Telecommunications & *Agriculture*

Telecom Australia

PROVIDING FOOD for all is one of the major global preoccupations as humanity heads into the 21st century. This section of *Telecommunications in Action* looks at how those responsible for managing agriculture and the production of food in the developing world can use telecom applications to help deal with the problems facing them. To produce adequate food for ever-increasing numbers of mouths will demand the adoption and appreciation of new production methods, sustainable for the foreseeable future, by all those who work in agriculture and agricultural planning. Unfortunately, many current practices used in farming have harmful direct and secondary effects, such as desertification, soil erosion and groundwater pollution, which threaten future survival. In order to avoid and reverse these trends and protect the environment for future generations, farmers will have to abandon some of their old ways and learn new techniques. Information and communication technologies are proposed as essential tools to disseminate the knowledge and information needed by workers in agriculture to improve the production processes. Telecommunications also provide vital tools for planners and administrators in the agriculture and food sectors.

THE TOTAL QUANTITY OF FOOD produced today is adequate to provide each person on the planet with more than the United Nations minimum daily survival level of 2,200 calories, and yet 20 per cent of the population in developing countries is chronically undernourished and millions of people are suffering and dying of starvation. While there are productivity gains in many places, they are evidently not happening where they are most needed. If logistics, costs and politics were no barrier, the distribution imbalance, which keeps food out of the mouths of starving populations, would be solved. Unfortunately, it is far from being that simple. What are needed are sustainable food production processes in each developing country that would provide, as far as possible, all that country's food needs on a continuing basis. What is possible, logically, depends on the conditions for successful agriculture being met – and even when these are met, it may be impossible due to other, non-logical conditions, such as political instability or armed conflicts.

Food production soared following what was called the "green revolution"

CORPORATE VIEW

Low-cost connections

AN INNOVATIVE, low-cost telephony system is bringing telephone services to rural and often remote areas of Indonesia, areas which are in great need of modern communication links with the rest of the country.

The Xpress connection system, introduced by Linkabit Wireless, is based on VSAT (very small aperture terminal) technology, and uses the company's allocated frequencies on the Papal C2 satellite. It allows Linkabit Wireless rapidly to deploy satellite-based telephone services to areas not served by the public switched telephone network. In fact, about half of the 70,000 or so villages in Indonesia have no access to a telephone service.

At the start of 1998, 1,600 terminals had been installed, mainly in public call offices.

The company plans to focus on public call offices, but it may also market the terminals to private and public businesses and to other organizations, for low-cost private use dedicated to data communications. Most of the terminals operate on a revenue-sharing basis between Linkabit Wireless, the local telecommunication supplier and the regional telecommunication company.

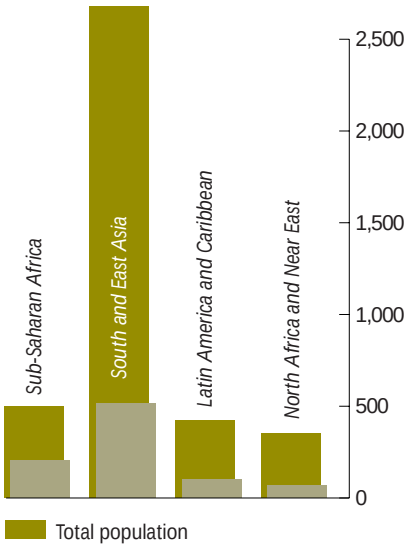
Linkabit Wireless's main customers are PT Telekommunikasi Indonesia (Telkom), Indonesia's state operator, and five companies that provide basic telephone services in the country. Telkom and the other companies are subject to universal service obligations, requiring them to expand telecommunication coverage to rural areas and villages not served by the present telecommunication network. They see the Linkabit terminals as a cost-effective solution to meeting these obligations. Agreement has been reached with Telkom so that traffic from Linkabit terminals placed directly by the company is treated as Telkom traffic for connection to the public switched telephone network.

The terminals are 1.2 metres in diameter, which is smaller than the more usual VSAT, because the frequency used is generally subject to less interference from other satellites. Linkabit Wireless has established a network control station in Jakarta and will install nine gateway sites to handle the calls.

It is true that the fixed telecommunication network is expanding, but because of the terrain and the number of islands that make up Indonesia, there will be a continuing demand for Linkabit wireless terminals for many years ahead.

Linkabit Wireless
E-mail: fjudge@titan.com
Website: http://www.titan.com
For further information see Annex B

ESTIMATE OF CHRONICALLY UNDERNOURISHED IN DEVELOPING REGIONS *(millions)*



"Chronically undernourished" is defined as those whose estimated annual energy intake falls below that required to maintain body weight and support light activity

Source: *Dimensions of Need,* FAO, Rome, 1995

of the 1960s. But the new varieties of plants introduced were discovered to work well only under specific conditions (irrigation, heavy fertilizer and pesticide use) while the new chemicals were found to have negative effects on soils, leaving toxic residues in the ground, in water and in people. Now a second green revolution is in preparation, but with the resolve that it will bring sustainable gains in productivity and help alleviate the food shortages that plague so many developing countries. The approach this time is to rely much less on unadapted plants and excessive use of chemicals and instead to breed (either by careful selection and hybridization or by genetic engineering) plants with built-in resistance to climatic conditions, diseases and pests. One other important factor which was largely neglected in the first green revolution was the need to involve the farmer in the process. As the person who is at the end of the line, the farmer must be able to apply the results of research, frequently carried out far from where he is, and follow any special instructions in planting, cultivating or harvesting.

The Food and Agriculture Organization of the United Nations (FAO) is the principal agency providing aid and advice in agricultural matters to the developing world. Fifty years' experience of dealing with people, from the individual farmer up to heads of state, has provided FAO with a number of proven instruments which continue to facilitate dialogue and provide a viable interface that is indispensable in working with agricultural planners and workers toward sustainable development. FAO makes use of telecommunication applications to further its goals, and some of these are discussed below.

The International Telecommunication Union (ITU) deals with international telecommunication matters on behalf of the United Nations. In the ITU, the Telecommunication Development Sector (the Bureau de Développement de Télécommunications, BDT) deals with telecommunications for development and is active through fieldworkers, seminars, conferences and study groups in finding ways to apply information and communication technology solutions to development problems. It has encouraged the use of multi-purpose community telecentres in developing countries as a rational, low-cost means of service delivery to areas where no telecommunication infrastructure exists (see the section of *Telecommunications in Action* dealing with rural development).

WHAT TELECOMS CAN DO

The power of information and communication technologies can be harnessed for the tremendous task facing agricultural planners and workers worldwide, assisting planners to understand the whole picture and to work in new ways for sustainable ends, and educating and training the millions of agricultural workers, who are frequently remote from any educational (or other) infrastructure.

GIS – aiding planners and decision makers

The power of the computer, added to satellite imaging, has made possible the ultimate tools for overall land-use planning: geographic information systems (GIS). GIS is a powerful information tool at the disposal of decision makers. The term GIS is applied to computerized information storage, processing and retrieval systems which have hardware and software specifically designed to

cope with geographically referenced spatial data and corresponding information. The spatial data is commonly in the form of "layers", which may depict topography, water availability, soil types, forests and grasslands, climate, geology, population, land ownership, administrative boundaries or infrastructure (highways, railways, electricity and communication systems).

One of the primary sources of geographic data used in GIS is information about the Earth that is obtained through remote sensing. Remote-sensing data are usually acquired either as digital satellite imagery or aerial photographs. After these images are geometrically corrected, enhanced, analysed and interpreted, the results can be fed into the GIS and integrated with other geographic databases. Its capability of combining different map layers – in an operation known as "overlaying" – is one of the most important GIS functions. For example, in an early application of GIS, Landsat digital satellite images, meteorological, agronomic, economic and field validation data were combined to help government planners in the Po Valley, Italy, develop more accurate crop production estimates for five major crops.[1] GIS applications in agriculture are discussed below.

Helping the farmer communicate

The farmer, by the nature of his occupation, must spend much of his time on site in a rural and often remote setting. In an industrialized country he can communicate electronically with the wider world. Telecommunication infrastructures are available, over which various services are provided. The scenario that follows is still largely confined to the industrialized world, but it does give an indication of the future possibilities worldwide. At the simplest level, a telephone permits the farmer to discuss a problem or activity with a neighbour or to be in touch with family members who do not live on the farm. When he is in his tractor in the fields, he may use a mobile radio telephone (of various possible types, and available on varying tariffs, but costing around US$150 to purchase), which is capable of any telephone-type service. From his home or from his tractor he can use a modem to connect a personal computer over the fixed or mobile telephone network to access distant databases, markets, weather services or any Internet service, for the cost of a local telephone call in most western countries. For example, he may contact a database in a research station to get the latest information on fertilizer formulae and quantities for the new strain of wheat he is about to plant. Market price and supply information could permit him to call a meat processor and sell cattle that are ready for slaughter. Consultation of weather information may reveal the probability of a hailstorm and make him delay his planting for 24 hours.[2]

John Constable

A mobile radio telephone can help the farmer communicate from a rural or remote setting, even from his tractor.

Research and knowledge dissemination

Production increases in agriculture are, in the vast majority of cases, the result of much hard work and research. This research is carried out by agricultural experts and specialists who study local food crops, soil conditions, rainfall and irrigation, and pests and diseases. Much of their work is performed in laboratories, but they also spend considerable time in the field, conducting their

studies, working with farmers and reporting their findings. In remote areas, their work is frequently complicated by lack of communications requiring more frequent travel, reporting delays and lack of contacts with colleagues doing similar tasks in another area. Telecom applications, from simple telephony and e-mail to accessing databases on the Internet could play a useful role here.

The normal follow-up to the research is spreading the knowledge to farmers through extension workers or specialized non-governmental organizations who can train farmers in the new techniques or tell them about new seed varieties. (Extension workers is a general term applied to specialists or technicians with knowledge of the domain involved and of the local situation and conditions, and whose job it is to help the indigenous workers to apply technical procedures, use new equipment, work with new seed stock or plants, etc. The extension workers are frequently part of the field staff of national government departments, international organizations or non-governmental organizations.)

CORPORATE VIEW

Keeping in touch

INFORMATION and communication technologies are shrinking the world at a staggeringly fast rate, making it increasingly possible for people even in some of the most remote places on the planet to communicate with each other in a matter of minutes, sometimes only seconds. The opportunities, especially for the developing regions, are enormous. Yet ensuring reliable connections between locations, particularly scattered ones, remains a major challenge.

Iridium is now pushing this universal communication revolution into a significant new phase.

In November 1998 the company launched the first-ever global satellite telephone and pager network, an innovative satellite-based telecommunication system that will provide global wireless telephone access between virtually any two places on Earth.

The network is built around 66 satellites orbiting at a height of 781 kilometres, together with a terrestrial cellular system. This combination allows users to reach one another at any time, and practically anywhere. Calls are routed either through land-based telephone systems, when users are in an area covered by one of Iridium's premium local telephone service providers, or via the global Iridium satellite network, when users are outside these areas.

