INTERNATIONAL FOOD
POLICY RESEARCH INSTITUTE

sustainable solutions for ending hunger and poverty

IFPRI

2020 VISION

AFRICA

Making Information and Communication Technologies Work for Food Security in Africa

Romeo Bertolini

Africa faces a difficult challenge in meeting the main target of the first Millennium Development Goal—to halve the number of people suffering from malnutrition and hunger by 2015. Bridging the digital divide through the development and use of information and communication technologies (ICTs)—such as fixed-line and mobile phones and Internet services—will not directly solve this challenge, but it can make a significant contribution.

2020 Africa Conference Brief 11

The Digital Divide

The digital divide is the gap between those with and those without

- access to ICTs,
- access to content that benefits them socially and economically,
- skills necessary to take advantage of ICT services, or
- ability to pay for ICT services.

Knowledge and information are important factors for accelerating agricultural development by increasing agricultural production and improving marketing and distribution. ICTs can enhance the integration and efficiency of agricultural systems by opening new communication pathways and reducing transaction costs, given greater accessibility of information on prices, transportation, and production technologies.

Several obstacles stand in the way of ICT use in developing countries. Most particularly, access to telephone and electricity networks is limited, and telecenters offering broader ICT services and training are scarce because of the disproportionately high investment and operating costs required. Shortcomings at the subnational level are where the digital divide becomes most obvious. Innovative ways of combining ICT-based information sources (such as agricultural information systems) with traditional ones (such as radio broadcasting) should be considered when looking at the costs and benefits of ICT development. Further, funding from donors, governments, and rural communities could be used to connect users who are otherwise overlooked by service providers on the basis of profitability.

ICTs IN AFRICA: A BRIEF ASSESSMENT

ICT sector reform has promoted large-scale investments in telecommunications infrastructure in African countries, in turn promoting the expansion and modernization of fixed networks. Telephone lines, for instance, grew by 9 percent per year from 1995 to 2001, and 100 percent of most networks have been digitized. Nevertheless, service availability is concentrated in the main cities (70 percent of service in Ghana and Uganda, for example, is in urban areas), and as a result the penetration rate in Sub-Saharan Africa is one main line per 100 inhabitants. This undersupply of fixed lines has led to an explosion of mobile networks, such that mobile phone subscribers now outnumber fixed-line subscribers in most African countries. Fueled by the introduction of prepaid services and the proliferation of mobile phone companies (given competition and deregulation), growth in mobile subscriber numbers over a two-year period during 2002–2004 ranged from 30 percent in Morocco, to nearly 50 percent in South Africa, to 125 percent in the severely underserved Kenyan market. Figure 1 further illustrates Africa-wide growth in mobile use compared with Internet and fixed-line use during 1998-2001.

In light of these positive developments, an industry of retailing services has emerged. Senegal's incumbent operator, for example, introduced a simple franchise system creating over 10,000 commercially run public phone bureaus that employ more than 15,000 people and generate more than 30 percent of the entire network's revenues. As another example, in markets where initial connection fees are high and rates are out of reach of most people, small entrepreneurs are reselling airtime at rates above those applied to subscribers.

In terms of Internet access, most infrastructure projects have focused on the countries' bandwidth availability. For example, a Southern Africa Development Community (SADC) initiative identified projects to connect countries to each other and to fiber optic sea cables. Similar activities aimed at improving connectivity on a countrywide basis exist in East and West Africa, often involving developed-country assistance. As a

result, data services have become increasingly available in urban areas, where they have been adopted by the educated elite. Because individual access is scarce, private cyber cafés and public call offices have become a regular feature of the modern African city. But donor-driven telecenter projects designed to serve areas with low population density and minimal private enterprise have almost entirely failed in terms of financial sustainability and acceptable service continuity.

So despite the investments and government-driven telecommunication development programs, the supply of phone or Internet services in rural and remote areas is still hampered by underinvestment and lack of electricity: approximately 60 percent of African households do not have access to their national grid.

