the metrics. The *Social* aspects in particular are often ignored.

1.4   Definition of Poverty Alleviation

Trickle-down Growth

There is evidence that the use of ICTs can help generate economic growth. For a long time, there was a belief that if one could create overall economic growth, then some of the benefits would trickle-down to the poor and that poverty would be alleviated. Unfortunately, this poverty reduction is often insignificant compared to the overall growth. Moreover, in areas where the inequality between the poor and the affluent is greatest, the benefit to the poor of overall economic growth is often negligible.[5] When the poor are largely rural, and the growth areas are urban or specific-resource based, the benefits to the poor can be non-existent.

The above notwithstanding, it is quite clear that we are not going to easily address poverty in countries with stagnant or shrinking economies, so overall growth is still necessary and must be supported.

Pro-Poor Growth

The term *Pro-Poor Growth* has become quite popular. Even though it does not have an agreed-upon definition[6], there are two basic variations:

- Absolute Pro-poor Growth – the financial position of the poor improves. In simplistic terms, the typical income increases.

- Relative Pro-poor Growth – the financial position of the poor improves at a higher rate than that of the general population. Relative Pro-poor Growth explicitly focuses on the problem with trickle-down growth discussed in the previous section.

Relative Pro-poor Growth reduces the gap between poor and affluent, but most donor agencies consider Absolute Growth as the real measure of how much the poor have been helped. They opt for the scenarios where the poor benefit most, regardless of how the inequality changes.

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[5]   "The results […] all suggest that growth, as such, does not have an impact on inequality." See Bibliography Ref. WB-6
     "…for high inequality countries, growth will be quite a blunt instrument against poverty unless that growth comes with falling inequality."
     See Bibliography Ref. WB-8

[6]   Development practitioners and policy makers are fond of the term "pro-poor growth" because, rather like Humpty Dumpty in Alice's Wonderland, to each of them "it means exactly what [they] want it to mean." See Bibliography Ref. WB-5

However, there is a larger problem with the concept of Pro-poor growth. All definitions of Pro-poor growth that are practically measurable rely on measures of financial poverty. Although adequate money can help offset some of the other aspects of the more generalized poverty definition, there is little evidence that it is a good metric for them. Its real merit is that it is relatively easy to quantify and track, while the other measures are far more difficult to quantify, and when they are quantifiable, there are typically time-lags in obtaining the data.

Poverty Alleviation

Since the operative definition of poverty for this study includes far more than financial solvency, neither of the Pro-Poor definitions really applies. Accordingly, the term *Poverty Alleviation* will generally be used to refer to the substantive reduction of any of the negative aspects of poverty.

This position supports and expands on the two major poverty reduction landmarks, the Millennium Development Goals and the Organisation for Economic Co-operation and Development (OECD) Guidelines on Poverty Reduction.

In September 2000 the member states of the United Nations unanimously adopted the Millennium Declaration. The UN General Assembly recognized the Millennium Development Goals (MDG) as part of the road map for implementing the Millennium Declaration. The MDGs are listed in Appendix 1. MDGs have helped the development community and developing countries focus their efforts by providing quantifiable and measurable targets.

In 2001, the OECD Development Assistance Committee (DAC) introduced its Guidelines on Poverty Reduction. The Guidelines are an all-inclusive review of the issues related to poverty and poverty reduction. It includes the MDGs as measurable targets, but also addresses the less measurable social aspects of poverty.

1.5 Definition of Information and Communications Technologies

ICTs are often categorized based on how long they have been in common use, and to some extent the technology used for the transmission and storage of information.

New ICTs: Computers, satellites, wireless one-on-one communications (including mobile phones), the Internet, e-mail and multimedia generally fall into the *New ICT* category. The concepts behind these technologies are not particularly new, but the common and inexpensive use of them is what makes them new. Most of these, and virtually all new versions of them, are based on digital communications.

Old ICTs: Radio, television, land-line telephones and telegraph fall into the *Old ICT* category. They have been in reasonably common use throughout much of the world for many decades. Traditionally, these technologies have used analog transmission techniques, although they too are migrating to the now less expensive digital format.

Really Old ICTs: Newspapers, books and libraries fall into this category. They have been in common use for several hundred years.

It is worth noting that the labels New, Old and Really Old are ones that generally apply to the developed world. In many parts of the developing world, and particularly in areas where literacy rates are low, they are all *effectively* new!

Often the best solution for a particular problem may be a combination or *hybrid* of several different ICTs. Old-fashioned radio combined with the Internet has been a particularly useful combination, as has been paper news-bulletins coupled with the same material

on the web. Radio (for widespread access) and telephone (for feedback) is also widely used throughout the world.

In the literature, the term ICT can varyingly mean just digital ICTs, all electronic ICTs, or all three aspects. In this study, ICT will encompass the above definitions of *Old ICTs* and *New ICTs*. A useful working definition is "electronic means of capturing, processing, storing and disseminating information". Although traditional paper media still has many strengths, it will not be the focus of this report.

2. The Challenge of ICTs

ICTs are often viewed as near-magic solutions to problems. ICTs are extremely powerful tools that have proven useful in many areas. Their use has radically transformed how many businesses and organizations operate, and it is natural and reasonable to assume that they should be able to help us address issues related to poverty in developing countries. Moreover, there are issues related to poverty where ICTs should obviously be a good fit.

Unfortunately, there are several potential flaws in this reasoning.

2.1   The Solow Paradox and Critical Mass

In 1987, Robert Solow, Nobel Laureate in Economics, noted that *"You can see the computer age everywhere these days, except in the productivity statistics"*. His concern was that after decades of very heavy investment in ICTs, there had been no apparent improvement in productivity – the very thing that much of the investment had been targeting.

Ultimately, within the next ten years, productivity statistics did begin to improve. There is now reason to believe that earlier ICT investment was at least partly responsible for these improvements. It would appear that several effects can be associated with the long delay in seeing productivity improvements:

- If we just "automate" processes without re-thinking them, we bear the large cost of ICT investment but productivity benefits rarely accrue.
- If we re-think the processes, we often get ambitious and add functionality, off-setting potential benefits.
- It takes significant time before an organization can fully benefit from new technologies. Effectively people and organizations must acclimatize to the new processes and capabilities.
- There is a "critical mass" effect, where benefits are not seen until ICTs are integrated into a large percentage of an operation or an industry.

This is not the first time that this overall effect has been recognized. When electric motors were introduced in the late 19th century, it took close to 40 years before productivity benefits were generally seen.

The problem of reaping benefits from ICTs can be worse in developing countries where low wages reduce the value of "labour-saving" changes.

2.2   Technology is Difficult

Despite the wide availability and use of technology in the developed world and despite falling unit costs in many areas, good technology implementations are often difficult and costly. Although the outcomes are rarely announced as such, many projects fail and many that are successful far exceed their original budgets.

Given these general characteristics, in developing countries where funds and skills are often in short supply, it is unlikely that the overall track record will be significantly better. Moreover, as technology is pushed out to those with few ICT skills, one must overcome the normal fear of the unknown and timidity that goes along with first-time users.

2.3   Digital Divide

In recent years, there has been great focus on the *Digital Divide*, the wide gap in access to new technologies between the developed and developing world. To address this, we have often tried to introduce the newest and most sophisticated technologies into developing countries. Moreover, the newer, fancy technologies are more interesting and fun to work with, and often make it easier to attract funding. Such projects are often failures or are non-sustainable. Fortunately, a more rational approach has emerged, recognizing that the digital divide is just one of many divides, and perhaps not the most important one. Moreover, the digital divide can be viewed as one of the symptoms of underlying problems and not one of the core problems.

