It's More Than Just Being Connected

A Discussion of Some Issues of Information Technology and International Development

A Working paper by:

Geoffrey Kirkman
Information Technologies Group
Center for International Development
Harvard University

Many people have come to speak of new information and communication technologies (ICTs) as a magic bullet for developing countries to use to advance their social and economic development. Leaders of developing countries ask longingly for advice on getting on the Internet, developing electronic commerce, and partaking in the burgeoning global information economy. Many international development practitioners look upon the application of the Internet and wireless technologies as a panacea that will make up for decades of what many deem to be a failed profession littered with white elephants, bloated bureaucracies and corruption. While overall poverty has been alleviated somewhat over the last half century, the gap between rich and poor, both among countries and within countries, is at its highest level ever. With this in mind, many are turning to cell phones, distance learning, telemedicine and electronic commerce as the answer to narrowing the gap. Is this a realistic vision? Is the "leapfrogging" of development through ICTs feasible?

The short answer to these questions is *Maybe*. The slightly longer answer is *We Are Trying to Figure This Out*. And the most insightful answer from the people who devote their lives to these questions is *We Really Hope So.*

The technologies that facilitate activities like telemedicine and electronic commerce are so new and are changing so rapidly that no definitive template for their deployment in developing countries has yet been found. The tremendous power of Moore's, Metcalfe's and Gilder's respective Laws is well documented and recognized, and the potential of the new technologies to break down old barriers of time, distance and access is exciting, even intoxicating in the context of developing countries. The success stories of applications of technology to old industries, and of the creation of new sources of economic growth in the unlikeliest of places are inspiring examples of entrepreneurship and creativity.

Information and digital products are now routinely sent around the globe through a dizzying array of technological platforms, the Internet being only the broadest and perhaps most ubiquitous example. And these success stories inevitably breed the desire to imitate or replicate them elsewhere. If medical transcription services can be carried out in Madras, India for Boston doctors, then surely Russian language translations of computer magazines can be coordinated between London and Ulaan Bator, Mongolia. If the government of Costa Rica can attract mighty Intel to build a silicon-processor plant in its country, surely Mauritius can cut a deal with Microsoft. And without a doubt, many say, if only the Internet were taken to all corners of the globe, then the global economic and social inequality would be lessened.

Unfortunately, translation of a utopian vision of the positive impact of ICTs on the developing world into reality is not so simple. In practice, whether or not a developing country can build an ICT-based economic or social sector depends on overcoming many of the same microeconomic and macroeconomic barriers that have long contributed to its underdevelopment – What is the state of its educational system? How are telecommunications costs regulated? Is there a reliable transportation network? Are there limits on foreign direct investment? What sources of investment capital are there for small or medium sized businesses? Is there a tradition of capitalist entrepreneurship in place? – Plus a number of newer concerns – What kind of intellectual property rights protection is in place? What sorts of data networks are present? Is there competition in the ISP sector? The list goes on and on.

What follows is a rather abbreviated and incomplete discussion of some of the issues, obstacles, lessons learned and generalizations about the role that the new technologies can play in developing nations. Although it is only a brief overview, it is hoped that by touching upon some of the major concerns of the role of ICTs in developing countries, more discussion and consideration of the issues will take place.

Conquering Fear and Adopting New Paradigms

If developing countries are to "leapfrog" stages of development through the adoption and use of information and communication technologies, they must act quickly and decisively. It is essential for policy-makers to see the potential, and not the threat, of technologies such as the Internet or wireless telephony. It is essential for IT vendors to use new business models when dealing with developing markets. It is fundamental to tap into indigenous entrepreneurship to develop local uses for ICTs. And it is essential for all actors to realize that the implementation of ICTs in developing countries is an investment that will yield both economic and social rewards, and that although they will pay for themselves on a scale of several orders of magnitude, it will likely come in the longer rather than shorter term.

The unfortunate truth is that most policy-makers are acting neither decisively nor quickly regarding the new technologies. While numerous leaders in developing countries want to jump on the Internet bandwagon, many still are afraid of the economic and political impact of the Internet and other technologies. How will they undermine political control? How much will they cut into government revenue? Most policy-makers do not understand the steps that must be taken to successfully build a commercial sector that incorporates electronic commerce, an educational system that uses technology as a tool for learning, or a health care network that uses networks to gain access to badly needed medical information and expertise from elsewhere in the world.

