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Bridging the Digital Divide

Information and communication technologies are increasingly considered development tools. But how will the poor get access to them? A number of different answers are emerging as experts balance cost and access.

Before the Internet came to Veerampattinam, a coastal village in southern India, the local fisher folk went to get their daily catch without knowing sea conditions or the location of fish shoals. Lives were sometimes lost because of particularly high waves and rough seas. But in late 1998, the M.S. Swaminathan Research Foundation (MSSRF), an Indian research center, installed a computer in a "village information shop" with financial assistance from the International Development Research Centre, Canada.

Through a wireless local-area network based on radio frequencies, the computer makes available daily data on wave height and wind forecasts from a U.S. Navy website. This information is broadcast to the villagers in the early morning via loudspeakers on the roof of the information shop.

Armed with this knowledge as well as with details about fish location, the fishermen now ply the seas in greater safety and with more efficiency. Not only has the Internet-enabled computer made the main work of the village easier, but it has also made information about prices, health and transportation facilities, and entitlement schemes accessible. Indeed, before the computer arrived, villagers were unaware of housing loans that they were entitled to. Most fishermen in the village have now benefited from these low-cost loans.

Veerampattinam is one of many recent examples of the way the Internet has reached and benefited the poor in developing countries. Although small in scale, these examples have posed a challenge to the view that the Internet belongs to the technologically advanced and that it would be out of place in poor rural areas. As M.S. Swaminathan, MSSRF's chairman of the board, says, "The technological empowerment of the poor adds value to their work and lives. Just as with the Green Revolution, information technology in the hands of small producers, particularly women, benefits everyone, whereas information technology in the hands only of the rich does not."

Villagers use the computers of the Kothmale Internet Community Radio project in Sri Lanka to access the web.

Without doubt the Internet and other information and communication technologies (ICTs), such as faxes, video, digital radio, mobile phones, and satellite technologies, have helped people gain access to, process, respond to, and distribute information in a faster and more far-reaching way than ever before. This ongoing shift toward a more information-intensive society gives both added weight and new meaning to the old maxim, "information is power."

ICTs at a minimum can enhance the livelihoods of the poor and improve market efficiency. As development tools in their own right, ICTs can also help lead to higher literacy rates through distance learning; gender equality through the empowerment of

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Roots and Tubers for the 21st Century

The major roots and tubers—cassava, potato, sweetpotato, and yam—rank among the top 10 food crops produced in developing countries. They contribute to the energy and nutrition requirements of more than 2 billion people in the developing world. They also constitute an important source of employment and income in poor, rural areas. Moreover, they adapt to a wide range of uses: food security crop, regular food crop, cash crop, feed crop, and raw material for industrial uses.

But roots and tubers often get treated as undifferentiated commodities, and this has obscured their varying uses and performances by region. In *Roots and Tubers for the 21st Century: Trends, Projections, and Policy Options,* 2020 Vision Discussion Paper 31, Gregory J. Scott, Mark W. Rosegrant, and Claudia Ringler examine the contribution major roots and tubers have made, singly and together, to developing-country food systems in recent decades, make projections about the use and production of these crops through 2020, assess environmental effects, and offer policy recommendations for overcoming constraints on supply and demand. To launch the paper, the 2020 Vision initiative held a seminar on June 8.

The use and production of roots and tubers vary owing to differences in population and economic growth, cultural factors, and levels of urbanization. For example, although overall consumption of roots and tubers as food in developing countries increased by 22 percent between 1983 and 1996, cassava consumption stagnated in Latin America because of changing diets that favored potatoes, but rose sharply in Sub-Saharan Africa, because of stagnant incomes, rapid urbanization, and population growth led poor rural and urban consumers to rely on a cheap, starchy staple.

The adaptability of roots and tubers to marginal environments, their contribution to household food security, and their flexibility in mixed farming systems and end uses will make them even more important as population and urbanization increase and poverty remains in the midst of rising incomes. The challenge will be to make roots and tubers a part of a targeted, sustainable strategy for improving the welfare of the rural poor and linking smallholder farmers to markets. ■

Integrated Nutrient Management and Sustainable Agriculture

With world population expected to exceed 7.5 billion by the year 2020, concerns are growing that food needs will not be met unless soil fertility and agricultural sustainability improve. To ensure that food production keeps pace with population growth in an environmentally friendly way, Peter Gruhn, Francesco Goletti, and Montague Yudelman argue in *Integrated Nutrient Management, Soil Fertility, and Sustainable Agriculture: Current Issues and Future Challenges,* 2020 Vision Discussion Paper 32, that integrated nutrient management (INM) should be widely implemented in developing countries. INM should complement production strategies such as irrigation, conversion of marginal lands, and development of new seed technologies in order to maximize yields.