The above notwithstanding, the Digital Divide has become a symbol and prime example of the often-wide gulf between developed and developing counties. Developing countries understandably and justifiably want to be able to participate in the global economy which increasingly relies on ICTs. This desire to use the newest digital technologies has often been consciously or unconsciously merged with the desire to use ICTs to help alleviate poverty. As will be discussed in section 6 introducing new ICTs has great merit, but it is not always these newer technologies that are best suited to address poverty-related issues.

2.4   ICTs in support of Poverty Alleviation

The title of this section is a keystone[7] concept. If ICTs are to help address poverty, they need to be used to address real problems in sustainable ways. This may seem like an obvious statement, but as implied in the previous section, there have been many projects where the effective target was to use the newest ICT "toys", often in impractical, un-affordable and unsustainable ways.

The focal point must be poverty reduction and not ICTs. A reasonable approach is to ask what needs to be done to reduce poverty, and then ask if or how ICTs can help.

That being said, when a new technology becomes available, it is understandable that one would want to ask how it can be used to attack poverty. This approach can lead to innovative and effective uses of new technologies, but such projects must be viewed with a healthy dose of scepticism.

For a number of reasons, Poverty Reduction Strategy Papers (PRSP)[8] have not tended to pay significant attention to ICT issues and solutions.

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[7]   A keystone is the stone at the central topmost stone of a stone arch that holds everything else in place. Without it, the arch would not be stable and solid.

[8]   A PRSP is a country-led, country-written document that provides the basis for international assistance. It summarizes the country's objectives, policies, and measures for poverty reduction.

2.5   Criteria for "good" uses of ICTs

In the context of poverty reduction, "good" uses of ICT must obviously have a positive impact on one or more aspects of poverty. However, as a target for the investment of scarce development funds, there are several additional criteria – similar to those criteria applied in most cooperative development projects.

Affordable

Affordable means that the project has a reasonable price given the benefits and the funding available. It is easy to find examples of projects which would have poverty reduction benefits, but where the costs far outweigh the benefits or where funding is unattainable on a large scale.

Scalable

Scalable means that if successful, the project can be widely replicated to help many more people. Non-scalable projects often cannot be replicated because the initial conditions are unique, or replication would require other non-financial resources which are in short supply.

Self-sustaining

The self-sustaining criterion is related to the previous two, but implies that ultimately, the project can continue to help people without external financial or staffing support.

Sensible

If a project is sensible, it accepts the realities of the environment in which it is operating. As a trivial example, if you are going to deploy PC-based computers, it would only be sensible if you knew that technical support people would be available.

Exceptions

The previous criteria are, in essence, a rather simple-minded recipe for the successful use of ICT to help alleviate poverty. It is very important to note that projects which do not meet all of the criteria can and will be successful. Because they do not meet one or more of the criteria, they have a somewhat higher risk of failure. This risk can be off-set by other factors which make the project particularly desirable.

3. What Works and What Doesn't?

3.1 Literature

There is a vast amount of formally and informally published literature on ICTs and poverty reduction. Much of the literature is informative and insightful. The large number of papers is an unavoidable consequence of the popularity of the subject. Despite the often high quality, it does add to the confusion, as it is virtually impossible for development practitioners to follow all work in their field.

Moreover, it is easy to find reports that discuss how specific uses of ICTs should theoretically be helpful, but there is little published that attempts to provide any guidance on how to select and design projects. Where recommendations have been made, they are often too narrow, missing some of the best opportunities.

A large segment of the existing literature provides anecdotal evidence of how specific ICTs have worked in specific situations. It is somewhat disturbing that despite the typical rate of failure of all ICT-based projects, the literature includes relatively few reports of failure in ICT/Poverty projects.

3.2 Report Format

The substantive part of this report is loosely divided into focus areas and sectors. In each area, there will be a discussion of how technologies are used, often including generic or specific examples. These will be followed by conclusions in the form of Suggested Target Areas. Suggested Target Areas are areas where there is a good probability that ICT projects have a chance of meeting the criteria identified in section 2.5 and of helping to reduce some of the aspects of poverty. Thus, they are good projects to be funded by donor agencies or government initiatives.

Ideally, these conclusions would be based on substantive controlled studies. Although a number of more rigorous studies are currently being developed, there is little available at this point. Accordingly the conclusions are essentially generalizations of the documented projects, combined with a modest amount of intuition.

Of course, these are not the only types of projects that can succeed; they are simply ones that are good investment targets with high probabilities of success.

3.3 Do ICTs help?

Can poverty be alleviated through the affordable, sustainable use of ICTs? The following sections of this report answer the question in some detail, but a short answer is possible.

The answer is clearly YES. Increasingly there are examples where the thoughtful use of ICTs has markedly addressed various aspects of poverty. Despite the various pitfalls associated with deploying ICT projects, there is growing evidence that the use of ICTs can be a *critical and required component* of addressing some facets of poverty. It is quite clear that ICTs themselves will not eradicate poverty, but it is equally clear that many aspects of poverty will not be eradicated without the well thought-out use of ICTs.

Part II: Detailed Findings

The short form conclusion of this study is that ICTs can help alleviate poverty. Part II of the report looks at how this can work from several perspectives.

ICTs used as aids to personal and community communications. Communications, often simple verbal communications, are arguably the most important and certainly the most successful use of ICTs in the developing world. The almost overnight spread of mobile phone technology has been nothing short of revolutionary. The impact of communications on the social aspects of poverty has been large and important.

ICTs in support of sector-based activities: Education, Livelihoods, Healthcare and Government. ICTs are applicable in virtually every sector, but in terms of poverty reduction, these four areas are the ones where ICTs can be most readily exploited. In each case, the approach in using ICTs is quite different, but the potential benefits are all large.

ICT as a sector in its own right. In the first two cases, ICTs provide direct poverty alleviation benefits, or are tools in programs helping to bring about such benefits. This case, ICT as a Sector, operates on another level[9]. The ICT sector acts as an *enabler* for the other uses of ICT. For ICTs to succeed as tools for poverty alleviation there must be a local ICT industry to provide trained, skilled people.

This dual-path model is critical to the successful use of ICTs for poverty alleviation:

a)   targeted use of specific ICTs in support of poverty alleviation. In many cases, these will be basic ICTs.

b)   a robust ICT sector fully participating in the global ICT community.

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[9]   As with any industrial sector, the ICT sector generates jobs and thus does have some poverty alleviation benefits, but that is not the prime reason for its inclusion in this report.

4. Communications and Community Access

4.1 Technologies

Personal and community communications technologies tend to fall into three categories – Radio (unidirectional, broadcast), Telephone (bidirectional, person-to-person) and Internet-based Communications (computer mediated, all forms). Both radio and telephone have the strong benefit that they can be language and literacy independent. Given that typical literacy rate of many developing countries is in the order of 50%, and that it has been estimated that a majority of the world's poorest people do not speak their own country's official language(s), these characteristics are quite important.

Radio

Although far from a new technology, radio is unique in that it is relatively inexpensive to set up, it is estimated that more than 50% of all households in developing countries have ready access to radio receivers, receiving broadcasts does not require literacy, and it can use indigenous languages even if the population served is small. The cost of receiver batteries is its major limitation. To the extent allowed by availability of receivers, electrical power and coverage, television has similar characteristics to radio.