Similarly, on the technology supply side, most high tech firms do not consider developing countries to presently be viable markets. Overcome by concerns of protecting and extending local market share in North America, Europe and Japan, strategic consideration of developing countries is something that is left to the distant future. A cursory glance at per capita GDP data and other indicators of wealth would seem to confirm these businesses' suspicions that these markets are not ready for their products. Yet this perception of the unattractiveness of developing economies is one that is not necessarily true. Eighty five percent of the world's population lives in developing countries – consideration of the low PC penetration rates and other similarly dismal IT indicators makes it clear that in terms of sheer market size, most of the world is left untouched.

Furthermore, as will be discussed later, the common perception of the unattractiveness of developing markets may be fundamentally flawed and unfounded. It may be that typical developed-market business models may have to be seriously altered to work in developing countries. There is in fact an unexploited willingness-to-pay that for reasons of misperception and misunderstanding keep many firms in developed nations away from the more undeveloped markets. This is unfortunate for most private companies from another point of view, for at this rate, especially with the "winner-take-all" nature of most high tech markets, the few firms that are venturing into the developing world are positioning themselves well in terms of building brand equity and market share – factors that give them a tighter grip on markets that most are leaving for the future.

Finally, there is a tendency to impose technology and developed-world applications of this technology upon developing countries with little regard to appropriateness or sustainability. Assumptions that U.S.-style electronic commerce should flourish in Latin

America are simply misguided. Ideas that surfing the Web will solve a rural Botswanan peasant's concerns about how to feed his family are just plain silly. With proper due diligence, however, including identification of entrepreneurial potential and local "champions," confirmation of educational, commercial and policy environments ripe for the incorporation of ICTs, and rollout of the necessary infrastructure, real economic and social gains can be made by taking ICTs to developing countries.

ICTs as an Engine for Inequality?

Instead of achieving the tremendous potential of positively changing the world with technology, there is another dark possibility. In the rapidly changing, winner-take-all technology environment that is evident worldwide, there are signs that gaps of development, as great as they have been for such a long period of time, are growing even wider. As the information revolution roars onward, it's most lasting legacy could be that the great economic divide that separates developing from developed countries eventually pales in comparison with the yawning gap that is opening in terms of information and communication technologies.

While most observers extol the virtues of the information revolution, and cite its ability to "level the playing field" for all participants, it is not entirely clear that these are either realistic or likely results. Data suggest that inequality across the globe, both among countries and within countries, is deepening along already established fault lines, and may be taking place in entirely new arenas. Along with the rich and poor, we are rapidly separating into the connected and the unconnected. The connectivity gap is being driven by a number of factors that include public policies that hinder the spread of ICTs, a lack of understanding about the uses of technology and of course by a key driver of this vicious cycle of inequality – poverty itself.

The bottom line of international development work is to eradicate poverty in the world, particularly the developing world. There are a number of statistics that highlight the huge global disparities in economic prosperity and development, but the following three facts capture at least a broad brushstroke of economic inequality in the world:

- The three richest individuals in the world have a net worth that is greater than the combined GDP of the 47 poorest countries.

- The 15 richest individuals in the world have a net worth that is greater than all of sub-Saharan Africa.

- 1.3 billion people in the world survive on less than US$1.00 a day.

With the advent of telecommunications and newer technologies, analysts now have at their disposal a number of other statistics that show tremendous technological disparities:

- Half of the world's population has never even made a phone call.

- According to the International Telecommunications Union, at the beginning of 1997, sixty-two percent of the world's main telephone lines were in 23 countries in the developed world. These countries have fifteen percent of the world's population.

- There are fewer telephone lines in all of Africa than in Tokyo.

- Twenty-five percent of the world's countries have a teledensity of less than 1 – in other words, there is less than one telephone line per 100 people.

- Sixty percent of the population in the developing world live in rural areas, yet over eighty percent of main telephone lines are in urban areas.

- Eighty-four per cent of mobile cellular subscribers, ninety-one percent of all fax machines and ninety-seven percent of Internet host computers are in developed countries.