OPPORTUNITIES FOR ICTs IN PROMOTING FOOD SECURITY

ICTs and Agricultural Production

The telephone is the only ICT used (if any) by the majority of farmers in Africa. Empirical research in rural Ghana shows that the proportion of households using public community call offices—where available—is around 60 percent, and average household telephone expenditure is over 5 percent of monthly household income. The same research indicates that, in terms of agricultural production, prices of inputs such as seeds, fertilizers, and pesticides are the most frequently telecommunicated information.

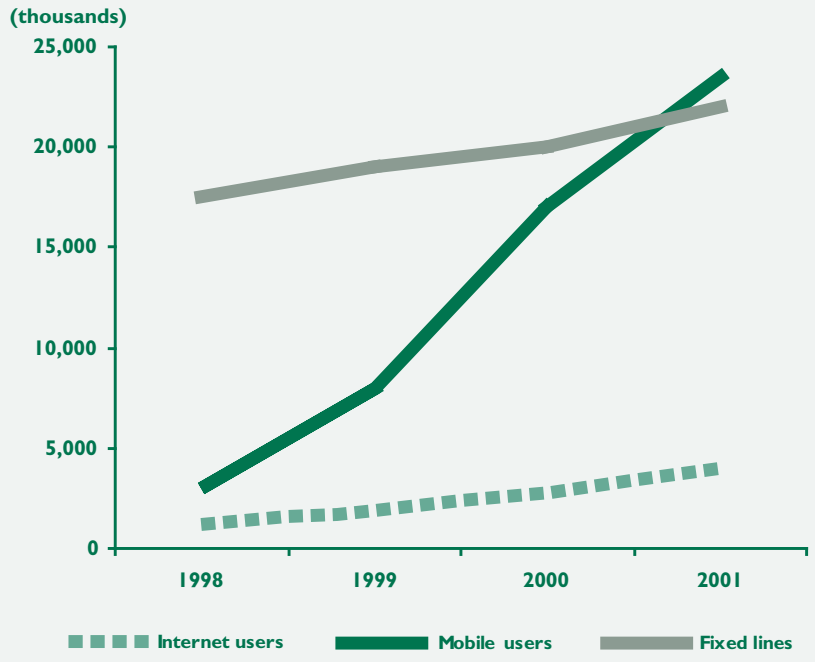
Beyond that, more sophisticated ICTs could make the greatest contribution by shortening the distance and reducing the cost of interactions between stakeholders. National and international policymakers and organizations dealing with rural development and agriculture require, generate, and provide information relevant to agricultural production. ICTs enable the exchange of information about innovations in crop varieties, pest control, manuring, weather forecasting, irrigation, and efficient monitoring methods. To take advantage of these opportunities, the African farmer relies not only on good government decisions but also on intermediate agencies such as nongovernmental organizations (NGOs), extension services, and producer associations, which are more likely to have the necessary capacity and access to nationally and globally available information. To be more effective, these agencies need to shift from purely disseminating information to assessing and brokering relevant information.

Capacity building is another area of opportunity. ICTs, for example, have enabled the World Bank to initiate its Global Distance Learning Network with 50 learning centers around the globe, and the Commonwealth of Learning (COL), the Consultative Group on International Agricultural Research, and the Food and Agriculture Organization of the United Nations (FAO) have also promoted distance learning and ICT applications within their training programs.

Other ICT applications relevant to resource-sensitive agriculture involve satellite-based systems. On the important issue of land property rights, for instance, administrative bodies increasingly use Geographic Information Systems (GIS) and database applications for efficient land surveys and registration. Having a registered asset both encourages farmers to undertake sustainable land management and enables them to borrow funds against the asset (to invest in production means, for example).