INM is an approach to farming that uses both natural and manmade plant nutrients to correct nutrient imbalances in the soil, thereby attaining higher crop productivity, preventing soil degradation, alleviating pressure on the land, and safeguarding future food supplies. It relies on nutrient conservation and application, better planting practices, new technologies to increase nutrient content in and availability to plants, and the transfer of knowledge between farmers and researchers.

INM's productivity benefits alone can be substantial. In Kenya, for example, the application of nitrogenous fertilizer on nitrogen-poor soils increased maize yields from 4.5 to 6.3 metric tons per hectare. Widespread adoption of INM could lead to significant increases in agricultural output in places like Africa, where about 86 percent of the countries lose more than 30 kilograms per hectare of the main soil nutrients every year. Success of INM, however, will depend upon the combined efforts of farmers, researchers, governments, the private sector, and nongovernmental organizations (NGOs), with each group playing its part to exchange knowledge and develop or adopt technologies that suit local conditions.

The discussion paper describes the key components of the INM approach; delineates the roles and responsibilities of various actors, including farmers and institutions, and makes recommendations for improving the management of plant nutrients and soil fertility. ■

Feeding an Urbanizing World

By 2020 the number of people living in developing countries will grow from 4.9 billion to 6.8 billion. Ninety percent of this increase will occur in cities and towns. As urban populations increase, so will urban poverty, food insecurity, and malnutrition. To discuss the nature and consequences of these increases and the best means to prevent them, the 2020 Vision initiative has published *Achieving Urban Food and Nutrition Security in the Developing World,* Focus 3, edited by James L. Garrett and Marie T. Ruel.

In this collection of 10 briefs, experts provide an overview of the urban transition, examine the economic and social links between rural and urban areas, discuss urban livelihoods and labor markets, analyze urban agriculture and food supply, diagnose the effects of urbanization on nutrition and health, investigate the relationship between women's labor-force participation and childcare, and delineate the key issues that programs for achieving urban food and nutrition security have to address.

The briefs show that policymakers must pay attention to the effects of policies both at the macroeconomic and household levels. For example, food markets must be efficient, but the prices that households pay should remain stable. Job creation is necessary, as is increasing the capacity of the poor to find and hold jobs that pay enough to live on. The survival strategies that the poor use, such as urban agriculture and complex urban-rural socioeconomic networks, need to be taken into account rather than undermined when formulating policies. The public health sector must address the dietary changes brought about by urbanization and the unsanitary conditions in poor urban areas. Policies to promote child health have to focus on the greater time urban mothers spend working away from home.

The most effective, relevant policies to treat these and other issues must

connect the needs of the poor to a politically responsive local government that has the technical and institutional capacity to act.

Whereas most rural interventions to increase well-being aim at agriculture in some way, urban interventions must address a broader range of sectors and actors. Only holistically conceived responses that coordinate actions across sectors, public and private actors, and household, community, national, and global levels can lead to sustainable urban and food and nutrition security in the future. ■

A Visual Guide to the Future World Food Situation

IFPRI's most-requested charts and graphs showing past and future trends in the world food situation are now available online for use by teachers, researchers, journalists, and others. Many of the figures are based on IMPACT, IFPRI's global model of future world food supply, demand, and trade. Twenty-three visuals are now online, and more will be added as they become available. To find these visuals, go to IFPRI's website at **http://www.ifpri.org/pubs/catalog.htm#visuals.** ■

Ian Johnson Joins 2020 Advisory Committee

Ian Johnson, the recently appointed chairman of the Consultative Group on International Agricultural Research, is the newest member of the 2020 International Advisory Committee. Johnson also serves as World Bank vice-president for environmentally and socially sustainable development. Johnson helped found the Global Environment Facility (GEF), which was established after the 1992 Rio Earth Summit to combat four critical threats to the global environment: biodiversity loss, climate change, degradation of international waters, and ozone depletion. ■

Innovating to Release the Potential of Agriculture in South Africa

Like farmers everywhere, farmers in Africa are working to keep up with, and exploit, the rapid changes in agricultural technology, information, and global markets. NEWS & VIEWS interviewed Bongiwe Nomandi Njobe, director general of South Africa's Department of Agriculture, on how farmers in South Africa, and in Africa more generally, are faring and what programs and policies are underway to support them.