- One third of the world's population has no access to electricity

Statistics like these have led to the formation of the well-known catch-phrase "information haves and have-nots" which describes one more aspect of global inequality. The potentially most disturbing aspect of these observations is that it is not clear that these conditions are improving. The data (although better data are needed) suggest that the gaps in ICT indicators are growing worse. This leads to profound and fundamental questions about how the new technologies are changing the structure of the global society. One important question is how developing countries can tap into the empowerment that can result from the adoption of these technologies instead of falling further behind. The short answer is that the obstacles are many, existing good models of success are few, and hard decisions involving difficult trade-offs and huge perceived risks need to be made. The Internet and wireless telephony may not be magic bullets for the poorest countries of the world to slay the technology gap. With some creativity and willingness to think in new ways, however, they certainly seem to at least offer a degree of hope that no longer exists in the failed development paradigms of recent decades.

Serious commitment and hard work have to take place on a variety of levels to turn this hope into action, from macro-level trade and regulatory policy to educational reform to grassroots training and microeconomic entrepreneurship. If not only multinational corporations, with the benefits of economics of scope and scale as well as the resources to take advantage of ICTs, but also schools, small and medium sized businesses, and people in general in developing countries are to participate in the global information economy, they need (1) access to the new technologies; (2) applications that use the technology to maximize economic and social gain; and (3) a macro environment that allows the first two conditions to flourish.

Access to the New Technologies – Rolling Out the Information Infrastructure

Defining the Limits of Market Forces

While many factors contribute to the successful introduction and use of ICTs in developing countries, the basic necessary (but insufficient) condition is the availability of information and communication hardware. Without basic infrastructure, none of the best case scenarios for ICT usage – telemedicine, educational technology, electronic commerce, etc. – can take off and prosper.

First of all, there seems no doubt that market forces will take ICTs to all developing countries – by now, the global Internet connectivity maps that only two or three years ago showed gaping holes throughout sub-Saharan Africa and central Asia now are, with several exceptions, fairly complete. In addition to the Internet, wireless technologies can be found in most major cities in the world. With the November 1998 launch of Iridium satellite service and the ITU's recent announcement on a global roaming standard, worldwide telephony in both urban and rural areas is now becoming a reality. On the most macro level, therefore, the world is pretty much wired.

An examination of sub-national ICT infrastructure, however, reveals that many countries have connectivity that does not extend beyond the capital city or major economic centers. With regard to the next step of rolling out voice and data networks into rural areas, however, the private, market driven model seems to break down. At the very least, under most current policy and business paradigms, it becomes unclear where private actors will be willing to "follow the money" because it is not apparent where the money is, beyond limited, urban, wealthier markets within developing economies. Because of this impending market failure, the impact of ICTs, therefore, although full of so much potential, will be negligible upon societies-at-large.

The key to coordinating efforts to make the global information infrastructure truly global and push national information infrastructures into rural areas, is to determine how far market forces will carry the process, and fill the gap with concerted action by government and other non-private actors, with the support of the international development community. This is not just a theoretical question from an economics text on market failure, but a real question about the respective roles of private and non-private actors in the provision of new technologies in the developing world, about the willingness of governments to make difficult budget tradeoffs and about the most effective use of international financial and intellectual resources.

Furthermore, the question of how far the market can go is becoming harder to assess, as the plummeting cost of technology combines with creative entrepreneurship to create new business models. A new wave of innovative businesses, better known as social entrepreneurs, is defying conventional wisdom about how deeply into developing countries private firms can go. In Tanzania, for example, a Cambridge, MA-based company called Adesemi is doing the unheard of – installing wireless payphones and pagers throughout the country, with a focus on peri-urban and rural areas. Users use phone cards to make calls and access voice mail, and will eventually use their cards to get Internet access. In the five years since it was founded, Adesemi has established a network of 600 payphones with 80,000 subscribers, moved into Ghana, is implementing plans to install 2,000 more phones in Sri Lanka, and is planning to expand next year into Latin America and Asia. Adesemi's reputation in Tanzania as "the phones that work" has placed significant pressure on the government owned PTT to improve its own service, and begun a new era of service-based competition within the country. Equally relevant to this discussion is that the company is making money for its investors as it does so.