Users need only a palm-sized multi-mode or satellite-only telephone, a pager and a single telephone number to be connected. They can receive alphanumeric messages up to 200 characters in size, in a choice of 19 languages, as well as numeric messages up to 20 digits. The messages can be received from a variety of sources including operator dispatch centres, touch-tone telephones, e-mail and the World Wide Web.

Iridium's technologies will particularly benefit international travelling professionals who are constantly on the move and who need to remain in touch. But the new network will also bring considerable advantages to domestic users in areas which suffer from overburdened and/or incomplete cellular coverage, or limited telecommunication facilities.

This will make it especially attractive to developing countries, particularly more remote areas, where there is a pressing need for efficient communications to foster development, but where the usual land-based systems are inadequate owing to lack of investment or the difficulties of providing infrastructure and solutions that can guarantee reliable, first-class links. The Iridium network opens up the possibility of providing areas like these with public call box or payphone services, as well as small telecentres where local people would be able to make national and international telephone calls, send and receive both faxes and e-mails, and access the Internet.

Iridium
E-mail: john_windolph@iridium.com
Website: http://www.iridium.com
For further information see Annex B

In some regions research has already helped augment food production but in sub-Saharan Africa, where conditions are particularly difficult, the hoped-for production increases have not happened. Better working conditions for specialists and extension workers in the field through the use of information and communication technologies could accelerate this improvement. See, for example, the case study on the electronic rural information system in Chile, which enabled extension workers, facilitators and field-workers to receive training and tools for better communication and identification of farmers' needs.

The Internet and agriculture

The Internet provides a low-cost communication tool, one which is becoming progressively more accessible in developing countries. As the supporting infrastructure spreads throughout rural areas, so use of the Internet will become more important. In North America and Europe, all major agricultural

CORPORATE VIEW Partnerships

UNDER-INVESTMENT in telecommunication infrastructure over many years left Romania, like several of its neighbours, with only basic terrestrial networks, outdated equipment and virtually no digital network. In order that Romania could build its economy, it had to be able to compete effectively in the world's capital markets. To do this, an efficient, reliable communication network needed to be in place as soon as possible.

Logic Telecom, a local telecommunication company first quoted on the Romanian stock market in 1994, quickly realized the potential for revolutionizing telecommunication systems in the country. Its initial strategy was to expand its own Internet access data network, LOGICnet, to increase coverage and at the same time provide broader access to its data services. During the first year of the expansion programme, Logic installed and commissioned 39 new data communication nodes, bringing nationwide coverage for the first time.

Later agreements with Scientific, Atlanta, Ski Relay and Skylinx gave Logic access to satellite transmissions. This enabled data to be delivered across Romania quickly and efficiently. The next step was the installation of an Earth station in Bucharest, with the appropriate management system and control computers. Two distinct satellite communication networks were established, one dealing only with data and the other with voice, data and video applications. Customers are able to connect to the service by using VSATs (very small aperture terminals) either fixed to the building or set up on the ground.

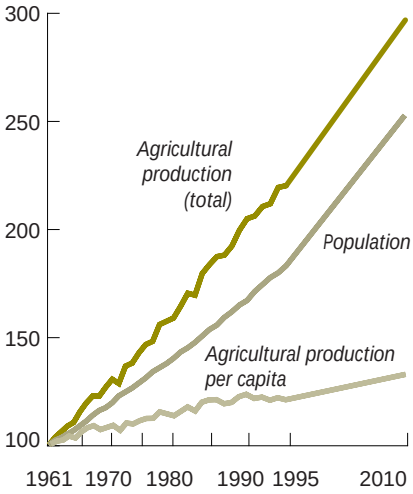
To ensure global efficiency, Logic formed new international partnerships, signing an agreement in 1995 with British Telecom (BT). As a result of this agreement Logic was able to install and maintain a data switch in Bucharest, in addition to supplying technical and installation support to data customers.

Through this relationship Logic was able to transfer BT's technology to Romania, while BT entered a new market with the help of an experienced local data network supplier. Both companies' data networks were interconnected as the result of a follow-up agreement, and a subsequent distributor agreement has empowered Logic to sell these services in Romania. Logic now has an international network connection and has established an important carrier-to-carrier relationship with BT. Future collaboration will result in the installation and maintenance of a BT frame-relay node for transmitting bursts of high-speed data.

Having previously been restricted to the data market, Logic is currently developing its business in the digital television and video conferencing markets. As liberalization takes hold in Romania, Logic is poised to expand into the voice market.

Logic Telecom
E-mail: tstanescu@logicnet.ro
Website: http://www.logicnet.ro
For further information see Annex B

GROWTH OF WORLD FOOD PRODUCTION, POPULATION AND PER CAPITA FOOD PRODUCTION
(index 1961=100)



Source: *Food for All*, FAO, Rome, 1996

research centres and teaching institutions are connected to the Web and provide access to their electronically stored databases; such connections would be of great benefit in developing countries. The growth of Internet usage provides opportunities to obtain information, communicate with specialists, deliver first-line support and promote new techniques or activities. For instance, a number of broadcasters are taking advantage of agricultural information available on the Internet and passing it on to their audiences (e.g. the Farm Radio Network). Radio broadcasters were restricted until recently by the inadequate audio quality of information from an Internet (telephony) circuit and had to obtain material on audio cassettes by mail. Special audio compression techniques now allow downloading of script material of acceptable quality directly from the Internet.

In Latin America, information is downloaded from the Internet onto an FAO-sponsored electronic information network. A farmer association in the state of Sonora, Mexico, reported that by using market price information circulated by e-mail through the network it was able to sell its cotton crop for US$82 per quintal as opposed to US$72, which was the price local buyers were trying to impose. Knowing the future prices for cereals and oilseeds also enabled the association to better plan the quantities of crops to plant.[3] Organizations are starting to use the Internet but, for the moment, equipment costs, access fees and training costs put it financially out of reach for most individuals. In Zimbabwe, for example, Internet access costs around US$5 a month, plus the cost of the calls, while the average monthly wage of those working in the agricultural and related sector is just US$1.75.[4] One way to help overcome this is to share the costs in a community telecentre, which makes access more affordable for more people (full details on this approach are given in the section of *Telecommunications in Action* dealing with rural development).

TELECOM APPLICATIONS

Tele-education and agriculture

The greatest telecommunication needs of farmers and others in agriculture in the coming years will be for provision of basic education, specific training in agricultural techniques and much-needed instructions for agricultural applications. The education requirements in agriculture vary at each level. Farmers in remote rural areas need to improve and broaden their knowledge. Basic literacy and numeracy may be the first step. They then need information about improved livestock, plant and cereal varieties, different methods for planting, cultivating, harvesting and storage, new techniques such as management of soil, water and pests, and finally how to work in a way that protects the land for future generations. And if they wish to be commercially successful they must be ready to plant new cash crops, learn about markets and acquire the basics of accounting and management.

All this will not happen overnight, especially as the majority of these farmers may be illiterate to start with, and much of the success will rest with extension workers. The extension workers require specialist training with regular updating (at technical college level) and follow-up on research findings and new discoveries. For much of the knowledge they will pass on to farmers, the extension workers will depend on field research workers, who should work in

G. Diana/FAO

Specially trained extension workers pass on knowledge about new varieties and techniques to farmers.

practical domains based on identified regional or local needs, maintaining dialogue with the farmers. The research workers will require periodic updating (at university level) and must be aware of, and follow, basic research through constant contact with university and scientific institutional researchers.

There has to be a steady flow of students from secondary level through the specialized higher-learning levels in order to make this transfer of knowledge possible, and practical problems arise in finding candidates to feed this cycle. Traditionally the farming population comes from rural youth but, even for those who get some schooling, 90 per cent do not get beyond a primary education level. Urban-dwelling students do enrol in agriculture, but they frequently lack basic knowledge of rural and farm conditions. Moreover, the curricula and teaching methods are frequently not adapted to the need for trained manpower in agriculture, especially in the private sector. Finally, there is too often an intellectual gap which separates university staff from the real world of practical agriculture and this gap must be bridged as part of the adaptation process for higher-level education.

While the situation with regard to producing agricultural professionals, as described, is discouraging and a great deal remains to be done, at a practical level the use of information and communication technologies can rapidly open educational opportunities at every level of agricultural expertise. It can range from simply using existing rural radio broadcasting for educational purposes to the provision of full Internet connectivity with teleconferencing techniques for course delivery. With telecommunication facilities, farmers can act collectively, organize community networks and establish specialized services (messaging, market information, weather forecasts) for their own use. With their knowledge of local conditions, farmer communities should play a major part in directing and correcting field research efforts. (See also the section of *Telecommunications in Action* on education.)

Farm radio networks

For many farmers, perhaps too distant from urban centres to receive television broadcasts, radio has for long been a major information source. Weather news is of particular importance to those involved in agriculture, and market information can be crucial to market gardeners dealing with perishable crops or to farmers deciding when to slaughter livestock. As a low-cost, broad-coverage communication medium, radio broadcasting is popular and widespread in developing countries and represents an appropriate communication technology to address questions such as sustainable agriculture, food security, poverty and environmental protection. So far, most of the more practical instruction in agriculture has been through the low-tech medium of radio because, as discussed above, many rural areas of the developing world still await telephone networks that will enable the delivery of more sophisticated services, and because rural literacy rates are often low. To exploit its full potential, listener participation is (or should be) a feature of farm radio; it could, for example, permit preliminary discussion of proposals to bring more powerful and versatile information and communication technologies into a region.

CASE STUDY

Sharing farm knowledge by radio

OBJECTIVE

■ To help people learn about simple, proven ways to increase food supplies, and to improve nutrition and health, with radio as the primary means for the exchange of information.

BACKGROUND Following a visit to Zambia in 1975, Canadian farm broadcast veteran George Atkins decided to try to help broadcasters and farmers in developing countries by encouraging networking among local broadcasters. The idea came about after hearing local radios which were providing high-tech farming information that was inappropriate and not adapted to their farmer audience's needs. Atkins was convinced that low-tech information, which could help these farmers, was probably to be found with other farmers in the region but was not recorded or able to be shared.

The first network took shape and, in 1979, 34 stations in 26 countries were broadcasting the same basic script material, assembled through consultations among Canadian farm experts and local farmers. Among the topics covered by the Developing Countries Farm Radio Network are: how to grow better crops; soil, fertilizer and soil conservation; water and water conservation; pest control; storage; fish and fish ponds; livestock and poultry; women farmers; health and nutrition; urban agriculture; and the natural environment.

DESCRIPTION The Network aims to find simple, low-cost techniques that any farm family can use to increase food supplies and improve nutrition and health. It distributes information on these techniques to farm broadcasters, writers, agricultural advisers, teachers, missionaries, health workers and other rural communicators. Packages containing 12 radio scripts are sent out quarterly. Illustrations are included to help interpretation and to broaden the uses of the material. Packages are produced in English, French and Spanish, and participants translate the scripts into 237 dialects and languages. Material comes from farmers, while participants with practical experience send descriptions, drawings, photographs and articles. The Network also checks published material from around the world. Scripts are reviewed by an international panel of experts in developing world agriculture and health. Some recent programme titles include: "Save soil on sloping fields", "When is an insect a pest?" and "Guatemalan farmer tests repellent plant to control grain moth".