Bongiwe Nomandi Njobe

NEWS & VIEWS: Many African farmers are small farmers, and many are women. Will small-scale agriculture remain a viable way of meeting food needs in the future?

I tend to have a bit of an aversion to the term small. It doesn't describe your production or your economic unit. African farmers are often described as small because many of them operate on a combination of small holding units, but I think the biggest problem for African agriculture is that many of the farmers are resource limited. They are resource constrained not so much from a natural resource point of view, because our resources are very rich, but from the fact that they need inputs and technology and information, which are critical for unlocking the potential of the natural resource.

Women for various reasons have remained the core producers of food for the household. In South Africa, for example, because of the migrant labor system, women have been left in the rural areas with very few employment opportunities other than some basic agriculture. Women are moving into other jobs, but that's still a slow process. What is changing is that women are actually making money in those rural areas in many creative ways. You have some groups of women who grow peppadew—a new product, something between a green pepper, paprika, and a chili, that they bottle and export to Europe. In other areas we are introducing goat production, where value-added takes the form of leather processing. Lots of women are doing food gardens, but we've got others who are entrepreneurs in new fields, like cotton-growing and asparagus. In my department we run a Female Farmer of the Year competition, which is helping female farmers become more visible and is a really interesting way of learning what they do. So there are quite a lot of innovations happening.

NEWS & VIEWS: Are you trying new ways of getting information to these women to help them get the most from their farming?

We're going to try something quite brave—we're going to try to digitalize. In South Africa we have something called multipurpose centers, or community meeting halls, which are instrumental at building social cohesion at the community level. In and around the community hall, you have small marketplaces that traders can rent to sell their wares, and you can have entrepreneurs opening shops and businesses. We have experimented with what we call farmer support centers, which become focal points for farmers in rural areas. We're working on expanding that into rural information centers which would bring Internet connectivity right into those areas, so that people could access websites and all sorts of other information right from where they are, with somebody to help them interpret what that information can help them do. We find that the greatest need is for people in rural areas to understand what services government has on offer and how and under what conditions they can access these. For agriculture we have available planning information based on the resource maps of an area, climatic information for an area, technical information on the range of crops and products that can be grown or even developed in an area, and disease and quality-related information. We can also facilitate a link to market-related information—particularly prices of commodities on the market—which is often already available from the private sector for free. We realize that radio remains a dominant form of effective communication in rural communities, so we also use that quite extensively.

We're trying to build a national ethic of land care and soil and water conservation. We have a whole package of legislation which actually forces that ethic.

NEWS & VIEWS: In Africa, as in many parts of the world, the land most suited to agriculture is already under cultivation, and farmers are encroaching on less favorable lands. How much should countries like South Africa invest in policies and research to improved yields in these less-favored lands, as opposed to higher-potential areas?

Land quality issues differ in different countries, and the extent to which appropriate land is available for agricultural production differs in each country. Speaking for South Africa, what we've done is introduce the "land care" concept. This supports good nurturing of the land and replenishment of its capacity, so you build that into the production system. It doesn't help to avoid fragile lands and go for the high-potential lands, and then down the line they become fragile and you walk away from them. So we're trying to build a national ethic of land care and soil and water conservation. We have a whole package of legislation which actually forces that ethic, and we're doing a lot of work at the grass-roots level to facilitate catchment-related associations on natural resource use. We're also doing this as part of our antipoverty intervention, because a lot of poor people tend to find themselves in degraded areas. There is a cyclical effect of poor people on degraded areas and degraded areas on poor people—whichever way you look at it, it's bad, so we try to make that part of our antipoverty intervention.

NEWS & VIEWS: Agricultural biotechnology, and specifically genetically modified organisms, is very controversial in the industrial countries. How do you see this technology fitting into agriculture in Africa and South Africa?