This example illustrates a growing new conception among private vendors of how to assess consumer markets in developing countries. The private sector is beginning to realize that the market traits for groups, be they villages, schools or organizations in developing nations, are very similar to those of individuals in the more developed countries. In other words, the willingness-to-pay of a community center in suburban Quito may be equivalent to that of a middle class family in Des Moines. And while the initial profit margins on selling technology to villages and telecenters may not be quite the same as those in developed countries, as first steps in capturing global market share, companies are beginning to realize that this kind of conception is essential to begin building brand awareness. In Bangladesh, Grameenphone has been much in the press as of late because of its model of selling GSM 900 cellular telephones to individuals and groups in rural villages who then build microenterprises by renting out the phones. The company plans to be operational in 68,000 villages across Bangladesh by the year 2003.

It is clear that the new technologies offer room for entrepreneurial initiatives that did not exist before.

A Panoply of Choices – Fiber, Wireless, Satellites and more

As a further aid to the efforts to build out telecoms infrastructure in developing countries, telecoms operators have in recent years been able to take advantage of newly powerful, cheaper wireless technologies in combination with, or at the expense of traditional land-based lines. Wireless technology has been instrumental in extending national networks into areas that for topographical or other reasons had previously been left out. In Argentina, for example, the privatization and reorganization of the national telephone system has led to a hodgepodge of wireless, satellite and landline solutions to reach into provincial areas that were never before on the national grid. Similarly Rwanda was able to create a 100 percent digital national network using a mix of technologies. Unlike more developed countries in which the cell phone is a complement to land-based telephony, the plummeting cost of wireless in developing countries has made PCS, wireless local loop and other systems legitimate substitutes for landline services. When one considers the notoriously long waiting periods for many land-based telephone services, obtaining a cellular phone to bypass them becomes quite appealing.

One of the hottest topics in international development and sources of tremendous hope and speculation over the past few years is the potential impact of the spate of low-earth orbit (LEO) satellite networks that are being launched over the next decade. Whether it is the already-functioning Iridium voice system, Teledesic, Spaceway, or any of the other planned initiatives, the promise of connectivity anywhere on the planet could have a fantastic impact upon bringing previously disconnected areas on Earth into the mainstream voice and data corridors.

Whether or not these satellite initiatives actually realize their potential in terms of extending access to the world's underdeveloped will depend upon the agreements that national governments, NGOs and international organizations will be able to reach with the private satellite companies. The prohibitive cost of LEO handsets and the extremely high per-minute usage fees will otherwise certainly limit the real impact of these services to corporations and wealthy individuals. If, as has been reported, there is will be a large underutilization of satellite capacity (Iridium, for example, is only expected to utilize twenty percent of its bandwidth capacity over the next two decades) it makes good development and business sense to literally give away this bandwidth to developing countries. Not only would this be seen as an act of good faith, but it would certainly be a good step in building brand awareness and loyalty throughout the developing world, both of which will be essential when competition begins to heat up over developing country markets.

A by-product of the LEO initiatives is that the predominant satellite systems of past decades, now in effect provide a second tier of telecommunications service. This too offers an opportunity to developing countries who can now get access to satellite-based telephony and other services at a lower price than before. Firms such as Tachyon, a re-marketer of these satellite services, are taking advantage of the major shifts in the satellite market to expand the breadth depth of traditional satellite clients.

With the widening array of technology options and their declining costs, the ability of both national governments and non-governmental actors to build out developing countries' information infrastructures is only growing stronger. The line between public and private roles in this buildout will continue to shift and blur, as businesses seek creative ways to make a profit in previously untenable regions and markets, and governments increasingly realize the importance of their national information infrastructure in their strategic vision.

Now that They're Connected, What Do They Do with It?

The real power of wiring (or unwiring) the world lies in how those wires (or unwires) are used for economic and social benefit. In development terms, there are three broad areas

in which ICTs can have a big impact: commerce, education and health, the three building blocks of a society. Aside from technology-specific obstacles such as repair and maintenance, bandwidth and infrastructure reliability, applications for these areas face considerable impediments as well.

Technology, Education and Health

The potential impact of ICTs upon health and education could be enormous. Giving health care providers access to information that they did not have before, and giving students of all ages links to educational materials that were previously unavailable would open up possibilities for previously impossible gains. The dearth of libraries in developing countries, and the notoriously poor access to quality research materials can be remedied through providing access to information resources on networks. With the convergence of technology media, declining cost of technology, and improvements in miniaturization and product design, the potential applications of handheld devices should have a wide-ranging impact upon health and education development work. The ability to remotely monitor environmental and health conditions, engage in project-based learning at a distance and effectively communicate where there once was virtually no communication at all could have revolutionary repercussions on the development impact of fieldwork.