INFORMATION EXCHANGED MUST:

■ be aimed at increasing food supplies and improving nutrition and health;
■ be simple, safe and practical;
■ be ecologically sound and environmentally sustainable;
■ have been proved to be useful in the developing world;
■ require only resources ordinarily available to small-scale farmers;
■ require little or no technical help to implement;
■ meet the needs of both women and men;
■ be able to be communicated clearly by radio.

The farmers are regularly consulted by field staff on their needs and on the relevance and usefulness of materials broadcast. Where a telephone service is available, farmers can call in with comments during or after broadcasts.

COSTS Packages are distributed free of charge. Participants must tell the Network how the materials are used and how they can be improved: that is their only obligation. The Network is supported by contributions from thousands of individuals and companies in Canada and by the Canadian International Development Agency and the International Development Research Centre.

For general guidance on the costs of setting up and running instructional radio programmes see the section of *Telecommunications in Action* dealing with education.

RESULTS The Developing Countries Farm Radio Network now works with more than 1,500 broadcasters in 121 countries and estimates that its scripts reach more than 500 million people. The radio networking idea has become popular and regional networks have developed, such as the Farm Information Network of Eastern and Southern Africa in Zimbabwe which works in partnership with the original Network.

As an example of how the Network helps ideas spread, a woman fieldworker in Cameroon, trying to combat lack of vital nutritional variety in the diets of poor families, encouraged housewives to grow vegetables in a "kitchen garden". She was able to provide low-cost solutions to problems of limited land, water and time, and the kitchen garden idea became a big success. This experience was translated into scripts which were used in other parts of the Network, and was most notably taken up by a group of women in Mpumalanga Province in South Africa. The women of that region were able to duplicate the success of the Cameroon experiment and improve the nutrition and health of numerous families in their community.

CONTACT

The Developing Countries Farm Radio Network
366 Adelaide Street West, Suite 706
Toronto, Ontario M5V 1R9
Canada
Tel: +1 416 971 6333
Fax: +1 416 971 5299
E-mail: dcfrn@web.net

Radio Bobo, a local radio station in Burkina Faso, broadcast a series of weekly programmes to support an FAO initiative aimed at boosting rice production. The programmes ranged from game shows to raise awareness about the initiative to open discussion of problems faced by farmers. Information flowed both ways, increasing the effectiveness of the initiative. For example, the radio discussion made it clear that lack of threshing machines made it difficult for farmers to process and sell their rice. To overcome this, the farmers' cooperatives organized group savings and approached private-sector suppliers for loans.[5]

Beyond broadcasting

Where it exists and where it has been used as a basic information tool to help farmers, radio broadcasting has served a useful purpose. Efforts to improve farmers' educational level and provide technical training and information on new techniques for farmers, however, require more powerful tools and these

CORPORATE VIEW Universal access

MILLIONS of people worldwide have little or no choice about what they can hear on the radio every day: their local stations offer only limited news coverage and a restricted number of other programmes. At the same time, it is usually difficult for them to pick up international stations on their current receivers.

However, the new WorldSpace system will give up to 80 per cent of the world's population the opportunity to listen to a far wider range of programmes by providing them with access to some of the best in world broadcasting.

When fully operational, the system will use three powerful satellites to beam numerous digital sound channels directly to portable receivers below. Listeners will be able to tune in quickly and easily to a host of WorldSpace network radio stations. The network will broadcast around-the-clock news from leading international companies, in addition to news from local companies, and it will feature top events together with religious, educational and instructional programmes.

The WorldSpace system will feature cutting-edge technologies such as solar-powered satellites and state-of-the-art digital receivers which will have touch-button functions, fit into the palm of a hand, and be able to receive short-wave, AM and FM broadcasts, as well as WorldSpace satellite programming, thus widening listeners' choice to an even greater extent.

The new network will make it possible for local radio stations to reach an audience several thousand kilometres away, while international broadcasters will be able to tap into new audiences in areas that have been largely inaccessible to them in the past.

Already, the Kenya Broadcasting Corporation, the Ghana Broadcasting Corporation and Radio Sud have joined the network for broadcasting to Africa.

The possibilities will be enormous. No longer will listeners in many parts of the world have to settle for low-powered local stations with poor reception, or battle through lots of static to try to find a distant station on short wave.

Instead, someone living in a remote mountain region, for example in India, will be able to hear the latest world news from an international channel then, a few hours later, tune into a local radio station. And that "local" radio station could be in a town over 3,000 kilometres away.

WorldSpace
E-mail: ereich@worldspace.com
Website: http://www.worldspace.com
For further information see Annex B

are currently being developed. Field trials are under way in developing countries on the use of multi-purpose community telecentres, where sufficient telecommunication circuits are provided to serve the needs of whole communities for services ranging from basic telephony through fax to

CASE STUDY Better access to information

OBJECTIVE

■ To establish information networks for agricultural producers and farmer associations in Chile by applying computer technology in a participatory manner.

BACKGROUND The project began with an assessment of the local knowledge and information needs of farmers and their associations. This indicated that farmers wanted better access to information, while the extension services, local leaders and institutions needed better data to organize and manage agricultural development activities.

DESCRIPTION The networks provide essential data on crops, inputs, prices, markets, weather conditions, social services, credit facilities, etc. Messages are generated, processed and transmitted through low-cost computers via the Internet and delivered to farmers' organizations and other centres.

The project provided the electronic network designs, some equipment, logistical support, coordination and technical backstopping. Training in how to use electronic information technology for rural development, and in particular how to analyse and disseminate information that is locally relevant, was provided to local extension and farm organization personnel. Servers were established and small information centres, equipped with computers, modems and printers, were created within the offices of farmer organizations and non-governmental organizations.

The information centres distribute the messages to individual farmers and associations according to local conditions and the facilities available. For example, faxes and/or printed materials are used if access to the Internet is not available.[6] The messages are sent in a form that can be understood by the farmers.

COSTS The total cost to establish the rural information system in Chile was US$21,500 (equipment US$12,000, installation US$3,500, and training of national staff US$6,000).

The cost to establish an information centre in a farmer organization was US$4,500 (equipment US$3,000, and training of local personnel US$1,500). Annual operational costs were US$13,000 including personnel (two technicians), telephone and connection to the server.

RESULTS By 1996 the national agricultural extension service in Chile (INDAP) had established an electronic rural information system which connected farmer organizations, rural municipalities, non-governmental organizations and local government extension agencies to Web information services. Five local information centres had been established.

It was estimated that transmitting price and market information this way cost 40 per cent less than using traditional methods. In addition, the information was more timely, reaching the farmers much faster. In the past, the publication and distribution of a printed bulletin took 45 days.[7]

After six months on-line, the Web homepage of the electronic information system had been accessed more than 7,500 times. Much of the information available through the Chilean network was also useful to other Spanish-speaking Internet users: in a one-month period, there were over 1,000 hits from Latin Americans outside Chile, and a further 1,000 hits from Internet users elsewhere.[8]

The subsistence farmers and their families benefited from participating in the training and information activities. Vegetable producers reported that the information on meteorological conditions forwarded to them by e-mail informed them of climatic conditions faced by competitors in other states and countries and enabled them to plan markets for their products.[9] Extension workers, facilitators and fieldworkers had received training and had established ways of communicating with the farmers. They also had more knowledge and experience to provide farmers with quality technical information and training. Communication systems, methodologies and tools to disseminate information and transfer knowledge and skills on a wide scale were in place, and national and local institutions established by the project were generating income, thus guaranteeing sustainability of the communication activities.[10]

CONTACT

FAO Communication for Development Group
Food and Agriculture Organization of the United Nations
Viale delle Terme di Caracalla
00100 Rome, Italy
E-mail: SD-Dimensions@fao.org

sophisticated teleconference installations which permit consultation and distance learning to take place. Where access to the Internet is already available in urban centres, it can be extended to the telecentres as long as they are also equipped with computers.

Agricultural extension workers need to organize familiarization and training for the farmers in the community and could serve as animators/tutors for courses provided from a distance. Obviously, before a community telecentre can operate, telecommunication facilities must be brought into the community. This indispensable first step and the process of establishing such centres is discussed in the section of *Telecommunications in Action* dealing with rural development.

Telecoms at work in knowledge transfer

Information and communication technologies may be able to succeed where traditional educational systems have not, in transferring knowledge to the

CORPORATE VIEW Telecentres

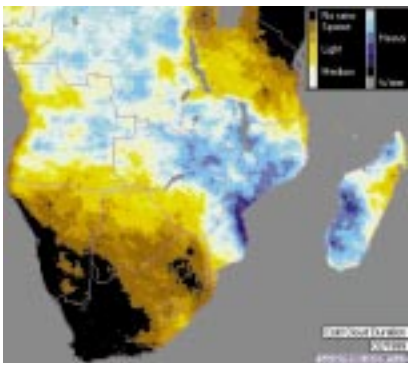
IN AFRICA, insufficient telecommunication infrastructure in urban and rural areas alike is hampering economic growth and regional development. Developing countries, although very aware of the importance of efficient and reliable communication systems to enable them to participate and compete effectively in the global market place, often find it difficult to raise the necessary finance to fund extensive infrastructure programmes. New technology, in the form of VSATs (very small aperture terminals), will help to bring cost-effective communication systems to large numbers of people for the first time.

Developments in satellite technology have meant that increasingly larger land masses have been opened up to receive electronic communication services. VSATs are able to access satellite communications without the support of expensive infrastructure. Terrestrial telecommunication infrastructure is costly and impractical to install across large areas, whereas a satellite has the ability to cover enormous tracts of land and can be installed in a comparatively short space of time. Remote areas are now able to connect to information and communication technology systems via the satellite, providing communities with a range of services for the first time.

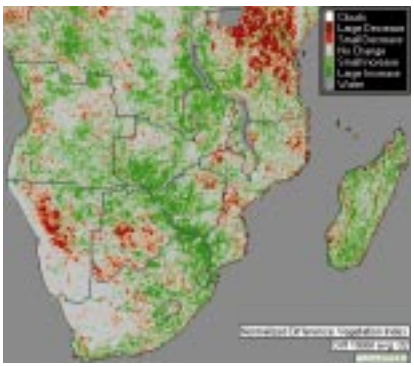
Wireless Business Solutions (WBS), an initiative of Vula Investments, is the first black-owned and operated South African telecommunication company to be awarded an operating licence. WBS has initiated the development of telecentres in rural communities where telecommunication facilities are only just beginning to have a positive impact on the lives of the people living there. By providing appropriate electronic equipment and services to remote communities at an affordable price, WBS will provide all the tools demanded by modern business practice. E-mail, the Internet, stock market information, commodity prices and an international news service will be offered by these telecentres, creating new opportunities for the development of regional and local businesses, schools, hospitals, clinics and other health care facilities.

Telemedicine, operating through the WBS telecentres, will be of enormous benefit to rural areas where specialist diagnosis is often not available and basic medical care is rudimentary. In this way advice can be obtained instantly on-line from health professionals at a distance. The technology can also be used as an interactive educational tool, ensuring improved information flows and therefore better health for the community as a whole. By introducing as many people as possible to the benefits of modern communication services, WBS telecentres will play a key role in community development.