In South Africa we tend to get a lot of the arguments that are presented in the North, presented here in an environment where people have not yet grappled with the totality of biotechnology. As a government we have legislation on genetically modified organisms, and what we're working on now is a balanced communications strategy and dialog on the totality of biotechnology—dealing with genetically modified foods as just one of the products of biotechnology. It's a much more constructive way of dealing with the debate. The benefits of biotechnology in improving precision in agricultural research are known to scientists, but the problem is, scientists are not very articulate in presenting those. The danger of a media-driven dialog on genetically modified foods is that it does not deal with the science behind the foods. You could say sweet potato, which has resistance to the mosaic virus because of work done in Kenya, is a genetically modified food, but all you've done with that modification is to introduce resistance into the plant rather than spraying it with some kind of chemical. Something that has been sprayed has been equally modified. We try to shy away from having a naïve discussion on genetically modified food, as if there's some kind of monster which is suddenly appearing out of the gloom. We recognize the benefits of good science in agriculture, in lowering inputs, but we also are not blind to the fact that there are probably risks associated with the introduction of genetically modified foods. To contain the risks, what we have in place is legislation to promote the responsible development and use of genetically modified organisms.

Should we depend on increased use of fertilizer and herbicides—the total package of traditional inputs—to increase yields, or should we be innovative and make the quantum leap into biotechnology?

NEWS & VIEWS: So GM crops could have a lot to offer African farmers.

I prefer to say biotechnology as a new package of technologies has a lot to offer Africa. And the range of ways in which we can apply biotechnology to African agriculture, from tissue cultures to gene markers, has so much value-added that by the time you get to GM foods, which I think are the craze of the northern countries, you've actually dealt with a lot of more basic issues. So when we talk about African agriculture, one needs to deal with biotechnology in its totality and not purely in the GM food dimension. The question we have to answer is, should we depend on increased use of fertilizer and herbicides—the total package of traditional inputs—to increase yields, or should we be innovative and make the quantum leap into biotechnology? We're grappling with these kinds of issues right now across the continent.

NEWS & VIEWS: What is the biggest challenge for African agriculture right now?

Looking holistically at the continent and the sector, I think probably our biggest challenge is to position the agriculture sector and negotiate that position in terms of global trends, because we cannot afford to be passive as a continent. We are a critical component of the global system of land, natural resource use, and food systems, but we need to establish and define a niche and negotiate for that niche. African agriculture needs to have an appropriate technology-transfer partnership with developed countries which facilitates economic growth by raising yields and incomes and at the same time satisfies food security at the household level, without compromising the sustainability of its biodiversity or the trade and new market opportunities that exist for its unique products. Linked to that of course is the economic and entrepreneurial character which African agriculture needs to take on and which has been latent in the past. There's a world of opportunity when you think of the combination of our rich biodiversity and new technologies. With the right minds thinking about things and coming together, I think it's a positive outlook. Our natural resources, in relation to the people we have to feed, have potential, but one needs to harness that capacity and negotiate that niche for the continent. ■

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women who gain greater access to economic opportunities and civil society; sustainable development through easier dissemination of appropriate information; more balanced social relations through the greater accountability imposed on the powerful by the marginalized; and other global goods. Hans d'Orville, director of the Information Technology for Development Programme at the United Nations Development Programme (UNDP), puts it this way: "Information technology has a place alongside adequate food, health care, education, and other fundamentals. By taking this place it has broadened our definition of poverty. Those people or countries who cannot or will not participate fully in the new information economy will find it all the more difficult to climb out of poverty."

The Digital Divide

The importance of ICTs is precisely why concern has escalated over the "digital divide"—the gap in information and communication technologies that exists between technologically advanced and developing countries, poor and rich, men and women, and urban and rural areas. Recent high-level international meetings, such as the Global Knowledge II conference this past March in Malaysia and the July G-8 summit in Japan, have pressed for solutions to the divide.