There are a number of obstacles related to the content aspect of the expanded provision of access to information. First of all, language can be a significant obstacle to making use of new information in much of the developing world because English is the primary language of the World Wide Web and other technology spheres. While the number of non-English websites is growing rapidly, it is still not keeping pace with the English-oriented Web. Second, coping with the sheer volume of information available on global networks such as the Web is a serious obstacle to all of us who use them for research. This task is made especially difficult due to the lack of browsers and other software configured for local needs. Third, there is the issue of training. Teachers, health care providers, and others must understand how the ICTs can impact their work and how to convert that understanding into generalized benefit. Technology must be carefully incorporated into educational curricula, and ways must be found to achieve systemic reform with the new technologies.

Electronic Commerce

Aside from the more straightforward consumer retail and supply chain management applications of electronic commerce that have begun to arise throughout the developing world, several manifestations of electronic commerce have arisen that could have great impacts upon the economic growth of developing countries. One of the most promising areas of electronic commerce that is especially suited for developing nations with high educational levels and reliable infrastructure is technology-mediated information service processing. There has been a global boom in the international trade in services, part of which has manifested itself in forms ranging from telemarketing in Ireland to software engineering in Bangalore to bookkeeping in Zimbabwe, all of which are performed thousands of miles away from the business source.

There are two main drivers for the success of this kind of model. On one hand, the rising quality and declining cost of technology (particularly the advent of more advanced data compression technologies) allows services to be carried out over global networks. On the other hand, the continuing discrepancy in wage rates between developing and developed nations allows firms to use a labor arbitrage model to contract out services to low cost service providers. Secondary drivers are factors such as language, time zone differential, training, and data security, all of which assure the competitiveness of offshore outsourcing models with local counterparts.

It is unlikely that U.S. style consumer retail electronic commerce will strictly translate to success in developing countries. There are number of conditions that do not lend themselves well to e-commerce. The "cookie" model of consumer electronic commerce, for example, is geared toward individual users who shop from their own hard drive, and is key to cyber-marketing and tailoring websites to customer preferences. However, communal use models predominant in most developing countries – in which users employ telecenters, cybercafes and other public access points to use the Internet – prohibit its use. Reliance upon credit cards for payment is another stumbling block in countries that do not have widespread credit card usage. Solutions such as virtual cash seem a long way off from acceptance, although some sort of hybrid online/bricks and mortar prepaid systems to third party brokers may be feasible. In nations with foreign exchange limitations, this may hinder electronic commerce activity. For e-commerce models that include the traffic in goods, issues regarding shipping, transportation and logistics will be extremely important. It is probable, however, that local innovations will produce new forms of e-commerce.

The whittling down of physical supply chains through data networks is already well underway, and will undoubtedly continue to streamline the processes among developed and developing countries alike. The major bottlenecks already existent in international trade such as customs, shipping issues, transportation logistics, and poor physical infrastructure will continue to plague many forms of electronic commerce-facilitated transactions. For this reason, the trade in services, as well as digital products, will continue to drive most electronic commerce in developing countries.

Telecenters – Using ICTs for a Variety of Purposes

One of the most innovative concepts in the international development community today with regard to ICTs is that of a telecenter. A telecenter is a flexible concept in which a connectivity node in a community is used for a variety of economic and social purposes. Similar to the idea of a cybercafe, which concentrates a number of rental PCs, a telecenter is designed to more explicitly deal with community needs like health and education, as well as local commercial needs such as access to voice and data networks for business purposes. There is no one-size-fits-all telecenter model. In one community, a telecenter may be housed in a post office, and consist of a public payphone used by the community-at-large, and a PC used by the local doctor to consult an online reference journal, the school to collect email from a partner school in another province, and a public official who wishes to know the details of a new national law. In another community, the telecenter may be found in a church, and be made up of five PCs which are used mostly for publishing community newspapers for the entire region, as well as by a local women's group which is corresponding with an NGO in the capital.