Wireless Business Solutions
E-mail: vulacomm@global.co.za
For further information see Annex B



FAO/GIEWS



FAO/GIEWS

FAO uses satellite data (rainfall, top; vegetation, below) to help forecast crop and food prospects.

vast numbers of agricultural workers who are often scattered in remote rural regions. They need to learn new techniques and acquire new knowledge, which is presented in their own language and uses terms with which they are familiar. Encouraging the farmers themselves to contribute their own ideas for improvement, increasingly recognized as an important part of achieving sustainable agriculture, can also be incorporated.

As part of an FAO project in Latin America, communication technologies were used to share knowledge and skills with small subsistence farmers, integrating their own knowledge and experience with modern scientific information. A video-based system ensured an interactive approach that works even with semi-literate populations. Audio-visual training packages were produced on key issues and technologies that were identified by the farmers and technicians. A World Bank study carried out in Bolivia indicated that the costs for audio-visual training activities were one-third to one-fifth of the costs of traditional extension activities.[11] The total cost of producing a complete audio-visual training package was estimated at US$25,000, including the costs of international experts and training local personnel to use the package with farmers. If the package is used to train 1,000 farmers, the cost of the course per farmer is US$25, but the unit cost drops proportionately with more users: for 10,000 farmers, the cost per farmer is US$2.50.

During the project, 153,309 small farmers participated in the information and communication training activities. New rural communication institutions were developed and are now generating income by producing communication materials and training fieldworkers to use them. The training system was subsequently applied in a number of Latin American countries as well as in China, India, Indonesia, Mali and the Republic of Korea.[12]

Bold educational initiatives, where telecommunication technology is the driving force in spreading knowledge by providing university-level courses, can have an impact on a whole region. Agricultural planners and managers can benefit from the courses directly, and there will be a filter-down effect to workers in the field. For example, the Virtual University of the Monterey Institute of Technology in Mexico is a consortium of collaborating universities, including 13 which are outside the country. It delivers courses in a number of subjects including ecology and sustainable development, through printed texts and live and pre-recorded television broadcasts. Students and teaching staff communicate via computers and the Internet.[13]

Satellite solutions

Satellites can now reach all the Earth's lands and seas and are used by FAO for a number of monitoring tasks applicable to agriculture. High-resolution satellites permit thematic mapping of land cover or erosion, and FAO has already collated this information for some 100 countries. In Africa, lower-resolution satellites such as weather satellites can provide rainfall and vegetation information which, when treated using a system called ARTEMIS (African Real Time Environmental Monitoring and Imaging System), allows FAO to forecast crop yields, drought possibilities and probable plagues of locusts and other pests, as well as identify likely needs for food aid.[14]

FAO's Global Information and Early Warning System is one of the primary users of ARTEMIS data to monitor crop and food prospects in order to detect

CASE STUDY Drought prediction by satellite

OBJECTIVE

■ To improve drought prediction in southern Africa, and mitigate losses in an area where past drought years have seen 20-40 per cent declines in crop yield (depending on the severity of the drought), representing a loss of around US$1 billion.

BACKGROUND The Clark Labs is a non-profit research organization within the Graduate School of Geography at Clark University in the United States. Activities undertaken by the Labs include:

■ research in the development and application of GIS and related technologies;

■ training and educational materials development;

■ the development, distribution and support of the GIS and image processing software, Idrisi, and the vector digitizing and editing software, CartaLinx.

DESCRIPTION Clark Labs has been following climatic developments in southern Africa for a number of years to try to improve techniques for predicting the periodic droughts that affect the area. Through historic comparison of events, there was evidence to believe that the El Niño phenomenon, which occurs in the Pacific Ocean, was responsible for the droughts. Clark Labs maintained a monitoring watch on the region and, in July 1997, researchers noticed anomalies in satellite observations of vegetation biomass. By December 1997, researchers were persuaded that there would be a drought in the region in the first few months of 1998 and reported their findings to a conference in Windhoek, Namibia (the Southern Africa Regional Climate Outlook Forum, December 1997).

Their predictions were disseminated via the Web to provide immediate information to a wide range of concerned users (organizations in early warning, FAO, USAID, governments and farmers) at no cost to them, apart from Internet access. The website attracted funding from the Department for International Development in the United Kingdom, which contracted Clark Labs to provide training to the Botswana Meteorological Department staff and Ministry of Agriculture personnel. Additionally, the company conducted a one-day seminar open to all ministries and agencies concerned with national drought preparedness and food security in Botswana.

COSTS Dr. Assaf Anyamba of the prediction project estimated costs to be c.US$200,000-250,000 for the period July 1997 to April/May 1998. Salaries accounted for c.US$100,000 (75 per cent of one person's time and 25 per cent of two others). The cost of materials, computer time, software, Web design, etc., accounted for a further c.US$100,000, and travel expenses for c.US$50,000. These figures reflect what a research unit in a non-profit university would conservatively charge.

RESULTS The project enabled Clark Labs not only to predict a drought but also what type it would be (there are two types which begin and spread differently). This was one which begins in northern Namibia/southern Angola and develops progressively during the months of January to April through Botswana, northern Zimbabwe, southern Zambia, northwest Mozambique and southern Malawi. Continued analysis of satellite observations during 1998 has correlated well with field observations and validated this method for future drought prediction.[15]

These results are highly important for this region where more than 150 million people live and where, apart from in South Africa which is not directly affected, three-quarters of them derive their livelihood from agriculture. When farmers are forewarned, they are able to take measures, such as planting drought-resistant crops, in order to cut their losses and avoid, at least in part, external food aid.

As an indication of the impact of the predictions, e-mail requests for further information were received from: the director general of the South Africa National Cereals /Grain Marketing Board; commercial farmers in Kenya, South Africa and Zimbabwe; a farming bank investor from South Africa; the Namibia Meteorological Department and Department of Wildlife Service; the Environment Advisor to USAID, and many others.

Clark Labs is now in the process of linking satellite-based data on vegetation with El Niño data to examine outbreaks of Rift Valley Fever in East Africa. There are critical links to health and the ability to forecast likely new outbreaks of climate-driven disease has important implications. The information will be made available on the Web later in 1999.

CONTACT

Clark Labs, Clark University
950 Main Street
Worcester, MA, USA
Tel: +1 508 793 7526
Fax: +1 508 793 8842
E-mail: idrisi@clarku.edu

Dr. Assaf Anyamba
Tel: +1 301 286 4585
Fax: +1 301 286 1775
E-mail: assaf@cerrado.gsfc.nasa.gov

emerging food shortages and assess possible emergency food requirements. Every day analysts study a mass of indicators that affect food supply. Satellite images and weather station data show how the growing season is progressing in large areas of the developing world. Socio-economic indicators are also monitored. In an emergency, aid donors and humanitarian organizations are alerted by fax or telex. The System issued warnings of developing drought in southern Africa in 1994-1995 some three or four months in advance of the harvest, enabling critical planning decisions to be made.[16]

As a further example, a small but very active FAO group, using satellite imaging and field reports, is responsible for monitoring desert locusts and other migratory pests, and coordinating national, regional and international action. The message below is typical of the sort of warning it provides to countries and organizations in the affected regions:

"Madagascar Locust Update. African Migratory Locust. During the first two-thirds of September 1998, adult populations persisted and were reported to

CORPORATE VIEW Scientific and technical information

IN GUATEMALA, government departments, universities and companies, as well as private individuals, are enjoying the benefits of private networks, connecting users to the Internet and to each other, for video conferencing and exchange of computer files.

The MAYANet uses a satellite connection provided by Interlink Communications, and users – among them scientists, researchers, professors and their students – can exchange information, talk to each other through teleconferencing facilities, access scientific and technical information databases and libraries and link to supercomputers throughout the world.

The network was set up by the Consejo Nacional de Ciencia y Tecnología (CONCYT), an organization that was created to promote the scientific and technological development of the country. Among other things, it coordinates the activities of the Sistema Nacional de Ciencia y Tecnología (National Science and Technology System), which is composed of people from the public and private sectors and the academic world, and is dedicated to scientific research and development.

Initially, MAYANet users accessed the Internet through a service provided by the local telephone company using shared facilities, but this resulted in very uneven and unacceptable performance. By installing a satellite station connected via the Solidaridad 2 satellite to Interlink's international teleport in Mountain View, California, users now have all the benefits of a permanent fixed communication channel dedicated to them alone.

Funding for the satellite Earth station equipment was provided by the Organization of American States, and ongoing financial support for the network, including the teleport services, is provided by the universities and other users. Three government ministries – public affairs, economy and education – use the system, together with the Guatemala Congress, and the Santo Tomás de Castilla National Sea Port Company, which handles all Guatemalan imports and exports. The universities of San Carlos, Rafael Landívar, Mariano Gálvez del Valle and Francisco Marroquín also use the network. Altogether, there are 4,500 MAYANet users currently accessing the Internet, and the network's capacity will be expanded threefold during 1999.

Interlink Communications delivers a wide range of satellite data broadcast services, as well as disaster recovery services, back-up for banking information, the placement of remote Earth stations in otherwise inaccessible locations (e.g. mining sites), and video conferencing, telemedicine and distance learning facilities.

Its international teleport has four large transmit/receive antennas, which link to three satellites to provide coverage throughout North, Central and South America. The company provides Internet access via satellite to other universities in Central America, including Universidad Latina in Costa Rica and the University of the West Indies.

Interlink Communications
E-mail: rhardy@interlinkcom.net
Website: http://www.interlinkcom.net
For further information see Annex B

be forming groups and swarms while others remained scattered. Swarms were seen flying over Antananarivo several times at mid-month. Adults continued to mature but at differing rates. There were unconfirmed reports of hoppers in a few places. Good rains during the second third should ensure favourable conditions for breeding. During the period, 18,095 hectares (53 swarms) were treated by the two helicopters and about 5,000 hectares by other aircraft."[17]

Geographic information systems for agriculture and food production

The ultimate use of GIS lies in its capability for modelling: constructing models of the real world from digital databases, and using these models to simulate the effect of a specific process over time for a given scenario. Modelling is a powerful tool for analysing trends and identifying factors that affect them, or for displaying the possible consequences of planning decisions or projects that affect resource use and management.

CORPORATE VIEW Value-added services

RURAL TELEPHONY has been on the agenda of governments and international organizations for years, but the problem has been cost. Everyone wants a line, but the price tag in areas far from centres of population has simply been too high – until today. In 1998 the governments of two countries, Ethiopia and Kazakhstan, opted for a VSAT (very small aperture terminal) solution to expand their telecommunication services cover. VSATs are small satellite antennas which allow for an easy-to-install data, voice and video infrastructure for a network of users.

Ethiopia is meeting the challenge to provide a flexible network with a combination of terminals – smaller, low-cost ones offering rural populations two to three telephone lines, and larger, more robust terminals to expand telephone services in semi-urban and urban areas.