An array of numbers illustrates the vast gap that has to be bridged: Nua Internet Surveys estimates that about 333 million people worldwide were online as of June of this year, but as many as 72 percent of them resided in North American and Europe. Africa claimed only 2.8 million Internet subscribers, Asia/Pacific 75.5 million, Middle East 1.9 million, and South America 13.2 million. In 1998, according to the International Telecommunications Union (ITU), low-income countries had 6.2 personal computers and 45 fixed-line and mobile phones per 1,000 people, whereas high-income countries had 311 and 832, respectively.

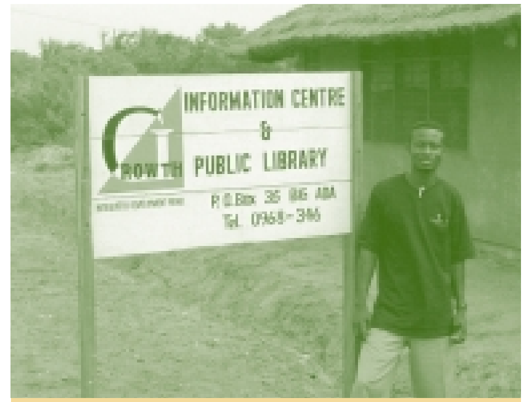
The digital divide is not only enormous—dwarfing even the per capita income gap ratio between high- and low-income countries—but it is increasing, according to a recent World Bank study. The authors of the study, Francisco Rodriguez and Ernest Wilson III, estimate that even East Asia, which is adopting ICTs at a rapid pace, will take another 40 years to catch up with the developed world. Inevitably, access varies widely among and within developing countries as well. Only 11 of 53 African countries for which there are data have 10,000 or more Internet users; 17 have less than 1,000. Gender, income, age, and other disparities also abound. In Ethiopia, for example, 98 percent of Internet users in 1998 were university graduates and 86 percent were male.

As the Internet becomes the norm for commerce and information exchange in the developed world, the poorer countries will have little choice but to try to bridge the digital divide in all its forms. They will go online to become competitive in the new economy or forgo significant growth. The stakes involve not only social development and productivity growth, but also the burgeoning e-commerce sector, which is expected to reach between US$2 and 3 trillion in transactions in the next three years.

Connecting the Poor

The last few years have witnessed a flurry of activity as the development community has put forward position papers and proposals and launched pilot projects to include the poor in the information revolution. Projects have ranged from providing price information to farmers to boosting microcredit-based sales via the web.

The hallmarks of this activity have been diversity and innovation in organization, technology, and funding. Results are trickling in, and no formula has emerged, though some ingredients appear to be critical. According to Roger Noll, professor of economics and director of the Public Policy Program at Stanford University,



A telecenter in rural Ghana set yp with the help of IICD to provide nontraditional exporters with price and other infromation

"Technological change has greatly affected the optimal strategy for starting ICT service. In many cases, fixed wireless is better for new networks because of its lower cost and quicker availability. And because economies of scale are not very important in wireless, competition is often feasible right from the start. Another common ingredient is that western-style universal service is not a practical reality in developing countries, where much of the population is too poor to afford individual access. The focus instead should be on convenient access through sharing, such as with telecenters and pay phones."

Meeting Community Needs with ICTs

This need to minimize cost but maximize rural access drives most ICT projects in developing countries. Not surprisingly, the Internet still often plays a lesser role than other technologies in the distribution of information in rural areas. Most farmers, for example, are years away from getting price information through the Internet because of cost and lack of human resources and adequate phone infrastructure in rural areas. But because a farmer's decisions about where, when, and how much to sell depend on the signals sent by national and international market prices, ICT proponents see the delivery of timely price information as one of the key benefits farmers receive from the new information technologies. Consequently a number of ICT projects focus on making it easier for agricultural producers to access prices.

"Price information helps connect farmers to markets," says Mike Weber, professor and codirector of a food security program run by the Department of Agricultural Economics at Michigan State University (MSU), "and the more up-to-date the price information, the better for the farmer and the market." Weber's own group uses both low- and high-tech means to distribute prices. For the past ten years, the food security project has delivered weekly agricultural prices by newspaper and fax to government offices, the private sector, and nongovernmental organizations (NGOs) in Mozambique. MediaFax, a fax-based newspaper, provides the same information each week to a wider audience. NGOs make copies of the weekly price lists and distribute the information to farmers.