Moreover, geospatial and information tracking technologies are becoming inexpensive tools for monitoring environmental

FIGURE 1 Growth in ICT Use in Africa, 1998–2001



Source: Compiled by author using data from Pyramid Research, "Pyramid Africa Mobile Benchmarks Report: A Pyramid Mobile Benchmark Analysis," 2003 (<www.pyramidresearch.com>, accessed 2003) and International Telecommunications Union, "ITU Telecommunication Development Indicators 1998-2002," 2003 (<www.itu.int>, accessed 2003).

Environmental Monitoring in Namibia

In Namibia, ICTs are used to monitor water, pollution, desertification, climate, and population parameters, ensuring the availability of relevant information in planning, decisionmaking, and coordination processes.

Data gathered are published for both public consumption and the attention of decisionmakers in a series of State of the Environment reports, from which indicators of sustainable use and development can be identified and appropriate action for improved farming systems derived.

management. Best-practice databases can indicate new ways for intermediate organizations to encourage rural smallholders to use environmentally sustainable farming methods.

ICTs and Nutrition

The most important ICT applications for addressing malnutrition relate to educating personnel and enabling efficient networking. The FAO's Food and Nutrition division, for instance, provides online training materials on many nutrition-related topics. Relatedly, given that health- and nutrition-related information is usually disseminated to the general public via mass media, ICTs have the capacity to enhance the accuracy and timeliness of information flowing to journalists. Projects supported by the German government are currently exploring the impact of links between radio stations and ICTs on the quantity and quality of the information transmitted in Mali.

Monitoring nutrition status—including reacting to large-scale threats—is a particular area of assessment and analysis that depends on ICTs. Food insecurity and vulnerability information and mapping systems (FIVIMS) are increasingly implemented to assemble, analyze, and disseminate information on who the food insecure and malnourished are, where they are located, and why they are at risk.

ICTs and the Marketing and Distribution of Agricultural Produce

The links between food security, markets, and ICTs are obvious when it comes to integrating farmers into regional, national, and international trade systems. ICTs improve the ability to search for information and increase the quantity and quality of information available, ultimately reducing uncertainty and enhancing market participation. Answers to questions such as, "How do buyers and sellers find each other, and what prices can be achieved?" and "Is it better to store the produce or sell it immediately?" open opportunities, support the functioning of markets—and hence the availability of food—and increase income. Positive externalities affect all aspects of development, ranging from better education opportunities to lower fertility rates to increased productivity—eventually feeding back to food security.

On that basis, it is not surprising that most efforts to make ICTs available to rural farmers have sought to improve the availability and quality of information either indirectly through producer associations, extension workers, and the like, or directly through broadcast radio information, telecenters, and mobile phone messaging (SMS). Small farmers only rarely initiate using ICTs to market products beyond local and regional markets. Instead, globally active organizations aim to mobilize smallholders to join a program and market their produce. Such programs use ICTs for overall coordination and to transfer knowledge, arrange transportation, and exchange market information. ICTs also benefit transport systems at various levels, from a one-vehicle truck business using a telephone to locate a destination or secure a return load, to larger businesses with sophisticated radio systems to locate and identify vehicles automatically and transmit posting instructions from a central control location.

Overall cost reductions and efficiency increases will eventually have an impact on the emergence of food markets and the distribution of food. ICTs will even be able to compensate—in part—for deteriorating transport infrastructure (not that the role of accessible rural

InfoPrix Benin: Market Prices via SMS

Surveyors of the food security office in Benin (ONASA) are monitoring 64 rural markets on the prices of the 25 most important staple foods. After business hours, prices are supplied to an Internet café where the data are processed and sent to ONASA headquarters. After a quality check, subscribers receive an SMS message with the prices of important products from the six most important markets. Other information can be requested via SMS, and information is also forwarded to radio stations to be communicated in local languages.