The concept of the telecenter takes advantage of the low marginal cost of addressing a number of needs once connectivity has been established. In its ideal form, a telecenter is financially sustainable through a carefully formulated revenue stream, incorporates a public purpose into its design, and embodies the idea that technology at its best can provide an excellent platform for a variety of purposes.

Some of the major concerns in the still-nascent process of employing telecenters as a development tool are the need for a local "champion" to look after the technology, guaranteed revenue stream for self-sustainability, provisions for facility repair and maintenance, identification of communal needs addressed by the telecenter, and adequate training of local personnel using the technology. Most telecenter practitioners agree that the easiest aspect of establishing a telecenter is the actual hardware and infrastructure. The more difficult part of telecenter operation lies in the human capability of using the telecenter.

While extremely attractive as a potential tool for development, it is still too early to assess the real contribution of the telecenter to local economic and social development.

Pitfalls and Mistaken Assumptions that Hinder Success with ICTs

A major danger of programs endeavoring to leverage technology into economic growth is to view technology as a solution unto itself. The introduction of new technology is often considered to be a cure-all for any number of problems or concerns. With regard to the most recent round of technology development, this predilection has led to initiatives such as the wiring of schools, the shipment of computers to areas where there were none before, and a focus on connectivity and installed hardware as end results. Yet the follow-up evaluations to many of these initiatives have shown that students are not using the connections in their schools and that computers sit unused within their original packing materials.

These situations arise primarily because of (1) a lack of solid due diligence that properly identifies the needs and possible uses of the technology in question and (2) a lack of training or awareness that allows the technology to be utilized productively. These circumstances are certainly not unique to developing countries, as the numerous studies on the negligible impact of computers on the classroom in the United States have shown, and as suggested by "urban legends" circulating from computer call centers that tell of users putting their mice on the floor to be used as foot pedals or pointing mice at the screen like a remote control. However, given the additional barriers of culture, language and extreme lack of familiarity with technology that can exist when introducing foreign technologies, these lessons are especially poignant. As necessary as connectivity is, no technology can be useful without placing it within the local context vis-à-vis local capabilities, needs and the application of the technology. While pushing ICTs into developing countries may be difficult, the development of valuable applications of those technologies is more difficult still.

There has traditionally not been enough emphasis on making hardware and infrastructure translate into economic and social development. Outlandish stories exist of the incongruities of modern technologies languishing in developing countries because they were installed without understanding the local context or with ill-conceived expectations of how they would be used. The large number of washing machines in Salvadoran villages without electricity that now serve as hen houses illustrates not only the "technology for technology's sake" trap that even the best of intentions can lead to, but also the "you'll be surprised at how the technology is actually used" paradigm that is the key to successfully incorporating any technology into a local context. The flip side of the Salvadoran washing machines is an example of local ingenuity in using new technologies – electronic mail that

arrives at Ghanian post offices for citizens with e-mail accounts there is delivered to the subscribers by bicycle messengers, giving new meaning to "wireless local loop."

Part of the problem of technology projects in developing countries lies in the erroneous view that technology can automatically jumpstart entrepreneurial initiative. Giving a rural village an Internet connection does not necessarily mean that the residents will now be able to participate in electronic commerce or have any inkling of how such a connection can improve their health or education. If a village has never organized a co-op before, the presence of the Internet will not awaken the entrepreneurial spirit. This is why in programs such as the Acacia Initiative, a Canadian-sponsored program that installs telecenters in South Africa, the biggest reason for choosing a new telecenter is the presence of a local champion who can transform access to technology into economic benefit. Local champions must have a business plan that predicts financial self-sustainability and must understand how the technology can be applied to both community and business needs.

Another mistake that is frequently made is assuming how a particular technology will be used. The Ghanian bicycle-email service is one that certainly must have surprised more than a few of the designers of the Ghanian e-mail network. A certain degree of flexibility should be incorporated into any technology project to allow it to best fit local needs. This is well-illustrated by the difference between two landscape architects who were designing the college greens for two different universities. The first planner was shocked to find that students refused to walk on the neatly paved paths that she had laid out in anticipation of the community's walking needs. The second planner, however, waited several weeks until there were well-trodden paths through the green that showed clearly where he should place the flagstones. The top-down imposition of ill-formed preconceptions has a long and ignominious history in many development projects.