Telephone

Until recently, telephone penetration in rural and remote areas has been quite low, and such services were very expensive. For many decades, the only way to establish two-way communications with rural and remote areas was to either build wire-based communications networks and/or to build point-to-point radio or microwave networks. There has been a radical and rapid change in just the last few years. In many parts of the developing world, mobile telephone communications are now widely available and can be accessed at modest costs[10]. There seems little doubt that the private sector coupled with thoughtful government oversight and in some cases moderate subsidies[11] will ensure that there is coverage virtually everywhere[12].

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[10] The change has been nothing short of revolutionary. In 2001 it is estimated that less than 3% of the population in Africa had access to a telephone. By late 2004, it is estimated that up to 80% of households make regular use of telephones.

[11] Subsidies are often funded by Universal Access Funds (UAF) with the money coming from a levy on all communications charges and sometimes jump-started with donor funds. A novel and effective way to distribute the UAF is by granting a licence to the bidder that offers to provide ubiquitous access for the lowest subsidy.

[12] GrameenPhone in Bangladesh is often used an example of the early deployment of mobile phones. By 2003, they had 45,000 phones installed in 37,000 rural villages (covering 35% of the rural population). These phones amounted to just 3.5% of the GrameenPhone subscriber base, but accounted for 15% of their gross revenue. Clearly this can be a profitable business.

Internet-based Communications

Internet-based communications have been the basis for many ICT projects in the last decade. The term *telecentre* is often used to refer to a centralized cluster of Internet-connected computers. Unfortunately, it is also used to refer to a facility providing shared telephone access and a number of other communications-related facilities. In this report, the term is used to refer to a cluster of Internet-connected computers usable by the public or specific target groups, at low or no cost. The physical facility may be close to what is often called an Internet Café, but the latter tends to be a for-profit operation aimed at more affluent communities.

4.2   Applications and Effectiveness

Communications technologies can be used as tools in addressing various aspects of poverty, and these applications will primarily be dealt with in the section 5 of this report.

All forms of communications can help foster a variety of *well-being* and *empowerment* benefits. People want to know what is going on around them, and want to feel that there are mechanisms by which they can have influence over them. All forms of communications improve this. It is also true that political oppression is made more difficult in the presence of good communications – thus the desire of some governments to control the press, facsimile machines and now the Internet.

Radio

Local radio can be an effective tool in community building, particularly for those who live in rural and sparsely populated areas. It has also proven effective at disseminating information about livelihoods (market prices, weather forecasts)[13], healthcare, education and potential disasters. There are cases where radio is used primarily for information dissemination applications, but is funded primarily through personal announcements such as birth and death notices. Although more costly to implement and less accessible to the poor, television can have similar characteristics.

Radio targeted at female listeners seems to be an effective way to reach this population that may have little access to other communications channels.

Telephone

It has been estimated that even in the poorest areas, people willingly spend several dollars per month on personal communications. Examples include talking to family in local cities or foreign countries, calls about remittances[14] and making appointments for medical care or government interactions. It has varyingly been reported that the ability to place a phone call can either avoid a time-consuming and potentially risky trip to the city, or by scheduling appointments, make the trip more effective. All of these benefits can improve quality of life, reduce costs and reduce time spent away from food- or income-producing activities. In areas where telephone service is available, studies have shown that a large percentage of the population will make a call regularly[15].

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[13] Studies have found that the improvement of crop yield from houses with a radio equal those of households who have regular visits from extension workers.

[14] Remittances are funds sent home home by family members working abroad. International remittances were estimated at $93 billion in 2003, with transfer fees averaging 12%. It is believed that practical ICTs can cut that in half, allowing $5 billion to reach its destinations. In country remittances are not tracked, but are likely equally large.

[15] "Service is available" means that there is coverage in the immediate areas or within several hours travel. "Regularly" means at least once a month.

Although it will be a long time before the majority of the poor can afford a personal phone of their own, in any area where there is mobile coverage, entrepreneurs spring up and allow effective phone sharing, albeit without the convenience of being able to easily receive calls.

Short Message Service (SMS) where text messages can be sent via mobile phones is an added value service that can be very cost-effective if literacy permits its use.

Internet-based Communications

Internet-based communications and particularly e-mail serve similar purposes to those discussed for the telephone. The high cost of communications and the lack of skills is a major barrier to wide use, as is unreliable electrical power. As with SMS, literacy and the use of a language which the technology supports in written form limits accessibility.

Voice-over-IP (VoIP) which allows voices to be carried over the Internet makes this technology equivalent to a telephone (with its literacy and language-free characteristics), but typically at a far higher overall cost[16].

Community telecentres have been a common way of introducing the computer and the Internet into urban and rural poor environments, often implemented in conjunction with NGOs (Non-Governmental Organizations). They have met with varying success, sometimes having a major positive impact on the community, sometimes falling into disuse, and everything in between. Being a very sophisticated application of technology, they need ongoing technical support and people need help in their often non-intuitive use. There are relatively few cases where telecentres have been financially (operating costs and equipment renewal) and technically self-sustaining. The exceptions tend to be facilities that are constructed in conjunction with some other use, and then are also used as a community telecentre – examples include school instructional facilities and banking or government access kiosks. In such cases, the other application provides ongoing funding and often personnel to help ensure sustainability.

Universal Access Funds and licensing policy can help ensure the availability of a base level of Internet access throughout a locality just as it can with base telephone access – see footnote 11.

4.3   Suggested Target Areas

Policy and Regulatory Initiatives: Affordable mobile telephone communications will become increasingly available, provided by the private sector if there is a suitable policy and regulatory environment. Policy allowing open and un-controlled communications (that is, free from political control) is also clearly a target. As noted in section 6, there is also a need for high-end communication at reasonable costs to allow the fostering and growth of an ICT-aware country.

Community Radio: Community radio has a very low cost and can be highly effective. It requires local organization and champions. There are examples where community radio has been effectively coupled with Internet access at the radio station.

Leveraged Communications Paths: When major infrastructure such as roads and power lines are being planned, consideration should be given to including fibre-optics facilities to allow the spread of ubiquitous, low-cost communications. Unfortunately, this is often difficult to implement due to telecom privatization.

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[16] It is interesting to note that in developed countries where there already is an installed base of computers and high-bandwidth communications, VoIP is the low-cost alternative compared to normal telephone service. In the few places where sufficient bandwidth, low-cost Internet access is available in developing countries, VoIP is also less costly than traditional long-distance phone calls.

Telecentres with Good Business Plans: Telecentres which are ultimately financially and technically self-sustaining can be effective in providing access to a host of Internet resources. Multipurpose telecentres have particularly good potential. Good, believable business plans are necessary, as is community involvement in the planning process.

Gender Equality: There has been some discussion that telephones and telecentres can improve the position of women in local societies. Essentially, if communications services are offered by women, then other women will make use of them. This certainly warrants additional study[17].

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[17] The Grameen Phone Ladies are often cited as examples of this, but a recent report indicates that although the phones are owned by women, the majority are actually operated by men in the family, thus eliminating the perceived gender benefit.

5. Sector-Based Analysis

ICTs are applicable in virtually all sectors, but four particular areas seem to have great potential related to poverty alleviation. These are education, livelihoods, healthcare and government. Education, livelihoods and healthcare are at the centre of any discussion about poverty and poverty reduction. Five of the eight MDGs focus on these areas and any discussion of poverty would be incomplete without them. The selection of government as the fourth focus area is not quite as obvious, but there is a critical role that only governments can play in the fight against poverty, and ICTs are the key to success in this role.

The use of ICTs in education in the developed world has been the subject of a great deal of study. Their use in education in the developing world is fundamentally no different. Therefore the models in everyday use in Europe and North America are quite applicable and one can benefit from the many lessons learned. However, the cost and logistics makes the implementation far more challenging.