Horticulture Marketing in Kenya

In Kenya, Fintrac incorporates 35,000 horticultural smallholders into a global supply chain through technical interventions in the field. Fintrac, a for-profit organization, provides market analysis, linkages with commercial buyers, and knowledge transfer; without the help of ICTs to initiate and maintain the program, this market-oriented business model would not work.

roads is questioned, since they are one of the most important preconditions for market development and food distribution).

Where agricultural products are distributed unequally, shortages occur; and where transportation systems are inadequate to bring sufficient food into the deficit region, or where people are unable to afford the costs of the food imported for their needs, food shortages develop into famine. It is widely agreed that the availability of appropriate information is an effective means of averting famine. Information on the variability of food production, for example, is needed to plan and accumulate food stocks. Further, the difficulties of moving food into isolated regions can be overcome if limited transportation facilities are used more efficiently, and the costs of food imports will be lower if there is sufficient time to purchase food on regional or world markets and to arrange for inexpensive shipment to the affected areas. Finally, government action can be better coordinated to respond to shortages. Again, ICT-based systems such as the Famine Early Warning System (FEWS) and the Global Information and Early Warning System (GIEWS) for food and agriculture are means of leveraging action to avoid disasters such as famines.

Where famines occur, ICTs can assist humanitarian aid organizations. Logistic support, timely information, and immediate feedback from the concerned region enhance the focus and effectiveness of aid. Timely food distribution and ICT-enhanced coordination helped World Vision and its partners, for example, to avoid a catastrophe in parts of Southern Africa in the food crises of 2003. Coordination could still be improved, however, to save critical resources, avoid redundant measures, and target priority problems effectively. The HumaniNet consortium has been founded to address these communication shortcomings. The consortium is investigating and testing affordable, integrated ICT solutions that enable the coordination of planning and operations, and facilitate information sharing among agencies.

THE STEPS AHEAD

Policymakers and members of agricultural extension systems need to be aware of how appropriate ICT-based instruments can help to influence agricultural practice and assist in the fight against malnutrition. Increased knowledge of food production systems through learning applications and access to best-practice data will enable international expertise to trickle down to local levels. Where the regional and local representatives of organizations are not involved in such processes, effects will be reduced. Decisionmakers should therefore free resources to build capacity for technologies to integrate regional and local intermediate organizations because they are *the* crucial link between ICT programs and the rural population.

For food distribution and marketing, the role of information is essential. Empirical research suggests that ICTs have a positive impact on farm-household incomes. It is also important to remember that food shortages are not exclusively a distribution problem. ICTs can, however, lower the hurdle for markets to emerge and improve the effectiveness of early warning systems and relief activities.

To raise awareness of the importance of ICTs, further research is needed to identify more precisely their prospective benefits as public goods, specifically their ability to generate network externalities. Negative outcomes should also be considered to avert the unnecessary repetition of mistakes, and—importantly—innovative private-sector and donor involvement will be needed to generate funding for socioeconomically desirable yet financially unsustainable initiatives.

Positive and negative lessons from past experience underline the importance of ICT-related capacity building and suggest the need to maximize the power of the market with a minimum of external resources. Nevertheless, the public and the private sectors and civil society need to cooperate in order to set the rules of ICT development and integration. To facilitate such collaboration, governments should provide

- a sound, market-oriented regulatory framework;
- universal access regulations and mechanisms that motivate operators to serve regions where it is economically infeasible but socially desirable for them to do so;
- incentives such as a sound business and taxation environment to encourage investor and donor involvement in ICT infrastructure development in Africa;
- the preconditions for inter-African collaboration through, for example, the introduction of common

standards, cross-border trade liberalization, ICT-based monitoring, forecast programs, and so on;

- support to research institutions and other nonprofit participants who help to safeguard the demand-driven implementation of ICT tools that assess and transmit commodity prices, thereby allowing markets to emerge;
- support for ICT use to increase the efficiency of knowledge systems for agricultural production, and support for intermediate organizations in terms of transferring knowledge from global or national to local levels, which in most countries will begin with the integration of agricultural extension services into knowledge systems; and
- leadership in combining existing media channels, such as rural radio stations, with ICTs to match potential local demand with global content and distribute the gained information widely in the relevant languages.