The Internet may actually not be of much use to most of the developing world because of the reasons commonly cited by those practitioners who champion applications of technology – improved access to weather information, prices of coffee at the nearest port or the ability to consult a cardiologist in Boston. But the ability to watch a championship football match in the capital city, to talk to one's family members two towns away, to coordinate a taxi driver's pickups for the next day, are all legitimate uses that a project designer may not perceive. For years development organizations like the World Bank have stressed the need for "local ownership" of projects, and efforts to get local input into project design have improved. But things need to change even further, and projects need to truly be demand-driven. Other assumptions may be turned on their head through experience – does rural connectivity really stem rural-to-urban migration? Or does it actually accelerate it by exposing rural inhabitants to new skills and information that they then wish to use in a setting where they can earn more income?

There is another pitfall involving technology and developing countries – the tendency for technology planners in developed countries to want to focus first on applying technology to the most extreme examples of underdevelopment – to want to help the "poorest of the poor," the most rural, the most destitute communities. More often than not, however, this just does not make sense. Communities with low educational levels and no previous contact with any technology whatsoever are not necessarily promising candidates for a local offshore data processing industry.

Instead of focusing on rural communities where the impact of technology would seem to be most dramatic, technology should be introduced into communities where there is the greatest chance of success. In other words, it is important to identify local champions, and to identify and develop needed skills among the potential users. PEOPlink is a pioneer organization in international electronic commerce that trains artisans in developing countries

to use digital cameras and design web pages in order to sell their wares on the Web. It has built a network of thousands of artisans in 14 countries by focusing on existing business efforts, working through umbrella NGO organizations. Testimonials from other entrepreneurs who launched technology-oriented endeavors in developing countries point to the ease with which technology can be imposed from above, the difficulty in providing training that allows that technology to be useful, and the impossibility of imposing creativity, entrepreneurship and basic wherewithal to be successful technology users.

Finally, the introduction of technology into a community can have dramatic effects upon the power relationships within that group, either creating new power issues or reinforcing/accentuating existing power. This can have either positive or negative results, particularly in terms of gender. But the consideration of who will have control of particular technologies, how a community will access them and their concomitant economic and social impacts should be carefully assessed during a due diligence stage.

The need to understand a local environment and technology's potential place in that arena, as well as the importance of training and raising local awareness of the uses of technology, cannot be overemphasized.

Some Qualitative Benefits of Networks

This is not to suggest in any way that connectivity and the creation of networks do not have their own inherent benefits. The cross-cultural collaboration and learning that can result from entrance into a network can be wonderfully empowering, sometimes surprisingly so. As a case in point, the World Links for Development (WorLD) Program of the World Bank has shown the tremendous value of building international networks of schools that can participate in project-based learning. One of the most interesting anecdotes from this program arose when a school in Wyoming in the U.S. entered into partnership with a school in Uganda. The students in Uganda were extremely intimidated by the prospect of interacting with their peers in the U.S., and devoted hours and hours to the project on which the two schools were to collaborate. Their counterparts in Wyoming, on the other hand, saw the relationship with the Ugandans as only one facet of their already media-intensive lives, and did not put much effort into the collaboration. Until, that is, they received their work back from the Ugandans, complete with grammar and spelling corrections and rebukes for the sloppiness of the work. The result was a noticeable rise in the self-esteem of the Ugandan students, and an eye opening learning experience for the students in Wyoming.

In terms of international development, this psychological/sociological empowerment is the kind of benefit that is not easily quantifiable, and it certainly does not fit within any traditional econometric approaches. Yet the benefit is there nonetheless. If we consider why this is a success, however, we can see that it lies not in the connectivity itself, nor in the wiring of a school, but in channeling the use of the hardware and connectivity into a productive relationship. Unlike too many introductions of technology in the classroom which result in rooms full of computers that sit unused and not understood, the WorLD program's emphasis on teacher training and curriculum development allows both for indigenous creativity in using the technology as well as the benefits from joining a network.

The next stage, which would link an endeavor such as the Uganda-Wyoming experience explicitly to gains in economic growth, could be to create a cottage industry of IT-savvy Ugandans who could use their newly acquired abilities for economic gain. Let us say that a local entrepreneur in Kampala wishes to hire graduating students from the networked school to form a firm that performs back-office document processing functions for hospitals in England. There are a number of obstacles that this entrepreneur must consider, some of which have been discussed earlier – what kind of bandwidth does he have? What kind of

training program is in place to ensure quality? How will he find clients in England? What kinds of protection for intellectual property rights are there in Uganda to safeguard against this entrepreneur reselling sensitive information to English insurance companies? What kind of cryptography does Ugandan law allow? Where is the entrepreneur going to get seed financing? Can he pay the student enough that they will not leave Uganda to use their skills elsewhere in the world?