Livelihoods has received much attention in the ICT/Poverty literature, and there is a large collection of anecdotes and reports describing ways in which ICTs have been used in specific applications throughout the developing world. This study builds upon and generalizes those examples.

Healthcare has received relatively little focus in the general development literature, and in fact has at times been ignored when identifying good uses of ICTs in poverty alleviation. When it has been discussed, the focus has often been on its uses in education and on remote diagnostic capabilities. This report has a somewhat different focus. To illustrate the potential and dramatic applications of ICT to healthcare, several detailed examples are presented.

The use of ICT in government has been the focus of a very large number of projects and has been extensively described in the literature. Most focus on various views of e-government – a widely used but poorly defined term. Regardless of the merits of various e-government activities, the connection between them and poverty reduction is tenuous at best. This report focuses on a small but critical aspect of government responsibilities that can have a very large impact on poverty and poverty alleviation.

5.1 Education

Education, in theory, is arguably a "perfect" use of ICT. In developed countries, ICTs such as radio, television, and now computers and the Internet have proven useful in virtually all aspects of education:

- Teacher training
- Primary, secondary and university education
- Adult training
- Technical training
- Vocational training
- Distance education
- Teacher networking
- Student networking
- Central education administration
- Local/district/university administration

With the possible exception of primary education, computers, networks and the Internet are being used successfully in all aspects of education within developing countries. But in general, such use is sparse and erratic. Moreover, there have been few large-scale implementations.

As in developed countries, there have also been many cases where both large and small deployments of technology have been complete failures – usually because of a lack of understanding the pre-requisites necessary for success.

5.1.1 Applicability

Thoughtful use of ICTs has been shown to help in all aspects education and it is generally accepted that improving education ultimately alleviates various aspects of poverty. It is easy to come to the conclusion that ICTs deployed to address education problems will help meet our goal of poverty alleviation. But, there are a few problems with this conclusion.

- *Millennium Development Goals:* The Millennium Development Goals (See Appendix 1) set the prime poverty-reducing goal for education to ensuring that by 2015, all children have access to full primary education. Of all aspects of education, ICTs probably have the smallest role to play in primary education – not because they are not applicable, but because of the virtual impossibility of deploying the technology and skills widely enough to be effective in this time-frame.
- *Prerequisites:* Deploying technology requires a number of prerequisites. Specifically, skilled people to design, implement and provide ongoing support to the technology. In a teaching environment, it is also essential that the teachers have sufficient technical and pedagogical skills to use the technology. All of this is difficult, expensive, and time-consuming in an urban environment, and much worse in a rural environment. For example, if one wanted to introduce computers into secondary schools, one must first train the teachers. To do this, the teacher-training schools must be upgraded and their instructors trained. This entire process has multiple steps and is clearly a long-term endeavour.

Arguably, the most successful education-related ICT implementations in developing countries have been in post-secondary education. Although the poverty-reduction aspects are indirect, there is abundant evidence that the technology "seeds" sown in universities spread to the rest of the community helping to build the ICT industry. In many countries, the Internet was first introduced in universities, later spreading into commercial use.

The use of technology in the administration of education has value, although also not leading directly to poverty reduction. It is difficult to imagine the successful deployment of computers and networking for pedagogical purposes without also making the same technologies available to those who manage the educational processes.

The deployment of computers in secondary schools is likely the most important ICT-Education project. It is also one of the more difficult projects, but here are several benefits:

- Students will gain some experience with modern technologies. As they move into the job market, these skills will give them and their employers a strong benefit. No doubt some will ultimately become ICT professionals, strengthening their country's ability to use ICTs.

- The computers (and network connections if available) can be used for teaching and learning. Access will surely be limited due to the computer-to-student ratio, but some access is better than none.

The various *SchoolNet* projects around the world have demonstrated the benefits of networking for allowing students and teachers to communicate with their peers. For students such exposure can break down all sorts of barriers, and for teachers it can reduce the sense of isolation, particularly for those in rural areas.

As noted above, the full deployment is a multi-stage, phased project. Given the sheer numbers involved, the cost and complexity will be high. Cooperation with industry should be considered.

Radio and television are no doubt useful technologies for education, but with the advent of newer digital technologies, they seem to be somewhat out of vogue. However, there are many examples where broadcast radio in particular is being used effectively in the formal school environments. Radio is also useful for education aimed at home audiences.

Girls in most developing countries do not have equal access to schools compared to boys. Yet there is evidence that girls who received more education can protect themselves better against HIV, marry later, have fewer children and the children they do have are more likely to be better nourished and to survive. It is unclear how ICTs can help improve the situation, but the need is sufficiently pressing that if opportunities arise to address education-gender issues, they should be pursued even if the risk factor is higher than normally acceptable.

5.1.2 Suggested Target Areas

Most education-related ICT projects have the potential for improving the quality of education and thus ultimately addressing poverty. The key to whether they will succeed or not hinges on proper preparation, sequencing and pre-requisites. These key indicators and issues include:

- Competent technical design, implementation and ongoing support;
- If a project requires significant communications, access to reasonable, sustainable tariffs;
- If a pedagogical project, adequate teacher training prior to implementation;
- Private sector involvement may reduce or allow sharing of costs;
- Commitment for long-term funding;
- For large projects such as nationwide in-school deployments, the plan should have a pragmatic deployment schedule;

- Local commitment and buy-in is essential – it cannot be purely top-down;
- Introduction of ICT into curriculum will likely require other curriculum reforms as well;
- Opportunities for gender equality linked to the use of ICTs.

5.2 Livelihoods

Since many formal definitions of poverty and poverty alleviation rely heavily on effective income, livelihood support is a natural focus of poverty reduction programs. Unfortunately, it is probably the most difficult to address, particularly from an ICT perspective.

There are numerous anecdotal examples where technology has directly allowed for increased income, and some of these will be discussed in the next sections. Many, or perhaps most, of the examples depend on communications technologies. Often, the ability of ICTs to lower transaction costs is a key component. There are typically two types of situations:

- Livelihood opportunities that either did not exist previously, or were altered radically with the availability of ICTs;
- Marginal improvements in income or productivity.

5.2.1 New Livelihood Opportunities

New livelihood opportunities are either centred on some ICT or are enabled by an ICT. In most such cases, each community can only support a few such entrepreneurs, so it will not vastly change a single community's overall position. But they can very significantly alter the status of these entrepreneurs and those who work with them. Two examples will illustrate the point.

Telephone access provider: In any virtually all environments where personal telephone access is not ubiquitous, entrepreneurs acquire a telephone (originally a land-line, but more recently a mobile telephone) and sell access to it. In some cases, such as the now-classic case of "Grameen Phone" in Bangladesh the process is relatively formal and organized. In other cases, as will be found in virtually every city in the developing world, the provider is more than likely an independent operator who has managed to acquire a mobile phone.[18]

Internet/Web-based Sales: With the creation of the web, it is now possible to sell products and services directly to people around the world with a larger penetration and much lower investment threshold than was previously possible. The technique was initially used for the sale of local handicrafts and art, but has expanded to include, among other things, tourist facilities and even ICT services. The threshold for entry is very modest as ICT-based projects go, but is nevertheless non-trivial. The entrepreneur or her agent must be able to upload to a server details of the things that they are selling, receive orders, interact with customers and will likely need a bank account into which revenue can be deposited. There is an organization that has built generalized "online catalogue" web software[19] that is being actively used by small enterprises in 42 countries. They offer their services for a modest fee, but more importantly, they make their open-source software available to ICT entrepreneurs in developing countries who can then offer the service and support locally (thus helping to develop

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[18] It is interesting to see how innovative people can be when opportunities arise. In the last few years, mobile phones with pay-as-you-go cards have become affordable to many rural villagers. Unfortunately, there is no electricity to recharge the phones. Entrepreneurs purchase an auto battery, and use it to sell mobile phone recharges, periodically carrying the battery to the nearest town with electricity or a generator to recharge it.