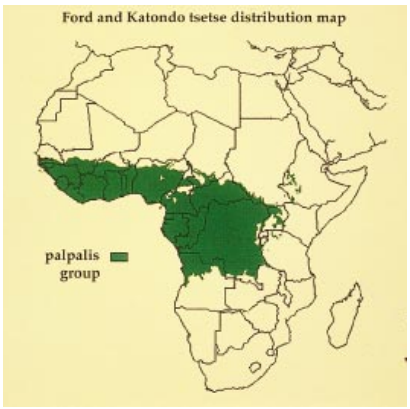
Just outside Addis Ababa lies the Sululta Earth station with its 13-metre antenna. The Ethiopian Telecommunications Corporation (ETC) has installed a control centre there to operate its 500-site VSAT network throughout the country. The network is powered by one transponder of INTELSAT's satellite over the Indian Ocean, which provides a service to more than 50,000 telephone subscribers, in addition to broadcasts for Ethiopian television. The network is made up of 220 sites with two channels of voice and fax, and 280 sites with eight to 16 channels. In the smaller ones, the terminals will provide one to three lines in a village where there was no telephone before. Usually, it will be a payphone or several payphones in a local shop whose owner collects cash fees for providing the service.

The larger sites have been commissioned to replace or extend the existing telephone network. Villages with about 1,000 people, who shared one or two unreliable lines, will be provided with between three and 16 new and highly reliable lines via their VSAT terminal. Telephones are placed in shops, public facilities and some private homes. In larger towns, the ETC has bought brand new digital switches, and the VSAT will allow them to link up over 250 subscribers. These larger sites will also receive direct transmission of Ethiopia's national television, recently upgraded to a digital system. The television signal is received by remote VSAT antennas and retransmitted locally. Ethiopia has about ten calling regions and each area will have its own VSAT point of entry to the public switched network. Solar panels provide cheap and environmentally friendly sources of power.

In the future, the ETC can provide distance learning opportunities, Internet access and other advanced data services using the same basic VSAT network.

Gilat Satellite Networks
E-mail: anina@gilat.com
Website: http://www.gilat.com
For further information see Annex B

- At the continental level, for example, terrain maps can be combined with hydrologic maps and climatological data to produce maps that show the suitability of land for various types or intensities of use, or for specific crops. Demographic and administrative data can be added to provide projections of future supply-and-demand scenarios by region or country. Data on livestock distribution and incidence of pests can be combined to work out the best use of land. For example, FAO produces electronic maps of Africa to show where cattle can be safely kept and where they might require protection from pests. One such resource, overlaying current cattle distribution on areas infested with tsetse fly, suggests that around 10 per cent of the subcontinent's cattle are being kept within the tsetse-infested area.[18]
- At the national and local level, possible GIS applications are almost endless. For example, to decide on the best potential sites for growing a certain cash crop, agricultural planners might use geographic databases combining soils, topography and rainfall to determine the size and location of biologically suitable areas, and then overlay this with land ownership and transport infrastructure, labour availability and distance to market centres. They could then change the characteristics of various attributes over time to determine the probable impacts of changing circumstances, such as the effects of a drought, the rise or fall of domestic or world prices, or the development of additional roads.
- FAO has developed a software package, Ecocrop, based on GIS and satellite sensing, to help identify suitable crops for a specific environment. The user enters data about the local climate and soil conditions, and Ecocrop identifies plant species with key climate and soil requirements that match.[19]
- In Senegal, GIS was used to clarify options for increasing production of rain-fed cereals. Existing data on natural resources, climate, demography, political subdivisions, infrastructure, agricultural production and nutrition were entered for analysis and it was concluded that Senegal could significantly increase its production of rain-fed cereals, without extensive costs in terms of natural resources, by applying improved technologies and by expanding cultivation. As a result it was decided to use the new technologies and to expand production within zones of reliable rainfall, with the aim of feeding twice as many mouths as formerly.[20]
- Applications of GIS to fisheries can take many forms. For capture fisheries, GIS can deal with the spatial aspects of the three main fishery "realms" – the environment, the fishery resources and the fisheries – both individually and collectively. GIS, using information from a variety of sources, including passive and active remote sensing, can predict where the fish will be, can be used for management, control and surveillance (e.g. to monitor fishing) and can optimize fishing operations such as trade-offs between distance to fishing grounds and markets.
- In aquaculture, GIS has been used to forecast development prospects using suites of parameters that vary geographically. Basically, this kind of application reduces to two broad questions: what is the suitability of any given area for the culture system (e.g. soil suitability for the construction of fish ponds); and what is the suitability of an area for fish growth (e.g. favourable temperature



FAO

FAO

R. Faidutti/FAO

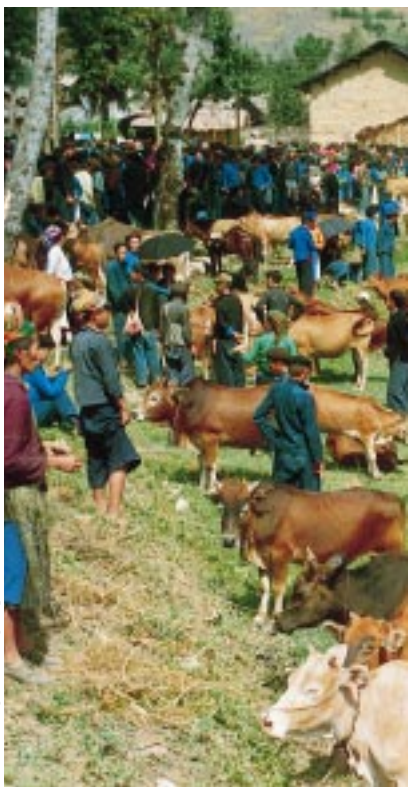
GIS is used to identify areas at high risk from tsetse fly, which are then targeted in cattle vaccination programmes.

regime)? Another GIS application is for the management of expanding aquaculture in the context of competing uses of land and water.

- A GIS was developed by FAO to map infestation and distribution of the golden apple snail across Viet Nam. The snail had become a pest in most of the rice production areas in Asia. This was used initially to help plan ways of controlling the pest. Rice-fish farming, where fish are raised in the paddy fields to eat the snails, has been found to be one of the best methods of control. The GIS is now being used to evaluate both the spread of the snails and the impact of control measures.[21]

In summary, what GIS provides is a means of converting spatial data into digital form that can then be displayed, manipulated, modified and analysed and reproduced quickly in a new format, available for either visual display or hard copy reproduction. Conventional (paper) maps, in contrast, are time consuming to prepare manually, and the display and analysis of changed data or the comparison of more than one set of map data (soil and vegetation, for example) requires additional manual labour. The digital data can also be easily transmitted from one user to another or from one GIS to another on disk, tape or via the Internet. As digital maps come into wider use, the cost of digitizing can be shared by many users. In fact, some digitized maps on CD-ROMs cost less than the same maps on paper. As networks and libraries of databases grow, information exchange should reduce the need for redigitizing regional or national maps and other geographic databases that are in common use.

Helping farmers find markets



UNEP/Nong Tu Tuong/Topham

It is important to improve knowledge and information to help farmers sell what they produce.

While the production side of agriculture is important, it is also indispensable to improve knowledge and information on the market side. In developing countries, however, such information is not always obtainable and may not always be reliable, so there is increased risk of poor market performance and failures. On a broader front, special knowledge of international markets is also required to support exports. Since markets themselves do nothing to solve these problems, government or public intervention is needed to collect, process and present the information, establish or adopt standards and create the conditions and framework to let markets work and be viable. This is an area where telecoms can play an important role. The case study on the marketing information service in Indonesia provides one example. The approach is one that could usefully be replicated elsewhere. However, many characteristics of the Indonesian vegetable production and marketing system are unusual, not least the year-round production and the concentrated production areas. Consequently, the type of service required in this environment may not be entirely similar to the type required in other countries. Given the considerable costs involved, the decision, in any particular case, to establish a market information system should only be taken after thorough studies have demonstrated its feasibility. In northern Mexico, a technical information and communication unit was established following a 1993 FAO study showing that farmers needed marketing information to be able to compete with United States and Canadian producers. The unit unloads information from various sources and databases, including weather forecasts, market opportunities and

CASE STUDY

Negotiating a fair price

OBJECTIVES

■ To assist farmers in negotiating fair prices for their produce by broadcasting market prices on a daily basis.
■ To assist traders and wholesalers in the setting of fair prices.

BACKGROUND Between 1978 and 1985 an original Indonesian price monitoring service was gradually replaced by a modern market information service that today provides a highly appreciated service to Indonesian farmers. It covers vegetables and a number of secondary food crops such as maize, soybean and cassava. A particular feature of vegetable production in Indonesia is that it takes place all year round. With good soils and appropriate climates, farmers are able to get three crops a year from the same land. This has important implications for the type of service required.

Detailed research into the operation of the horticultural production and marketing systems was conducted in order to develop a full understanding of how they functioned. Extensive discussions were held with farmers and other potential users of the market information in order to ascertain their requirements. As a result of this research a service was developed which placed emphasis on prices at farm, or wholesale market, level.

DESCRIPTION Price data are collected at production level at 17 locations for vegetables and at six locations for secondary food crops, and at 17 wholesale markets for vegetables and eight for secondary food crops. Prices are collected daily between Monday and Friday and are relayed by telephone, fax or radio to provincial headquarters. From there they are sent to the local radio station the same day for broadcast in the evening. A provincial price broadcast may have information on prices in several production pockets together with information on local and Jakarta wholesale market prices.

Provincial offices, in turn, relay prices to the central marketing information unit in the Ministry of Agriculture in Jakarta. Selected prices from production pockets and wholesale markets are broadcast daily on national radio in the evening. The central unit also informs the provinces of Jakarta prices, prepares reports for the national news agency, which distributes these twice weekly to newspapers, and prepares quarterly reports and a yearbook which provides monthly averages for nearly all prices collected.

An important aspect of the Indonesian service is that it provides daily information. Given the tendency of prices to fluctuate, every marketing information service for vegetables should aim to do this where produce is traded on a daily basis. This does, however, require a considerable commitment on the part of all staff to ensure that data are collected, processed and disseminated on time. Such commitment is evident in Indonesia, in part at least because the work of the entire unit, and the data collectors in particular, is clearly appreciated by the farmers.

ANNUAL RUNNING COSTS

Salaries (140 provincial officers and central unit staff)	US$405,000
Equipment (includes computers, radios)	US$30,000
Travel	US$135,000
Other (including telephone, training, maintenance, materials)	US$270,000
Total	**US$840,000**

The cost of running the service is equivalent to approximately 0.1 per cent of the total farm value of fruit and vegetables produced in the country.

RESULTS The main users of market information are farmers, as was foreseen from the beginning. Farmers tend to use local price broadcasts as a check on the prices they receive and, more importantly, as an aid to negotiation with traders the following day. Many of the vegetable farmers are commercial farmers, rather than subsistence farmers selling occasional surpluses, and almost all listen to the price broadcasts on a regular basis and greatly appreciate them. Traders and wholesalers, on the other hand, have other sources of information and claim to listen infrequently to the radio. Traders make regular, often daily, visits to terminal markets while wholesalers are in phone and fax contact with other markets. The service does not appear to assist them in any significant way. Possibly this represents a change from when it was first set up, in that telecommunications have improved noticeably over the last decade.