Creating a Receptive Environment for ICTs

While much of the preceding discussion focused on the micro-level aspects of spreading ICTs into and throughout developing countries, it is essential that the overall environment within a country be primed to allow ICTs to be effectively utilized for economic and social development. Policy-makers must attend to a number of areas of concern to create a regulatory, educational and overall policy environment in which connectivity can be encouraged and more importantly, in which fruitful applications of that connectivity can flourish.

As follows are some rules of thumb:

- *Competition is Good*. The greater the competition, the more vibrant the growth of the IT sector, and the more economic growth. Monopolies in the telecoms sector, especially in the markets for cellular telephony and Internet service provision, stifle growth. Indigenous competition in ISPs and elsewhere should especially be encouraged to create strong local content. Governments should treat new technologies like the Internet differently than they have traditional telecoms, and not simply dump responsibility for the regulation and consideration of Internet issues within existing telecoms bureaucracy.

- *Don't Reinvent the Wheel*. Focus on the localization of existing software and hardware solutions – adapt what exists for local needs.

- *Encourage Market Forces*. Let the private sector take the lead in extending services. If the right incentives cannot be put in place for private firms to provide the services, then identify the sources of market failure – the Canadian model of the information superhighway is one that focused on connectivity of rural northern communities education (encouragement and incorporation of technological platforms for education). Is connectivity a fundamental human right? Spain recently declared that it believes that it is.

- *Consider a Variety of Technologies*. Global experience suggests that depending on the terrain, population density and costs, different technologies are suited for different environments. Consider a combination of wireless, satellite and landline options when rolling out the information infrastructure.

- *Seek Private Partners*. The recent announcement of the partnership between the government of Argentina and Microsoft is an excellent example of an initiative that could reap huge dividends for both players.

- *Protect Intellectual Property Rights*. If developing countries wish to join the growing global information economy, then it is essential to guarantee IPRs. Given the ever-expanding international data backbones, it is all too easy to divert data flows and digital products away from countries that do not ensure their protection.

- *Bandwidth, Bandwidth, Bandwidth*. Encourage the development of high bandwidth infrastructure solutions. Technology is changing so quickly that it essential to make allowances for as much bandwidth intensity as possible.

- *Focus on Education.* The future of information and communication technologies in developing countries is dependent upon the educational system of a nation. The sophistication of any IT infrastructure that is introduced into any environment is meaningless if people don't have the skills to (1) know what to do with it and (2) be able to use to their best advantage. The successes of Bangalore and Madras, as well as the recent economic booms within Ireland and Finland (where fifteen percent of the Finnish GDP stems from Nokia) can be directly correlated to their highly educated labor forces and high degree of IT skills.

- *Connectivity Doesn't Matter if No One Can Afford to Pay for It.* As long as the cost of telecommunications service remains high, the impact of ICTs within developing nations will be extremely limited. Pricing plans that charge high per minute or hour of use charges are a major obstacle to widespread use of the Internet and other communications devices. While asynchronous usage models do develop where flat rate pricing does not exist, the richer forms of distance learning, telemedicine and electronic commerce that can develop with synchronous, interactive communication cannot flourish under 'per usage' pricing structures.

  In Europe, consumer pressure through "cyber strikes" and other means has been instrumental in pushing national telecoms carriers to introduce flat rate pricing. However, without a critical mass of citizens who are actually online, this kind of pressure is unlikely to arise in developing countries. Better forces for change have come from the growth of Internet telephony, call back services, and pressure from influential outsiders such as international organizations and consulting firms. Most governments, however, are unwilling to relinquish control over one of their few "cash cows." Even when governments commit themselves to the path of privatization or increased competition, they postpone the actual arrival of these events for a number of years, citing the need to "prepare" themselves. This tendency, which can be seen in countries ranging from Bulgaria to Mauritius, only sets them back even more in terms of reaping the benefits that ICTs can bring to their societies.