[19] http://www.catgen.com.

the local ICT industry – section 6). In some cases, it is just a single artisan who benefits, but in others, a large percentage of a village participates in product creation. The online-market for handicrafts is clearly limited and subject to various market pressures, but for some, this is a viable opportunity to rise from poverty where none existed before.

In many cases, it is women who benefit from this type of activity, helping to address gender equality issues.

5.2.2   Improved Income or Productivity

Market Information: This is a classic case where information can have value. In the simplest examples, products (crops, fish, wool, etc.) are sold to a middleman. Traditionally, the prices are set by the middleman. With appropriate communications, the seller can find out what the current market prices are, and therefore demand a higher wholesale price. Fisherman can use mobile telephones to determine which port they should go to with their catch. Similarly, advice on what crops should be planted next to maximize revenue can be very helpful[20]. Although the concept breaks down in cases where there are no alternative buyers or no alternative means to get the product to market, there have been many successful examples worldwide.

Expanded Sales: Access to markets does not need to mean International markets via the Internet. The humble mobile phone can be used provide access to markets in nearby villages and towns, thereby increasing income to small farmers and goods producers.

Weather forecasts: This is a good example of a service that those in developed countries take for granted, but that can be invaluable in rural or isolated settings. It is particularly valuable for fisherman.

Agricultural Advice: Advice of what crops to plan, fertilization, crop rotation, general pest control information, or details regarding a specific pest, can all have significant positive effects.

All three examples rely on modern, close-to-instantaneous communications. The communications path for the information can be broadcast radio, mobile voice telephone, mobile SMS, or the Internet (web or e-mail). There have been several studies that show that in towns where communications are readily available, the average income can be measurably higher[21].

5.2.3   Suggested Target Areas

It is difficult to identify target areas for livelihood support. The specifics of what will work vary radically from situation to situation.

As virtually all livelihood enhancements are communications based, the interventions supporting good and cost effective communications facilities listed in section 4.3 apply here as well.

Micro-credit loans clearly go hand-in-hand with many of these livelihood enhancements.

Over and above this, projects must be evaluated on their merits. ICT projects often seem simpler than they are, with the complexity showing itself only after detailed design. Accordingly, it is suggested that competent ICT professionals should be involved in either the planning process, or proposal audit, or both.

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[20] All such information must be used with care. In one case everyone in a village changed to the "profitable" crop, creating significant over-supply and reducing the crop value to less than the original crop.

[21] Depending on the study, the increases range from 7–50%.

5.3   Healthcare

Three of the eight MDGs relate to healthcare. It is questionable whether some of the other MDGs will ultimately be achievable in some countries, but there is no question that the ones on healthcare are quite possible, and that ICTs will play a role in meeting these goals. This optimism is based on the fact that for most of the issues mentioned in the Millennium health goals, we understand the problems and know of interventions that go a long way towards meeting the goals. The true challenge is to follow through and actually do it.

ICTs do not provide the direct health benefits that drugs or access to a health-care professional can. Nevertheless, ICTs have a *very* large potential for improving healthcare. Previous development literature has often focused on using ICTs for public education and for telemedicine. Far more uses exist:

* Monitoring and responding to disease outbreaks
* Community and patient record-keeping
* Compilation and analysis of health-related statistics
* Management of the healthcare process
* Health and hygiene education
    – Information to individuals – often targeted at the woman of the family
    – Information, education, consulting for healthcare professionals
* Telemedicine

All of these items have been demonstrated. All are effective and most are cost-effective and affordable. The only real exception is telemedicine. It can be highly effective, but in its high-tech implementations, it is unlikely to be cost-effective or affordable in widespread use[22].

All of these healthcare tools are of course also applicable to HIV/AIDS.

It is important to note that reducing illness has a very direct impact on livelihoods. Every day that is not spent being ill or taking care of a sick child can be used productively. With recurrent diseases such as malaria, this can amount to many days or weeks per year.

For many biological, political and social reasons, women are at a disadvantage with respect to illness and healthcare. It is estimated that in some African countries, the incidence of HIV is five times higher in teenage girls than boys. As with education, there is no obvious ICT magic that can address this problem, but as various health interventions are planned, focusing on this aspect of the problem is essential.

5.3.1   Healthcare Interventions and ICTs

Three examples will be given that show that effective, cost-effective and affordable interventions are possible.

Uganda: RESCUER

RESCUER is short for Rural Extended Services and Care for Ultimate Emergency Relief. From 1996–99 this pilot used several simple techniques to lower maternal mortality[23] in

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[22]   Telemedicine is a term that can be used for any form of remote consultation or treatment. It can range from a simple telephone call to high-bandwidth image transmission or even remote surgery. Those implementations requiring high bandwidth and sophisticated remote equipment have generally proven practical only in cases where money is not an issue or as an alternative to high-cost air transportation and lodging.

[23]   The death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and anatomical site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.

one district of Uganda. Previous studies had shown that a significant number of deaths occurred because there were complications during pregnancy or childbirth that were not recognized, or because obstetric care was not provided in a timely manner[24]. The program had a number of components including:

- Training for Traditional Birth Assistants (TBAs)
- Dedicated VHF Radio between TBAs and health facilities
- Motorized tricycles functioning as low cost, maintainable "ambulances" for transport between home and local health facility
- Two ancient ambulances for transport between local health facilities and hospitals
- Significant local involvement

Although there were many lessons learned during the study, the overall result was quite remarkable. Maternal mortality dropped by 50%.

If the study were repeated today, standard mobile telephones could be used in place of the dedicated VHF radio, reducing one of the large costs of the original study.

It is not clear to what extent this project has been replicated in other districts in Uganda or elsewhere – no definitive records could be found on the web and several local experts did not know of follow-on projects.

Tanzania: TEHIP

TEHIP is short for the Tanzania Essential Health Interventions Project. TEHIP was a Canadian International Development Research Centre (IDRC) program in collaboration with the Tanzania Ministry of Health running from 1994 to 2004. Two districts in Tanzania were involved. The essential components were:

- Based on a proposal in the 1993 World Bank World Development Report
- At the start, Tanzania spent about US$8 per person per year on healthcare
- The World Bank estimated US$12 per person per year needed
- IDRC added up to US$2 per person per year
- Prime condition on use of IDRC funds: additional money be spent based on real needs (BOD – Burden of Disease)
- Focus was on making sound management decisions and using proven and well-known interventions such as mosquito nets to prevent malaria.
- Required significant data collection
- Significant retraining involved
- Crucial local involvement

The focus on BOD was critical. In essence, it said that the money should be spent where it will create the most benefit. This is perhaps an obvious target, but one that had often not been followed. For instance:

- It was found that childhood illnesses accounted for 37% of the BOD, but received only 17% of the funding.

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[24] This is a simplification of a complex problem – see the references for further details.

- Additional funds were being invested in expanding the immunization program, without any evidence that significant expansion was necessary[25].

In most years, only about ½ of US$2 was typically spent – that was all that could be absorbed by rational interventions given existing staffing.