"Our first line of defense for the farmer is the fax and newspaper because they are inexpensive, and we also use the radio where possible," says Weber, "but the Internet plays a role too for those who can afford it. Our department at MSU hosts a website that provides comprehensive links to global market information, including the weekly price lists for Mozambique, but more than 50 percent of the hits right now come from U.S. farmers, traders, and analysts."

The Internet need not remain elusive, of course, as MSSRF has shown. Veerampattinam, the village in India, is actually one of five now hooked to the Internet as part of MSSRF's village information project. One of the villages serves as the information hub, with full access to the Internet. The others have wireless access only to the hub, to which they send information and requests for information. The hub searches the web and electronically delivers the requested information to the other centers, along with standard information in an email newsletter. This hub-and-spoke model avoids the cost of providing full Internet access to all villages and also creates a network for information sharing across the villages. MSSRF and its granters fund the project, asking only that the villagers house and operate the technology.

Some projects are devised to pay for themselves while providing developing-country poor with access to ICTs for socioeconomic development. Such is the case with the projects facilitated by the International Institute for Communication and Development (IICD), which was established by the Dutch Ministry for Development Cooperation in 1997. In Jamaica, for example, IICD and its partners are helping to put in place a comprehensive agribusiness information system that will enable small farmers, who are losing ground in the global marketplace, to get both print- and web-based information about markets, products, registration requirements, and technical assistance.

"Price information helps connect farmers to markets, and the more up-to-date the price information, the better for the farmer and the market."

—Mike Weber

This demand-driven system makes information available through a continually updated database on domestic agricultural production and marketing and through the Internet. Extension agents collect the information from producers and traders using palm-top computers. The information is then downloaded to PCs located in primary extension offices. These PCs are linked to the central database at the headquarters of the Rural Agricultural Development Authority. The system is currently being tested with 80 small farmers and traders in two regions in Jamaica.

The method for delivering information is still evolving. Currently large farmers and traders with access to the Internet get the information easily. Smaller farmers and traders generally visit the extension offices, where they can obtain standardized and customized reports in hard copy. If literacy is a problem, extension officers help interpret documents. A small subscription fee makes the project sustainable, and small farmers can pool their resources and subscribe as a group.

The project will eventually extend throughout Jamaica and is expected to reach 50,000 direct users and 150,000 indirect users. Ingrid Hagen, IICD's manager of Private and Public Sector Partnerships, observes, "Access is giving these Jamaican farmers a chance to compete seriously with imports that are crowding them out of markets, even for the main domestic products. The technical, regulatory, and market demands increasingly in force due to globalization can be met only with the help of ICTs."

The belief that ICTs have a role to play in the lives of small farmers has led to their introduction in many rural areas. But most projects remain relatively small-scale and not widely replicated because of cost, the multitude of approaches and local needs, and lack of interest from the private sector.

These factors, and the fact that ICT introduction is still at an early stage in developing countries, make the impact of projects hard to judge. "Undoubtedly ICTs are very useful for the people who have an opportunity to use them, but there is also a lot of hype about what computers and the Internet can do for rural people," says Cynthia Hewitt de Alcántara, deputy director of the United Nations Research Institute for Social Development and coordinator of its program on Information Technologies and Social Development. "Some serious social science research is needed to understand the institutional context that can make these technologies really useful and sustainable in specific rural settings," she

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adds, "and it is not the Internet that is always most important. Older technologies too, such as community radio, are opening up societies and allowing people to talk to each other. The telephone, of course, remains vital to people's well-being."

Using Mobile Phones

Perhaps the best-known example of bringing telephones to the poor is Grameen Phone, the Grameen Bank's rapidly growing cellular phone business in Bangladesh. A little more than three years old, the venture has already put mobile phones in the hands of women in more than 1,200 Bangladeshi villages. At the same time, Grameen Phone has secured more than 50 percent of the national, primarily urban, mobile phone market in Bangladesh, thus helping to assure both its financial ability to serve rural areas and its technical ability to create a reliable urban network with which to link the rural population.

In the villages, Grameen Phone works on the same principle as the Grameen Bank's microloan program, giving rural women from landless households access to credit. A woman who has already established good credit with the Bank, whose house is located in a fairly central part of the village, and whose family has one member familiar with the English letters and numbers on a phone, can borrow the roughly $350 needed to purchase a solar-powered mobile phone. After a day's training, the woman is set to provide phone service to other villagers for a price. This access to technology not only generates substantial income for the "telephone woman," who on average earns $450 a year after expenses, but also provides villagers with access to information and services that would otherwise remain far outside their reach.