FUTURE DEVELOPMENT While resources have been made available annually for the service, there is no guarantee that such resources will always be adequate. Attention should therefore be paid to ensuring sustainability of the service through both cost reduction, e.g. merger with the marketing extension service, and revenue generation, e.g. the sale of annual reports and the service's comprehensive database.[22]

CONTACT

Marketing and Rural Finance Service, Agricultural Support Systems Division
Food and Agriculture Organization of the United Nations
00100 Rome, Italy
E-mail: Edward.Seidler@fao.org
Website: http://www.fao.org/waicent/faoinfo/agricult/ags/AGSM/MARKETIN.HTM

actual and future prices of commodities. The information is incorporated in three bulletins a week which are faxed to farmers' organizations, and in some cases to individual farmers, and helps them plan their operations and obtain better prices for their crops.[23]

HOW IT CAN BE FINANCED

Making the best use of resources

Agriculture ministries in developing countries, dealing with widespread problems on inadequate budgets, need to find the most cost-effective way to use the resources they have. This implies the optimal use of their financial, physical and human resources to attain the objectives defined in their national strategy. Even though inadequate infrastructures and other barriers (e.g. geographical) to providing assistance to agriculture exist, the ministries will be working to improve the nutrition of the largest possible number of people. Information and communication technologies can help meet this challenge.

CORPORATE VIEW Overcoming funding difficulties

SOMERA COMMUNICATIONS, a leading international distributor of telecommunication infrastructure equipment specializing in innovative materials management programmes, has recently been involved in a development project to extend and upgrade Mexico's telecommunication services. Somera, which buys and sells a range of telecommunication equipment from major manufacturers and provides additional value-added services including buy-back programmes, was approached in late 1997 by Grupo IUSACELL, a cellular telephone company in Mexico responsible for upgrading the country's communication systems.

Grupo IUSACELL is dedicated to providing a quality telephone service to meet Mexico's rapidly expanding telecommunication requirements.

Having contracted to buy new digital cellular equipment to improve both the quality and efficiency of its existing network from Lucent Technologies, it had to find a way to provide an uninterrupted service to its growing customer base until the new equipment was installed in December 1998. To achieve this, Grupo IUSACELL wanted to continue to build up its current supply of Motorola cellular equipment.

As it had already made a major financial commitment towards the new digital equipment, the company needed to find a way of buying Motorola cellsites which would only be used for a short but undefined period of time, at a price which suited the already stretched budget.

By providing used equipment, Somera was able to offer IUSACELL fully configured Motorola cellsites at less than 50 per cent of the price of new equipment, and these were tested, packaged and delivered to IUSACELL within 30 days of receipt of the order. As part of the package Somera offered to buy back the Motorola equipment. In this way IUSACELL could afford the equipment it needed to maintain its service to its customers and was assured of an outlet for the cellsites.

Grupo IUSACELL was therefore able to keep pace with the demands of its rapidly growing customer base during 1998 and, by working closely with IUSACELL's management team and engineers, Somera was able to meet all its requirements within budget and on time.

During December 1998, IUSACELL began installing the new Lucent equipment and Somera deinstalled and repurchased the Motorola equipment. This partnership has not only brought vital, reliable communication services to an entire country, but demonstrates how funding difficulties, often experienced in developing markets, can be successfully overcome.

Somera Communications
E-mail: dfirestone@somera.com
Website: http://www.somera.com
For further information see Annex B

Sharing costs with other sectors

The following factors can diminish the financial impact of providing assistance to agriculture and thus encourage the development of new services and applications in developing countries:

- by their nature, these services are provided in conjunction with telecommunication services which can share the costs;
- there is a possibility of simultaneously providing other needed services in the domains of education, health, commerce, etc., permitting costs to be shared;
- the multiple-use aspect can be attractive to funding agencies which may provide financial aid.

Starting with a pilot project

Before turning to external aid, cost efficiencies might be realized through a team approach at national level involving the concerned ministries and the national telecommunication provider. Expert advice is available from international and other agencies (e.g. the ITU, FAO and the European Commission), and neighbouring nations with previous experience may be able to contribute. After discussions among the partners, agreement on objectives and pooling of resources, it is possible that funding, at least for one or more pilot projects, can be found. Pilot projects allow the accumulation of indispensable first-hand experience and can indicate, under particular local conditions, whether the service is cost-effective. This can lead to further steps, such as funding from the national budget being allocated for expanding the service or the introduction of other services. The design of any pilot project should incorporate the idea of continuity after the trial period and, therefore, becoming financially self-sustaining.

Possible sources of finance

With the experience of a pilot project behind them, authorities will be able to deal more confidently with funding agencies or experiment more knowledgeably with other funding sources. It should be kept in mind that help and advice will vary according to the provider. International organizations are motivated by open and wide objectives, while the objectives of the private sector, with normal commercial constraints, may be more narrow and self-interested. Some possible sources of finance follow. (An extensive list of funding agencies and contacts is provided in Annex A.)

- Ministries which have devoted a fixed percentage of their budget to using information and communication technologies for agriculture could solicit matching funds from an international funding institution.
- The ITU has sponsored projects setting up telecentres in rural areas. It could possibly finance some pilot project proposals.
- FAO has many farm aid programmes and has participated in the funding of pilot projects. On average, the organization has some 1,800 field projects operating at any one time. During 1995, FAO-assisted investment projects were worth some US$3.3 billion. FAO's Investment Centre helps developing countries formulate projects in agricultural and rural development, and the organization can also provide advice.

UNEP/Xintian Pan/Topham

The quest is to increase food production so as to improve the nutrition of the largest possible number of people.

- The International Fund for Agricultural Development (IFAD) provides direct funding and helps mobilize additional resources for agricultural projects designed to promote the economic advancement of the rural poor. Since its establishment in 1977, IFAD has financed 489 projects in 111 countries, to which it has committed US$5.67 billion in grants and loans, mostly on highly concessional terms. A further US$6.41 billion has been contributed by recipient governments and US$5.44 billion in co-financing by donors.
- World Bank agencies administer numerous programmes and can provide aid for sustainable agriculture initiatives in developing countries. The Bank's Information for Development Program (infoDev) is a direct financing source and can also act as a catalyst in attracting financing from other sources. It encourages applications for funding for both information and communication technology and agriculture projects.
- Regional development banks and national aid agencies may be willing to support pilot projects. The European Union has also supported projects

CORPORATE VIEW

Flexible digital broadcasting solutions

THE SWEDISH broadcasting company Teracom provides news, information and entertainment for its customers across the country, anywhere and at any time, delivering its products through terrestrial and satellite broadcasting networks. Products and services include programme transmission, telecommunications and data transmission, multimedia and servicing as well as consultancy and leasing services. Teracom's expertise and technology are easily transferable to other networks worldwide. The company has developed from a radio and television programme distributor and network operator into a modern information technology business. With a wide range of skills in emerging technologies, Teracom is already finding solutions for problems posed by tomorrow's digital information technology, by focusing its research and development strategy on digital audio broadcasting and digital video broadcasting systems.

Teracom Components, a subsidiary company, develops and produces antennas and coaxial systems for broadcasting, telecommunications and other methods of radio communication. Unique among broadcasting companies, it is both a manufacturer and a user. By collecting and analysing data from both perspectives, customers are guaranteed a product developed and tested by a fellow user. The company has more than 70 years' experience in terrestrial broadcasting and is the leading supplier of antennas, filters and other coaxial equipment in Scandinavia. Targeting global radio and television networks, the company has achieved strategically important installation contracts in Europe. With new products for digital audio broadcasting and digital video broadcasting already available, Teracom offers flexible solutions to meet its customers needs.

The conversion to digital television is accelerating the delivery of new services to customers; these include repeat services, live debate opportunities and interactive educational channels. Picture interference will no longer exist, while high-definition television in a wide-screen format will be the norm and the number of channels will increase dramatically, offering considerably more choice. Broadcasting will be cheaper and there will be new opportunities for television operators and distributors. Set-top boxes and digital television sets will be interactive and return channels will be in the form of permanent or mobile telephone lines. Each set-top box will have a modem which can be connected to a television socket or a telephone device.

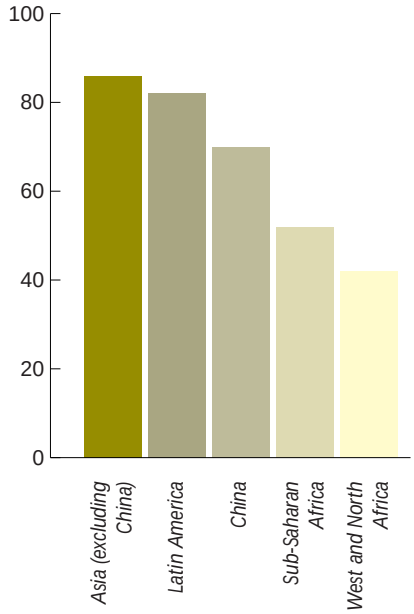
Digital audio broadcasting radio will offer CD-quality sound, no interference, more channels and lower transmitter costs as well as sophisticated, interactive, mobile multimedia services. Apart from digital audio, this service will provide data broadcasting and transmission to dedicated users or user groups and an interactive channel for mobile telephone customers.

Teracom Components
E-mail:bengt.stahl@teracom.se
Website: http://www.teracom.se
For further information see Annex B

through the European Investment Bank, including financing for the extension of the telephone network and installation of new telecom facilities in Chile.

- International organizations such as the United Nations Development Programme, the United Nations Economic Commission for Africa, the United Nations Educational, Scientific and Cultural Organization and the United Nations Environment Programme support pilot projects, supply seed funding and act as a catalyst to bring other partners together.
- Telecommunication operators could be approached to provide preferential tariffs for the telecommunication part of agricultural services. Developing countries could form regional groups in order to get better prices for telecommunication services provided by foreign operators. For example, RASCOM is a consortium of 43 African countries that has successfully negotiated more attractive tariffs from INTELSAT by making a joint approach. Telecommunication technology for agriculture could also be made part of a telecommunication operators' universal service obligations.
- Television or radio broadcasters might consider donating some programming time for agricultural education or promotion of other agricultural projects.
- Developing countries could consider establishing joint ventures in telecom projects for agriculture, by inviting local or foreign partners to participate and to take equity stakes in the delivery of services.
- Private sector suppliers of agricultural equipment, seeds, plants or chemicals might be willing to contribute to setting up a pilot project.
- Countries seeking to implement telecommunication technology for agriculture projects could consider innovative funding sources, for example by negotiating debt conversion through the Paris Club of creditors.[24] Ministries of finance could be encouraged to negotiate some portion of debt conversion for agriculture projects as a desirable social good.
- Beneficiaries of agricultural services could be asked to pay a reasonable fee for usage. This money could go towards defraying operating and other costs and help to make the service self-sustaining.

AREA PLANTED TO MODERN VARIETIES OF WHEAT* IN DEVELOPING COUNTRIES *(%)*



*Excludes tall varieties released since 1965

Source: *Food for All,* FAO, Rome, 1996

PLAN OF ACTION

Knowledge transfer is the first priority

The goal in agriculture and food production in developing countries is to increase production and improve the living conditions of the rural poor while adopting or maintaining practices that ensure long-term sustainability. There must be a transfer of the necessary knowledge to the whole agricultural workforce, from the farm worker up, so that new practices can be put in place to accomplish production goals. This in turn implies an immense task of education and training.