There are not a lot of hard outcome statistics published as yet, but what is available is quite impressive.

- In 1993, child mortality was 160–180 per 1000 births. Near the end of the program in 2002–03, it had been reduced by 45% while the overall average in Tanzania had increased.

- By the end of the study, spending in the two districts was roughly in line with the DOB. As an example, Malaria accounted for 31% of the BOD, and received 26% of the funding, as opposed to 11% of the funding at the start of the study.

- Non-budgetary DOB issues were also addressed. For instance, instead of following the past practice of allocating malaria drugs equally across regions, they now weight the distribution in favour of regions that have a high incidence of malaria.

- The healthcare practice and methodology had significantly changed, providing more timely care.

- Various tools were implemented to make the program easier to manage and replicate.

The practices that TEHIP developed are now being widely deployed in Tanzania.

One of the crucial issues was that it is impossible to make rational decisions on how to allocate healthcare budgets and resources without reasonably up-to-date, accurate statistics. The only practical way to gather and integrate up-to-date information is through the effectively use of ICTs. Anecdotally, the station manager responsible for statistics gathering in one region claimed that he had not had a "computer-free day" since 1999.

Uganda: UHIN

UHIN is short for the Uganda Health Information Network. It is an IDRC-sponsored project investigating the benefits of providing healthcare workers with networked handheld computers (Personal Digital Assistants – PDAs). This project is still in progress.

This project violates the "rule" stated in section 2.4 in that it is effectively *technology in search of an application* instead of vice-versa. However, the project was approached rationally. Although there is no question that the PDAs are powerful computers in their own right, this project uses them in very simple ways – essentially as electronic books and as data collection devices.

Reference Texts: The PDAs included medical reference texts and drug dosage guides. Both were not generally available in the field, and proved to be very useful. Not only are the "books" easy to travel with, but they can be updated. No doubt more sophisticated tools could be built using the full capabilities of the PDAs, but this simple and relatively foolproof usage has demonstrated the benefits of using this technology.

Data Collection: The prime usage of the PDAs was to be data collection devices – essentially flexible, electronic survey forms. In this capacity, they excelled, yielding close to

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[25] The immunization program had been very successful and there was no question about cutting it back – the only issue was whether additional per capita funding was needed. Based on the current immunization success, additional funding would not be an effective use of funds.

a ten-fold improvement in productivity over their paper counterparts. The real challenge was developing a technique to upload the collected data to the central servers. The GSM telephone system was the long-haul vehicle, but it would not have been viable or cost-effective to connect each PDA to a phone. The solution was to upload each PDA's data to a nearby battery- or solar-powered collection device (called a *Jack*) using the built-in PDA infra-red transmitter. The collection device would then periodically make a GSM call and send the data from many PDAs to the server. The acquisition and modification of this specialized hardware was a major part of the project, but ultimately the implementation was successful and could now be more easily replicated. The final results were that the overall process was four times as effective as manual data entry and that even with the additional costs it was 25% more cost-effective. More importantly, using PDAs and an upload capability allow information to be available centrally within hours and days instead of months. To cite an oft-mentioned example, measles is a leading cause of child-mortality in developing countries, but it is difficult for a government health department to take action following an outbreak if they do not find out about it for several months. GSM connection charges accounted most of the non-personnel operational costs, underlying the need for generally available, low-cost communications.

Summary
The examples cited are compelling. Among them they have a number of interesting characteristics:

- All referenced projects use ICTs in practical ways and none try to use advanced technology for the sake of the technology alone;
- None of the projects would have been viable without the ICT component.
- In all cases, at least some of the results show very large improvements or benefits;
- All projects required and provided significant re-training;
- All projects involved significant local consultation and involvement;
- All projects are scalable;
- The solutions are not unique to the locale of the pilot project.

5.3.2 Suggested Target Areas
Although no particular type of project is favoured, many of the effective interventions involving ICTs seem to be in the administration of healthcare or in patient management. Among the key success indicators and issues related to a high-impact, successful project are:

- Potential for significant benefits;
- Start with controlled, instrumented pilot projects;
- Keep ICT components simple, and when some level of complexity is required, make sure that there is proper focus on this component;
- Ensure that there is a focus on local involvement and commitment;
- Ensure that retraining is thoughtfully addressed;
- Healthcare is delivered by a wide range of formal and informal professionals, and all should be considered in building projects;
- Public outreach education is often very effective, particularly if aimed at women and mothers.

- Projects that can address health-related gender-inequality issues.
- Include as part of the project the process for scaling and replicating it if the project is successful.

Increasingly there are successful models that can be followed. It is rather unfortunate when we develop ways of addressing critical healthcare issues, and then ignore them.

5.4   Government

The government sector[26] has the most diverse variety of areas which can be helped by ICTs. Some are exceedingly large and complex, and others are more straightforward. All tend to be lumped under the generic and often ill-defined and confusing title of e-government. They can be divided into three personas – roles that government units play: Government as a business, Government in its role with relation to its constituents, and Government as an infrastructure manager. Many government units in fact play all three in parallel.

5.4.1   Personas

Government as a Business

This aspect of government is similar to any large and complex business, handling activities such as personnel, finance and information management. Its use of ICT can include:

- Re-engineering and automation of processes;
- Data-sharing between difference arms of government;
- Provision for transparency, accountability and corruption reduction.

There have been many efforts focused on using ICT within government, and they have had a varying degree of success. Certainly, a lot of money has been invested, partially with the hopes that technology will cure endemic problems within government organizations. Unfortunately, as discussed in section 2.2, the implementation of such technology is at best challenging and in the worst case, a waste of money. And the introduction of technology rarely makes endemic problems disappear. In short, it is not a silver bullet, but rather a potentially powerful tool.

  When successful, using ICTs to aid government in its business activities may allow a department to streamline its operations and thus become more effective, but it is difficult to directly correlate this with poverty reduction.

Government and its Constituents

Government's interactions with its individual and corporate constituents have been a major focus of e-government in developed countries. The maturing of the Internet and the web has given constituents tools to receive information and interact online, and many governments have responded by allowing and encouraging such activities. Ultimately such activities even reduce the cost of government, although it is often difficult to discern this given the high initials costs of technology and the increased functionality often provided.

  It is unclear how applicable this aspect of e-Government is in developing countries where a very small minority of people or companies have access to the Internet. Certainly telephone-oriented interactions can be accessible and useful for some transactions.

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26 The term Government is used in its widest possible form, referring to the all levels of government including national, region/province/ state and local as well as their ministries and departments.

It has been suggested that direct e-mediated contact between government and citizens could reduce opportunities for corruption. This is likely correct if citizens can get direct access. If indirect, it just alters who has the ability to improperly profit from the transaction.

For corporate interactions, and in particular purchasing and contracts with government units, this aspect of e-government helps to increase transparency and accountability.

Government as a Manager and Leader
Governments actively or passively have control over the infrastructure involved in many aspects of poverty. Among them are communications policy, education, electrical power, healthcare, human rights, roads, sanitation, water and many more.

To the extent that ICTs can help a government play this role more effectively, they have the potential to significantly address poverty issues.

5.4.2   ICT Poverty Reduction Applications in Government

The introduction of ICTs into the first two personas of central government will not likely have a major impact on poverty alleviation in the short to medium term. Certainly the use of ICT for the administration of the distributed networks of the education and healthcare sectors may improve the delivery of their services and this has already been addressed in sections 5.1 and 5.3. The same may be true to a lesser extent in other sectors.

There is one area where ICTs can play a major role. This is in the areas of information gathering and manipulation. A guiding principle is that if you don't know about and understand a problem, you will not likely be able to fix it.