The private sector's role should be to consult governments constructively and take advantage of their pro-ICT policies. Organizational as well as technological options exist to reduce access costs and eventually support the increase of available information. In terms of retail services, for instance, the private sector should (a) be aware of the socioeconomic dimension of activities related to the ICT sector; (b) take advantage of the lessons learned from franchise systems that have been successful business models in many developing countries, including Senegal, Gambia, and Bangladesh; and (c) aim toward the stepwise extension of phone shops to more sophisticated telecenters using knowledge transfer, capital availability, and, if need be, ICT infrastructure support schemes, such as universal access funds compensating for potential losses. In terms of technological options, the private sector should also develop low-cost access technologies that work off-grid and require a minimum of maintenance, thus making them more profitable; fixed wireless technologies and solar power panels have proven effective in this regard. Eventually, civil society's main activities should be to ensure that ICT-related activities are developed for those parts of society that require particular care: the poor, the malnourished, the isolated, and those suffering from discrimination. By improving the efficiency and impact of NGOs, the availability of new information flows and network opportunities can improve livelihoods in Africa.

Addressing such issues can help to promote the spread of ICT availability and open opportunities for farmers that they would not otherwise have. There is a general consensus that missing such opportunities will be costly and increase the digital divide where it is most apparent, at the subnational level between the urban elite and rural smallholders.

For further reading: R. Bertolini, "Telecommunication Services in Sub-Saharan Africa: An Analysis of Access and Use in the Southern Volta Region in Ghana," *Development Economics and Policy* 26 (2002); J. A. Daly, "Information and Communications Technology and the Eradication of Hunger," <http://www.developmentgateway.org/download/212039/hunger.pdf> accessed 2003; AED and Winrock International, "Future Directions in Agriculture and Information and Communication Technologies (ICTs) at USAID," background paper (Washington, D.C., 2003).

Internet resources:
http://info.worldbank.org/ict
www.aptsec.org
www.fintrac.com
www.fivims.net
www.germany-at-wsis.info/english/exhibitors/kfw_georgien.htm
www.humaninet.org
www.ifpri.cgiar.org/2020/focus/focus07/focus07_06.htm
www.runetwork.de

Romeo Bertolini (Romeo.Bertolini@detecon.com) is a consultant with DETECON International (www.detecon.com), working in the area of regulation of telecommunication and ICT markets, as well as telecommunication and ICT provision in rural and remote areas.

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE
2033 K Street, NW
Washington, DC 20006-1002 USA
Telephone: +1-202-862-5600
Fax: +1-202-467-4439
Email: ifpri@cgiar.org

www.ifpri.org

www.ifpri.org/2020africaconference

This brief was prepared for the conference on "Assuring Food and Nutrition Security in Africa by 2020: Prioritizing Actions, Strengthening Actors, and Facilitating Partnerships," held in Kampala, Uganda, April 1-3, 2004 <www.ifpri.org/2020africaconference>. The conference was organized by the 2020 Vision Initiative of the International Food Policy Research Institute, hosted by The Government of Uganda, and cosponsored by: European Commission (EC) • Centre de coopération internationale en recherche agronomique pour le développement (CIRAD) • Centre Technique de Coopération Agricole et Rurale (CTA) • Deutsche Welthungerhilfe (German Agro Action) • Development Cooperation Ireland • Federal Ministry of Economic Co-operation and Development, Germany, with Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), and Internationale Weiterbildung und Entwicklung (InWEnt) • Ministère des Affaires étrangères, France • Regional Land Management Unit (RELMA) • The Rockefeller Foundation • Sasakawa Africa Association • United States Agency for International Development (USAID) • World Food Programme (WFP) • World Vision International

Photo credits:
Cover photo © 2004 Panos Pictures/Jacob Silberberg