Extension workers are already in place in developing countries and the process of aid and knowledge transfer is already under way with beneficial effects which are starting to be felt. To take just one example, rice yields in Madagascar have been increased as a result of the System of Rice Intensification demonstrated by extension workers from the Cornell International Institute for Food, Agriculture and Development. The urgent need, however, if the knowledge/information gap is not to widen at an ever-increasing rate, is to

accelerate knowledge transfer and ensure that it reaches all levels and sections of the agricultural community. Unfortunately, in many cases, this is not actually possible for two main reasons: the lack of telecommunication infrastructure and the low basic educational level of workers in agriculture.

The provision of telecommunication infrastructure is discussed elsewhere in this publication but the question of education and narrowing the knowledge gaps falls logically to national governments. Education, from basic to university levels, must be backed by adequate national policies that encourage lifelong learning. Where knowledge must be acquired from outside the country, it can be obtained via information and communication technologies, whose capacity and content is constantly increasing while costs rapidly decrease. (See also the section on education in *Telecommunications in Action*.) But the green revolution proved that valuable knowledge also exists in the experience of farmers or can be created locally through agricultural research, targeted on local conditions, and these sources must equally be exploited.

Determining needs and priorities

The following action plan could be used by developing countries, possibly through a multi-disciplinary task force, as a tool to evaluate the needs for, and the potential benefits of using telecoms for agriculture. It comprises reasonable task force objectives and a list of open questions to help identify and prioritize areas of potential use of information and communication technologies to improve agriculture and food production.

The mandate of the multi-disciplinary task force could be:

- to identify problems and specific areas of agriculture that could potentially benefit from the use of information and communication technologies;
- to assign each area a degree of priority;
- to make an inventory of all relevant resources (physical, human and financial, in agriculture and in information and communication technologies) and their geographical distribution;
- to identify constraints, potential obstacles, socio-cultural factors and legal considerations to take into account before introducing new information and communication technologies;
- to coordinate a cost-benefit study of various technological alternatives;
- to make recommendations based on the findings of this study.

INCREASE IN YIELDS OF STAPLE CROPS, SHOWING FAR SMALLER INCREASES IN CROPS GROWN BY THE POOR *(yields in 1990-94 indexed to 1970-74, 1970-74=100)*

Source: *1971-96*: *Twenty-Five Years of Food and Agricultural Improvement in Developing Countries,* Consultative Group for International Agriculture Research (CGIAR), Washington, DC, 1996

Assessment of needs

The task force could use the following questions for assessing needs:

1. Are there comprehensive long-term regional, national and local plans for the agricultural and related sectors, and do they cover the situation taking into consideration new information and communication technologies that are available?
2. What are the most pressing nutritional, environmental, marketing and population problems that need to be addressed in the country, by region and by population group?
3. What is the geographical distribution (and quality) of agricultural resources?
   - number and quality of different types of infrastructure (including research

stations, experimental farms and laboratories), agricultural equipment and supplies;
- all categories of agricultural personnel;
- all categories of training infrastructure and personnel;
- inventory of and area covered by mobile expert teams.

4. What is the geographical distribution (and quality) of market facilities, information and communication networks and technologies? Information is required regarding:
   - the present and projected adequacy of road and transportation systems (in terms of time and costs);
   - the present and projected existence of centralized storage facilities;
   - the present and projected existence of markets for each product;
   - the present and projected telecommunication infrastructure and equipment of various types;
   - computers and peripherals in the agriculture sector (type, capacity);

CORPORATE VIEW Public call centres

BASED IN DENMARK, BD Consult Electronic Engineering provides solutions for converting traffic on cable networks into wireless communications for use with any existing mobile telephone network. The company has a worldwide sales and service network which supplies and installs BD Consult's fixed wireless terminals, such as the Cellink range. In situations where there is inadequate telecommunication infrastructure via cables, the Cellink offers a solution through wireless technology.

Wireless-based solutions to communication problems in remote and under-developed regions can be established economically and quickly, providing affordable modern facilities in these areas.

When entering new markets, BD Consult aims to build relationships with network operators who generally have established distribution channels. Recently, the company was approached by a network operator wishing to use a fixed wireless terminal as a mobile interface. The terminals were to be used in public call centres as a value-added service for customers. This would increase the revenue of the call centres and provide the means to access additional lines easily.

The network operator would be able to expand coverage, giving more customers access to telephones, and so improve its profit margins without having to sell, install or service the products itself. BD Consult was, therefore, selected by the operator to undertake this section of the work. The controlled distribution of products was of primary importance to the network operator who needed to monitor revenue flows, and BD Consult agreed a contract with the operator's agent to set up a regional manufacturing facility.

Through experience, BD Consult has learnt that settling agreements and finalizing procedures may take longer than expected when operating in a developing country. However, working in close cooperation with a local commercial ally meant that BD Consult was quickly able to amend its product's technical specifications to comply with those of the country's regulatory office and the network interface, and in doing so to bring the project to a satisfactory conclusion.

At the same time, BD Consult's local partner developed a marketing strategy for the products resulting in a successful countrywide campaign. BD Consult has developed a close relationship with the company and expects to build on this in the future, collaborating on other ventures in developing countries.

BD Consult Electronic Engineering
E-mail: jw@bdconsult.com
Website: http://www.bdconsult.com
For further information see Annex B

availability of parts and maintenance technicians; training programmes for users; modems and connectivity;
- the present and projected electrification coverage (all sources used to generate power for equipment, computers, lighting etc.);
- radio and television coverage (including cable and satellite).

5. Are there any specific geographical, climatic, cultural and political factors to be taken into consideration in integrating information and communication technologies? What are they?
6. What are the current uses of information and communication technologies in agriculture?
7. Has there been any evaluation of the use of information and communication technologies for agriculture and what were the benefits produced and problems encountered?
8. What are the present sources of agriculture financing (national and foreign) and what is the allocation of these resources?
9. Are financial resources sufficient to cover the present agricultural programme? Would they be sufficient to integrate information and communication technologies? Are there any strategies to generate new sources of financing?
10. Is there a concerted development strategy by different related sectors to share costs and resources at the national and community levels?

IMPLEMENTATION AND OPERATION

Getting started

Steps can be taken to help farmers even before new services are introduced in order to augment the effectiveness of telecom services for agricultural development. These steps could be part of an organized pre-project campaign conducted by workers from international organizations, non-governmental organizations or government extension workers. One such step would be to contact all the farmers in the region and discuss what, in their view, they need to help them obtain better results from their farming efforts. An overview of proposed telecommunication services could then be provided, giving a brief explanation of how information and communication technologies would give access to the outside world, bringing new information on farming methods and practices, markets and so on.

FAO

The members of a farmer group in Central America discuss ways to improve their results.

Another very important preliminary step would be to help farmers form groups (if they do not already exist) in order to share problems, compare experiences and present a more powerful bargaining front to sellers of equipment, chemicals, seeds, etc. FAO has experience of encouraging such groups, in Zaire for example, where they were used as a way of delivering training services to some 320,000 farmers over a five-year period.[25] The groups should meet regularly to discuss and possibly influence the types of new services to be provided, decide jointly on interaction and collaboration with other community groups and reach consensus on group needs (such as whether to form a cooperative) or other matters which could be transmitted to government. A number of non-governmental organizations offer credit services to small and micro-enterprises, which can be very important to poor farmers who are trying to improve and diversify their operations. In this case,

farmers' groups can be vital because frequently a prerequisite for such credit is that the creditor farmer be "guaranteed" by a group of at least five other farmers who are ready to secure the loan. Examples include the Grameen Bank of Bangladesh and the Volunteers in Technical Assistance (VITA).[26]

The more organized farmers are, and the better prepared they are to make good use of the new services, the quicker they will be able to benefit from them and contribute to the development process in the community and region. These activities also bring benefits to the authorities providing services by helping them to target those services to the needs of the community. Groups of farmers offer more concentrated feedback and the farmers within a group, through discussion and consultation, can more accurately describe their problems and their needs. These essential feedback mechanisms facilitate the "bottom up" approach to solving farmers' problems and avoid the "top down", one-way communication mechanisms which so frequently prove to be ineffective. Training through information and communication technologies

CORPORATE VIEW

Quality of service

TELECOM ARGENTINA was established in 1990 as a result of the privatization of Argentina's state-owned telecommunication company, Entel. It has a licence to provide fixed-link public telecommunication services and basic telephone services in the northern region of Argentina.

The infrastructure which Telecom Argentina inherited was out of date, comprising old electro-mechanical exchanges which had been working for 17 years, with almost no digital transmission. As a result, the quality of service was low, with faults being repaired 40 days, on average, after they had been reported. There was a four-year waiting list for a new line and customer service was unknown.

No accurate drawings of the network existed, which forced the newly formed Telecom Argentina to rely on experienced employees to locate and repair the broken lines they had inherited.

Today the situation is entirely different. The company has significantly increased efficiency and profits. It has installed 1.4 million new lines and replaced 100 per cent of the inherited network, increasing digitalization from 11.5 per cent to 100 per cent by 1997. The public telephone network has been dramatically increased from 10,341 public telephones in 1990 to 53,000 today.

Quality of service has also improved, with faults being repaired in only a day, while the waiting time for new subscribers is ten days. Only 0.1 per cent of the lines are out of service at any one time.

Due to an aggressive line installation policy and a 50 per cent reduction in staff, productivity has increased from 75 lines per employee in 1990 to 312 lines per employee.

Telecom Argentina has expanded its activities considerably. Now operating in neighbouring Paraguay, the Telecom group acquired a stake in a Paraguayan company which will enable it to construct and operate a personal communication service network in parts of the country.

It has an interest in Argentina's first satellite communication system and has been marketing its satellite communication services since 1997.

In 1998 the group was awarded a licence to operate one of the networks for the new Cellular Mobile Communication System. Telecom Argentina also provides domestic value-added services such as data transmission, telex and telegraph.

Having turned round the telecommunication system in Argentina in a decade, the company is well positioned to take advantage of its substantial opportunities for future growth.

Telecom Argentina
E-mail: rlagomar@ta.telecom.com.ar
Website: http://www.telecom.com.ar
For further information see Annex B

should be user driven and not technology driven. While such technologies are proposed as a means of bringing essential training information to the farming community, there is a tough challenge to ensure that the instruction material is appropriate in tone and approach. Farmer feedback will be important but this is a domain where extension worker participation, as an intermediary between the training services and the farmers, could be pivotal to success because field-based learning has been proved to be much more effective than classroom learning.

Service delivery – the multi-purpose community telecentre

The delivery of information and communication technology services directly to the individual farmer is probably a long way off and a centralized approach is therefore called for. An agricultural research or other special purpose facility may already be in place and can be used but, normally, there will be other sectors which need and will be ready to share the telecom services. A telecentre or community centre (which could be a church, school, post office,

CORPORATE VIEW Consultation and design

THROUGH its principal and parent companies, SLP Worldwide Telecommunications has been providing consultation and design services as well as equipment to developing countries for some considerable time. Experts in telecommunication, wireless and Internet technology, SLP companies have supplied new, used and refurbished equipment to distributors worldwide. This equipment has included cabling distribution systems for customers' premises, central office and data equipment, satellite Earth stations, microwave equipment, cellular and paging hardware and systems, fixed wireless station equipment, Internet access provisioning, electronic wire and cabling as well as power equipment. With a global spread of suppliers and contacts and some of the best technical consultants, designers and technicians in the telecom sector, SLP has earned a reputation for delivering a first-class service wherever it operates.