Governments often do not have access to the accurate, timely and up-to-date information that is needed to understand the magnitude or details of poverty issues, or to gauge the success of poverty reduction programs. Where they have the data, it is often not in a form that facilitates decision making. Several examples will help illustrate the problem.

- Following the devastating tsunami in January 2005, it was difficult to determine the number of people missing or dead in some regions, because the government had no accurate population statistics.

- Without reasonably accurate population and birth records, it is impossible to ensure adequate schools, or verify what percentage of children are attending them.

- Without reasonably accurate population and birth records, it is impossible to ensure adequate health facilities.

- Maternal mortality is one of the prime indicators of the state of healthcare in a country, yet the measures that are often used are typically several years out of date, and often represent the average mortality figures over a 10–30 year period.

- Governments often do not receive notification of epidemics until months after they begin.

- Information collected by one government ministry may not be accessible by another and at times it is not even known that the data exists.

Many aspects of poverty alleviation require that information be available and usable. This requires a number of discrete processes: collection of data in the field; transmission to central collection point; store data in repository (database); perform analysis as needed.

Systems which address some or all of these issues go under a variety of names. Census and birth/marriage/death registrations record full population statistics. Demographic Surveillance Systems, Disease Surveillance Systems, (Maternal/Child) Mortality Surveil-

lance Systems, National Sentinel Surveillance Systems and Poverty Monitoring Systems are used for various population and health-related data. Some of these use a full census, and some are based on representative samples. Governments also often have fragmented or accurate data on roads, electricity, water, sanitation, telephone coverage and many other parameters affecting their country.

Results can be presented in a large number of ways. In business such systems are often called decision support systems. For national planning and management, perhaps the most useful today is the Geographic Information System (GIS) which allows data to be presented on map overlays. Even a single data item presented on a GIS can be quite revealing. When multiple types of data are combined, the results can often be startling and illuminating.

The cost of GIS systems has dropped in recent years, and their capabilities have increased. A GIS system usable by all branches of government with wide access to government data should be considered a mandatory part of any country's fight against poverty.

5.4.3   Suggested Target Areas

Administrative Support: ICT projects that will increase the effectiveness of government departments/ministries directly related to poverty alleviation (health, education) are potentially interesting. Like any ICT re-engineering project, it needs to be coupled with a credible plan for changing overall processes and not just using computers to replace the previous manual processes. Specifically, there should be good reason to believe that government policies and practices will allow substantial benefits. As noted in section 2.2, there are many ways that such projects can fail, so prudent design and oversight is recommended.

Measurement and Monitoring: Collecting, transmitting and analyzing demographic and poverty-related data can be a very large task, but phased implementations are possible and suggested. Early phases should include the implementation of a GIS system for use by all poverty-related ministries and departments, and ensuring that data is sharable among the various government units. The cost of these projects is relatively low, and the benefits are potentially quite large.

Data collection is a larger task, but helping to create a sustainable infrastructure has strong merit[27].

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[27]   Interestingly, one of the very early uses of computers in developing countries was for national censuses.

6. ICT as a Sector

Throughout the majority of this report, ICTs are viewed as a tool. But these technologies also constitute a sector in their own right. These two concepts of ICTs are closely linked, because it is not practical to envisage using ICT as an ever-present tool for poverty alleviation without having a thriving ICT industry to provide skills and other resources.

Even without the need to support poverty alleviation activities, developing countries want and need to encourage a flourishing ICT sector. There are many reasons for this, including the need to actively participate in a global economy which is increasingly ICT-reliant. Moreover, access to new digital technologies has effectively become one of the measures of development.

Given the presence of a start-up or a thriving ICT industry, there are three aspects of it which are relevant to the discussion of poverty alleviation.

*   Employment – ICT is a growth industry that can provide jobs for skilled people. Although some jobs require very significant training and experience, many require only modest training.

*   A thriving ICT industry means that there will be an increasing number of skilled individuals – many of whom will be needed to support the technology used in poverty alleviation related programs and projects.

*   A local ICT industry will be sensitive to specific local needs that might otherwise be ignored by foreign or multi-national companies.

6.1   ICT Employment

In some areas, ICT skills are viewed as a guaranteed escape from poverty. There is often some truth to this.

As ICT usage in developing countries grows, there will be an increased demand for skilled people. Moreover, as technology appears in rural areas, there will be an increased need for support people who are willing to live there – most likely people who grew up in those areas.

In urban areas, the image of Bangalore's ICT success is always present, with the promise of developing a major ICT-based industry. Regardless of how unrealistic this target is, it is clear that:

*   ICTs are a *major* factor in the developed world;

- In order to fully participate in the global economy, developing countries *must* be participants; and

- as ICT industries develop, there will be jobs for those with ICT skills.

It is unfortunate that some percentage of those with ICT training will immigrate to developed countries in search of higher-paying jobs. However, even in these cases, the developing country benefits, as there are often significant remittances to the family left at home.

In most parts of the developing world, as in many parts of the developed world, women are under-represented in the sciences and engineering. However, ICTs have provided a path for women to break out of this pattern. Although women in most developing countries are not on an equal footing with men in the acquisition of ICT skills, their relative position is far better than in many traditional livelihoods.

6.2   ICT Capacity Development

ICT capacity development is important, not only to the development of an ICT industry per se, but to ensure that when ICTs are used in the support of poverty alleviation, adequate local support is available.

In most developing countries, basic ICT training is available at reasonable prices offered by the private sector, schools or universities. Quality control is an issue and in some cases, government action is necessary to ensure that training meets minimum standards.

As noted in the section 5.1, integration of computers and networking into secondary schools is a moderately high priority. As these programs are deployed, graduating students will have a head start by being familiar with computers and the Internet.

More advanced training tends to be the domain of universities. Quality is variable, but generally acceptable. In many countries, demand for advanced training outstrips availability.

It is critically important that all training programs include a placement component and that programs include an audit component to ensure that the trained people are indeed marketable.

Basic Internet infrastructure is being built in virtually all countries. More sophisticated applications and post-secondary ICT training and research demand a higher level of Internet access that is typically not available or affordable. Such demands put pressure on the telecommunications sector to provide more services and lower prices.

Although many poverty alleviation programs may only need basic ICT capabilities, it is important that the sector as a whole encompass the full range of modern ICTs. To do less would limit the countries ability to operate within the global economy and would also pre-judge which technologies will be best for poverty alleviation programs.

6.3   Technology Development

In general, technology development is in the domain of the private sector or universities. One very important potential exception is the development of language-specific or character-set-specific software and tools. Although these may be developed by private enterprise, in situations where this is not the case, it is important that such efforts be eligible for donor support. Technology that can interact with people in their local language is much more likely to be of used and usable.

6.4   Suggested Target Areas

Basic training and infrastructure is being provided by the private sector, perhaps in conjunction with the education or public sector, in virtually all countries.

The deployment of ICT in secondary schools helps pedagogically and has the secondary purpose of familiarizing students with computers and networks. This ultimately benefits local industry.

University-level ICT training as well as general university ICT infrastructure moves skills into the community quite quickly, and should be actively supported.

Local language and character set projects and similar efforts that make technology more accessible warrant strong support.

7. Overall Findings

There is no doubt that ICTs can be used in support of poverty alleviation in ways that are effective, cost-effective, affordable, supportable, scalable and self-sustaining.