The villagers, for example, can contact medical help immediately; get prevailing market prices for the crops they grow, thus avoiding underpayment by opportunistic traders; engage in commercial activities that require quick or frequent access to timetables, regulations, or other market-related information; or easily keep in touch with family members living in the cities or abroad. The arrival of the cell phone has also, for once, turned the social pecking order on its head as the relatively wealthy rely on the poor to keep in touch with the outside world.

"Instant access to the Internet is exciting, but for a third to a half of humanity affordable access is still several years away. In the meantime, satellites can provide low-cost communication and information services to poor and remote areas."

—George Scharffenberger

"Money, the old saying goes, speaks loudest, but it is user-friendly technology that begets money in the first place," says Nuimuddin Chowdhury, an IFPRI consultant on ICTs. "The Grameen Phone project has shown once again that the rural poor are among the most eager to innovate, and they could significantly improve their income if given access to ICTs, which are, moreover, environmentally clean technologies."

Using Satellites

For developing countries, bridging the digital divide generally means bridging the gap between super-sophisticated technology on the one hand and local logistics and financial ability to pay on the other. Because satellites can bring ICTs to rural areas at a relatively low cost, some NGOs promote them to help fill the information and communication needs in developing countries. Volunteers in Technical Assistance (VITA), a U.S.-based NGO, for example, links its satellite with ground terminals that enable users to send and receive stored emails four to six times a day as the satellite passes overhead.

Kept in a community center or some other central location, each terminal is estimated to serve roughly 10,000 people via the email access it gives to schools, clinics, NGOs, business people, and individual users. VITA's planned services include continually updated web indexes designed to meet the information needs of remote communities and a research service to maximize the impact of the 50-page limit that can be downloaded each day by each terminal. Costs for these services and for supporting the system will be defrayed by a relatively small annual fee per terminal and by proposed private-sector use of a portion of VITA's satellite bandwidth in exchange for technological production and support.

Currently at the experimental stage, the project serves 25 terminals. VITA plans to deploy 2,500 terminals throughout the developing world. "Basically we're trying to push the envelope to give the poor access to a culture of information," says George Scharffenberger, president of VITA. "Instant access to the Internet is exciting, but for a third to a half of humanity affordable access is still several years away. In the meantime, satellites can provide low-cost communication and information services to poor and remote areas while building critical information skills among teachers, health workers, people in small businesses, women, and youth."

VITA's other partner in this venture, SATELLIFE, also runs a health information system, HealthNet, which works through a satellite-terminal system similar to VITA's and through modem-to-modem telephone links. One of Africa's first sources for email, HealthNet also provides electronic publications, access to the web, and discussion groups, including one on AIDS, to about 10,000 health professionals worldwide. Locally owned and operated, HealthNet has been helpful in dramatic cases, such as containment of an Ebola virus outbreak in Gabon, as well as in more routine health care. It has succeeded in those countries where an adequate institutional structure exists or can be built to support ICTs, where training of technical staff matches investments in technology, and where a successful business model has been implemented to offset operating expenses.

Once familiarity with a computer-based information culture has taken root and the medical benefits have become evident," says Rebecca Riccio, SATELLIFE's director of programs, "we've routinely seen health professionals further develop that culture and demand a wider array of ICT applications, not only from us but from others."

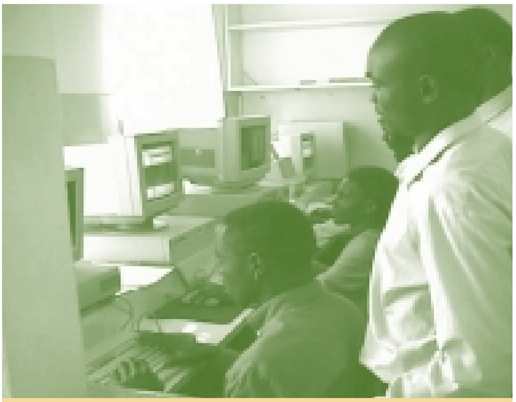
After training at SATELLIFE's Regional Information Technology Training Centre in Kenya, for example, one participant, a medical director of a charitable dispensary in Tanzania, became a telemedicine enthusiast, setting up a mailing list for his fellow trainees and seeking out how to transmit electrocardiograms and heart and lung sounds via the Internet to specialists for interpretation. "He also convinced management to provide two computers and set up an ICT training facility for his colleagues at the dispensary," says Eliazar Karan, project manager of HealthNet Kenya.