Perhaps the key point is that ICTs are used in support of poverty alleviation, and not as an end unto itself. The issue is poverty, not the digital divide. To date, there has been too much focus on ICTs as leading edge toys and on ICTs for data processing and insufficient focus of their thoughtful use to address poverty-related needs. The involvement of ICT experts in the preparation of the PRSPs would be good.

ICT-based projects are often:

- inherently difficult,
- perceived by non-ICT professionals as being easier then they are,
- somewhat risk-prone.

This is the case in developed countries, and is no less true in developing countries. Accordingly, reasonable precautions should be taken to reduce the risk and help ensure that the project meets its ultimate goal.

7.1   Areas of Applicability

Communications: The wide-scale deployment of mobile telephone communications had radically changed the ICT landscape in many parts of the developing world. With the help of appropriate regulation and policy, coverage will be close to complete. For occasional use, this technology is now affordable by a large part of the world's poor, and as we address the financial aspects of poverty, this will approach universal access. Such personal communications are important in linking families, providing access to government and commercial services, and addressing livelihood issues. Communications of all forms also serves to address one of the core symptoms of poverty – the inability to know and influence the events controlling their lives. Communications also has the potential for helping to improve human rights and democracy.

Radio, although an old technology, still has great utility and its use should be increased, both for public-service broadcasts as well as education.

Education: ICTs are applicable in all forms and aspects of education. The connection with direct poverty alleviation is not very strong, but it is well accepted that increased education

ultimately helps alleviate poverty, and it is becoming accepted that ICT can help improve the quality of education. ICT use in the classroom also helps increase a country's ICT capacity.

Livelihoods: ICTs can be used in a number of effective ways to enhance current livelihoods or to create new ones. Typically, the "enhancing" effect will be modest, but nevertheless measurable and important. For new livelihoods, the impact is typically quite significant on the smaller number of people directly involved. Although the general descriptions are applicable across a wide variety of locations and situations, the details will vary substantially.

Healthcare: The thoughtful use of ICTs in healthcare has the potential for large-scale benefits in modest time-frames. Typically the use of ICT is not in the direct delivery of healthcare, but it its management and in facilitating the fast and effective flow of information.

Government: There are many opportunities for using ICT in government, but most will not directly aid the poorest segment of the population. The potential benefits related to transparency and corruption reduction are nevertheless important. There are large potential benefits to the use of ICT in the collection, processing and (often graphical) display of demographic and statistical data. This data can provide the quantitative projections of poverty. The ready analysis of such data is key to understanding and addressing many aspects of poverty.

ICT as a Sector: Most countries will not become the ICT powerhouse that Bangalore, India has become, but it is essential that all countries be able to participate in the world economy. ICT is a major component of this economy and more important, it is a crucial tool in most other sectors of the economy.

7.2   Best Practices

Although individual anecdotal successes using ICTs to help alleviate poverty do not indicate general trends, if one looks at a sufficiently large number of projects, patterns can be discerned. There are a number of lessons that are common to many of the projects reviewed. Successful projects often had many or all of the following characteristics:

- The use of ICTs kept as simple as possible – the aim is to reduce poverty, not show off the technology;
- The KISSSS Principle: Keep it Simple, Supportable, Sustainable, Scalable;
- Significant community involvement;
- Training as a major project component;
- Significant involvement of the professional people associated with the specific discipline or sector;
- Professional ICT involvement in the overall planning, design and implementation of the ICT-sensitive aspects of the project.
- Planning for success – think about how to scale and replicate the project;

7.3   ICTs as an Enabler

ICTs will not, on their own, address most poverty issues. Moreover, the ICTs that *will* help fight poverty are often the older and less high-tech ones. However, it is very clear that some aspects of poverty alleviation will *require* ICTs. It is important for countries to develop a robust ICT industry, complete with the newest digital facilities. Such an industry will help ensure that all forms of ICTs are available and supportable when they are needed in support of poverty alleviation activities. An active ICT sector is also a strong driver for com-

petitively priced communications, supporting both the social aspects of poverty alleviation as well as the ICT-based solutions.

7.4   The Dual-Path Approach

The conclusions above could be viewed as contradictory, in that they are recommending a typically basic use of ICTs for poverty alleviation programs, while at the same time advocating an ICT industry capable of utilizing the most modern and sophisticated of ICTs. But in fact they are compatible and complementary. Although basic ICTs may be recommended for most poverty alleviation programs, there will be cases where the most sophisticated technology is appropriate. A robust and agile ICT sector is an enabler allowing the selected use of ICTs in poverty alleviation. Moreover, the ICT sector must address many other needs at all levels, and it is the enabler allowing the country to participate in the global ICT-based economy.

7.5   Summary

A strong case can be made supporting the selective use of ICTs for significant poverty alleviation. In some cases, advances will not be practical without ICTs. Although poverty alleviation will not necessarily draw on all of the newest ICTs, it is important that developing countries encourage a robust local ICT sector encompassing all aspects if ICTs to ensure that the country has the capacity to utilize them as needed in its fight on poverty.

This dual-path approach to the use of ICTs is critical. For poverty alleviation, the focus must be on poverty issues, with ICTs simply being tools and enablers. But to allow this flexible ICT use, a country must build a strong ICT sector focusing on all aspects of ICT.

Appendix 1:

Millennium Development Goals

1. Eradicate extreme poverty and hunger
- Halve the proportion of people living in extreme poverty between 1990 and 2015
- Halve the proportion of people who suffer from hunger between 1990 and 2015

2. Achieve universal primary education
- Achieve universal primary education for both girls and boys by 2015

3. Promote gender equality and empower women
- Eliminate gender disparity in primary and secondary education by 2005 and on all levels by 2015

4. Reduce child mortality
- Reduce the under-five mortality rate by 2/3 no later than 2015

5. Improve maternal health
- Reduce the maternal mortality rate by 3/4 no later than 2015

6. Combat HIV/Aids, malaria and other diseases
- Have halted and begun to reverse the spread of HIV/AIDS by 2015
- Have halted and begun to reverse the incidence of malaria and other major diseases

7. Ensure environmental sustainability
- Integrate the principles of sustainable development into country policies and programmes by 2005 and reverse the loss of environmental resources by 2015
- Halve the proportion of people without sustainable access to safe drinking water
- Have achieved a significant improvement in the lives of at least 100 million slum-dwellers by 2015

8. Build a global partnership for development
- Develop an open, rule-based, predictable, non-discriminatory trading and financial system.
- Address the special needs of the least developed countries
- Address the special needs of landlocked countries and small island developing states
- Deal comprehensively with the debt problems of developing countries
- Develop and implement strategies for decent and productive work for youth
- Provide access to affordable, essential drugs in developing countries
- Make the benefits of new information technologies available

Appendix 2:

Acronyms and Definitions

Acronym	Definition
BOD	Burden of Disease
DAC	Development Assistance Committee
GIS	Geographic Information Systems
ICT(s)	Information and Communications Technology/Technologies
IDRC	Canadian International Development Research Centre
MDG	Millennium Development Goals
OECD	Organisation for Economic Co-operation and Development
PDA	Personal Digital Assistant
PRSP	Poverty Reduction Strategy Papers
SMS	Short Message Service
TBAs	Traditional Birth Assistants
UAF	Universal Access Funds
VoIP	Voice-over-IP

Appendix 3:

Bibliography

The literature on ICTs and poverty alleviation is extensive. In preparing this report, the author reviewed several hundred documents. The ones listed here proved to be of particular value and contributed to the report's content and conclusions. Where possible, URLs are included. All URLs were valid when the document was being edited, but no doubt some will have stopped working by publication time. In many cases, another copy of the document can be found by searching the web using the title, author and publisher.

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