Improving Women's Access to ICTs

As ICTs begin to play a greater role in development, concerns are growing that women will be left out of the picture. Available data show that women account for 25 percent of ICT users in Brazil, 17 percent in South Africa, 7 percent in China, and 4 percent in Arab states. All the gender faultlines are present in ICT access, with poor, uneducated, and older women particularly affected.

To address these concerns, the United Nations Development Fund for Women (UNIFEM), ITU, and UNDP recently signed an agreement guaranteeing the inclusion of gender issues in their policy dialogue and decisionmaking about ICTs. Going further, Noeleen Heyzer, UNIFEM's executive director, has advocated that UN bodies that are developing programs to promote ICTs should consider allocating 50 percent of these program funds and program activities to women and girls until the digital divide closes.

"ICTs give us a new opportunity to build a confident, skilled, and participatory knowledge community that includes women," says Heyzer, "and failure to do this will only worsen the existing gender-related gaps. We should be striving for 'e-quality.' Women and girls must receive the training and preparation to become users and producers of ICT technologies and to understand and shape the regulations and policies associated with these technologies."



Health professionals can walk into SATELLIFE's HealthNet Kenya Information Bureau to obtain critical health information via the Internet.

Overcoming the Barriers to Universal Accrss

The success of some local-level projects says little yet about what should be the method and timetable for delivering universal access. Even the dilemma about whether to focus first on building a national infrastructure for instant access or on building ICTs around specific development problems remains unresolved.

Some developing countries, such as Malaysia, have made commitments to rapid and widespread ICT introduction. Others may move forward, at least in the near future, on two tracks: partnering with the private sector to install ICTs in urban areas and looking to donors, lowest-cost methods, and innovative schemes for subsidizing subscription fees to connect rural areas, with the two tracks sometimes overlapping.

"The countries that have been most successful in promoting ICT-based development," says Carlos Primo Braga, program manager at *info*Dev (the World Bank's Information for Development Program), "are those that have created a broad framework for fostering both competition and universal access. They've focused on expansion of the capacity to connect to ICTs, education to use that connectivity, appropriate content in the local language to make that connectivity useful, and competition to lower prices and increase market growth."

Perhaps the most neglected component of this framework is a well-developed legal system to facilitate effective regulatory policy. "Developing countries repeatedly treat this issue cavalierly," says Noll, "as if constructing an independent, effective, and efficient administrative system is something that can be set up casually over a long weekend."

As if these systemic hurdles were not enough, some governments are wary of the power of information and the political and economic uses it can be put to, or simply skeptical about its importance. They show reluctance to embrace the ICT revolution.

But the most pressing and universal barrier remains money. D'Orville estimates that a telecenter that serves 2,000–6,000 people costs roughly $60,000–80,000, a sum that includes provisions for training, content development, operations, maintenance, and management. Even so, the picture may not be so daunting because costs are decreasing and new technical devices are emerging. "Medium-developed countries already have high TV penetration, and devices to access the Internet are going to fall below the cost of TVs," says Josh Calder senior associate at Coates & Jarratt, Inc., a Washington, D.C.-based consulting firm that analyzes and forecasts ICT applications. "More people are

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years, and mobile phones already have extensive penetration even in quite poor countries. High-tech systems tend to go where they are demanded—note the ubiquitous presence of sonogram clinics in the poorest neighborhoods of India."

Expensive, potentially disruptive, and extraordinarily beneficial, ICTs are here to stay, and developing countries can ill afford to sit on the sidelines. As Richard Heeks, senior lecturer in information systems and development at the University of Manchester, puts it, "Information and communication technology is a runaway horse, and the choice for the world's poorer nations is stark: stand by and watch it carry the richer nations forward, or jump on and hope to steer it as best they can." ■

Reported by Uday Mohan

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2020 VISION

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