An SLP senior executive, while working as marketing director for a private telephone exchange equipment manufacturer, set up a series of meetings with the Chinese government in 1986 which culminated in a multimillion dollar joint venture agreement to manufacture and distribute private branch exchanges and automatic call distribution, each with a 2,300-line capacity, from China.

In the early 1990s, SLP was approached by an entrepreneur in the then Czechoslovakia to provide refurbished and converted cordless telephone hardware from a leading global supplier of telecom equipment. SLP successfully converted the telephones to the desired specifications and delivered them on time and in perfect working order. On another occasion, the senior executive, as director of international business development for a telecom business based in Memphis, Tennessee, in the United States, worked closely with Latin American government and private industry officials to offer assistance in structuring joint ventures for the provision and development of telecom and wireless infrastructure for the region.

In 1996 SLP arranged a series of similar meetings, in the United States and Madagascar, with the contractor commissioned to develop telecom infrastructure in Madagascar. This resulted in a joint venture agreement to provide telecom infrastructure, wireless, cellular, satellite, paging and Internet services. A complete turnkey solution was developed using refurbished cellular and satellite equipment where possible to reduce initial costs. This allowed a larger segment of the population to have access to these services against the relatively small numbers who would have benefited initially from a more expensive, advanced system. A strategy was developed to phase out the refurbished analogue equipment gradually and replace it with newer digital technology as Madagascar's economy begins to benefit from having a reliable, efficient and cost-effective communication system.

SLP Worldwide Telecommunications
E-mail: slpope@bellsouth.net
Website: http://personal.mem.bellsouth.net/mem/s/l/slpope/yourpage.html
For further information see Annex B

FAO

Food producers large and small will benefit from the wider use of information and communication technologies.

police station or specially built structure) is therefore the logical location, where the telecommunication needs of several user groups can be aggregated in order to maximize the utility and lower the cost of providing the services.

In the multi-purpose community telecentre approach, each of the partners has control over its own services but the costs of the locale, the telecommunication links and certain equipment are shared through a partnership agreement among the service providers and other interested parties. The negotiation and close collaboration that is necessary among the local authorities and the different sectors (and possibly, the national or international private sector) to arrive at a common accord is recompensed by the resulting optimal use of scarce funds and other resources. The aim is for the telecentre to be managed by one or more persons on behalf of all the user services in such a way as to become self-sustaining financially. Through experience this has been accomplished by demanding small fees for services which will gradually accumulate with increasing usage to the point of covering expenses. The multi-purpose community telecentre has already been used in many field trials and is discussed more fully in the section of *Telecommunications in Action* dealing with rural development.

Community micronetworks – a new approach

Large corporations, especially those with many geographically separated branches, are creating their own private networks. This is an approach which could be of interest to developing countries where radio communication techniques, such as VSATs (very small aperture terminals) can permit the establishment of small networks connected at one point to the national network. In India, fixed cellular radio systems have been used in this way to serve specific groups or communities of subscribers.[27] These radio-based systems are easier and cheaper to set up than conventional services. While initial financial assistance to install such micronetworks may be necessary, the operation could be managed on a franchise basis where the national (or major) operator pays for the installation and makes a franchise arrangement with a community to run it.

BENEFITS

National development objective benefits

The delivery of services can yield many socio-economic benefits from among established national development objectives such as the following:

- education of important segments of the population;
- employment opportunities for indigenous workers and technicians;
- dissemination of advanced technological knowledge;
- slowing population migration or attracting people back to previously abandoned areas as a result of recognition and support for farmers in remote areas;
- attracting businesses and professional personnel to remote and rural areas with a positive impact on the local and national economies;
- improving the food production indicators as set and followed by national governments;
- improving the image of a country (important, for example, for attracting investment).

Training and education

For those agriculture specialists and extension workers in rural areas of developing countries, access to remote databases on the Internet, for example, could be indispensable for following the development programme and keeping up with events and advances in their field or for consulting or sharing experiences with others. Their reports and input to central databases could also be an important record of experience and case study material for other parts of the world.

Revenues

The provision of agricultural knowledge and services should not only optimize the use of tight resources but, in the long term, through increased production, produce surpluses which would generate revenues and create employment opportunities. The telecommunication networks used could gain additional revenues. Commercial agricultural suppliers can also find opportunities in this

CORPORATE VIEW Low maintenance costs

IN DEVELOPING countries, installing traditional cable telephone systems often requires significant capital investment and maintenance – and this is the reason why wireless is emerging as a major, fast-growing alternative to the more usual cable solution.

It offers a number of benefits. Whereas a cable must cover the whole distance between all the subscribers and connect them to a central point, wireless subscriber units are used to send signals from anywhere in the cell through radio frequencies.

According to some estimates, the number of subscribers using this technique could exceed 160 million worldwide by the year 2005, as service providers switch to wireless systems because they are easy to deploy, have low construction and maintenance costs and can expand easily to accommodate future growth.

They also provide wireline-quality voice and advanced services, using radio technology for voice, data and multimedia transmissions, and are equally suited for big cities, towns or rural locations with small populations.

InterDigital Communications has pioneered the development of local digital wireless technology, introducing its UltraPhone system in the United States in 1987 and then deploying it in Mexico in 1990. The company has since sold the system to Brazil, Colombia, Indonesia, Kuwait, Myanmar, Namibia, Nigeria, the Philippines, the Russian Federation and other countries, and to date has delivered over 350 systems worldwide in environments ranging from rural Siberian tundra to tropical urban centres.

In 1998 InterDigital introduced its latest local telephony wireless solution, and in May that year one of the company's strategic partners, Samsung Electronics, announced that it had signed a contract with Unicom, a state-owned telephone company in China, to install the first of the new local wireless systems in that country.

Market analysts estimate that demand for the system in China will explode in the next two years, reaching 2 million subscribers a year. The decision to order an InterDigital system illustrates the keen interest by telephone utilities and the Chinese government in this technology.

The system provides a flexible and cost-effective wireless access solution for urban, suburban and rural applications, processing voice and data faster than other technologies. InterDigital successfully demonstrated its interface with live, over-the-air data video calls in 1997, and the system is commercially available following field trials in China, India and the United States.

InterDigital Communications
E-mail: howard.goldberg@interdigital.com
Website: http://www.interdigital.com
For further information see Annex B

sector of the economy, thanks to competition. Telecommunication operators, equipment manufacturers and specialized information and communication technology service providers already compete for local and global markets. The use of information and communication technologies in agriculture could provide experience or opportunities which would benefit other developing countries.

Summary of benefits

The benefits of bringing information and communication technologies to rural agriculture will not become fully apparent for some time, but could include the following.

Direct benefits

Direct benefits include:

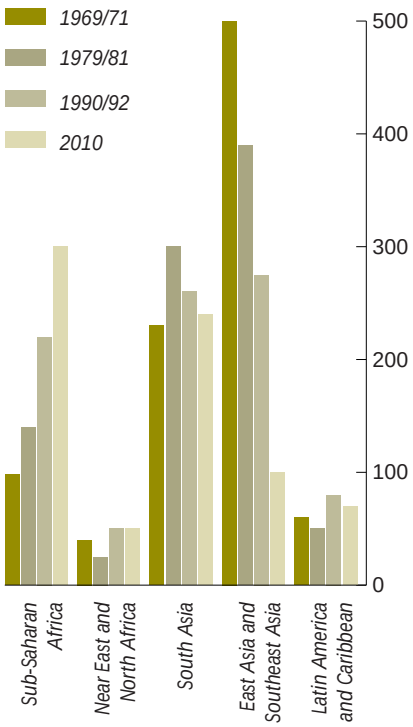
- increased agricultural production, moving towards the goal of adequate food for the population (and possible surpluses);
- better planning, control and management of farm operations and crops;
- increased revenue from sales of surpluses as a result of improved market knowledge;
- cheaper incoming agricultural supplies as the result of improved market knowledge;
- reduced migration and improved job satisfaction for farmers;
- improved environmental practices with benefits for soil and water;
- fewer accidents from toxic chemicals;
- reduced travel for extension workers or specialists engaged in agriculture research or consultancy;
- reduced expenses for nutrition-associated illnesses;
- improved effectiveness of agricultural extension workers and specialists: broader reach, more time spent counselling due to reduced travel;
- improved overall agricultural management;
- improved availability and reduced cost of training for local farmers;
- increased support for agricultural personnel working in remote and isolated areas, resulting in increased job satisfaction;
- improved teaching and learning possibilities and opportunities.

Indirect benefits

These are benefits accruing to various parties involved in the provision of telecom services for agriculture, such as:

- increased knowledge and qualifications among specialist and technical personnel;
- decentralization of responsibility and distribution of competence;
- maximization of scarce central resources, such as specialists, databases and computers;
- improved collaboration among the various users with benefits for the community;
- increased revenues to equipment providers, telecom service providers and the like.

HUNGER REMAINS A MAJOR CHALLENGE IN THE DEVELOPING WORLD
(number of persons chronically undernourished, millions)



Source: *Dimensions of Need,* FAO, Rome, 1995

WAICENT
World Agricultural Information Centre
Inter-departmental Programme on
Information Services
Food and Agriculture Organization of the
United Nations
Viale delle Terme di Caracalla, 00100 Rome, Italy
<http://www.fao.org/waicent/>

WAICENT facilitates the capacities to access and collect, analyse, interpret and disseminate information relating to food security and agricultural development. Support is being directed towards developing national capabilities, facilitating the transfer of information technology and establishing national information networks and partnerships. These activities are specifically aimed at enabling member countries to cooperate in policy and technology development through initiatives such as the Telecentres programme under the auspices of the ITU.

A series of corporate information tools has been set up for enabling access to FAO's information base, including FAOSTAT statistical services, FAOINFO providing textual and hypermedia services, and FAOSIS providing access to the data generated by specialized information systems. The use of the Internet has provided the means for an unprecedented capacity to disseminate information in a cost-effective manner to millions of users around the world in Arabic, English, French and Spanish. As part of efforts to expand access to WAICENT, especially in member countries where the Internet is not yet widely available, a portable set of WAICENT CD-ROMs has been developed, including the FAOSTAT CD-ROM, AGRIS and CARIS CD-ROM and many others.

Research and Technology Development Service
Research, Extension and Training Division
Food and Agriculture Organization of the
United Nations
Viale delle Terme di Caracalla
00100 Rome, Italy
Tel: +39 6 570 53037
Fax: +39 6 570 55731
E-mail: SDRR@fao.org

1. University of California, Santa Barbara, in *New Technologies: Remote Sensing and GIS, UNESCO Environment and Development Brief*, 1992.

2. For example, the US National Oceanic and Atmospheric Administration has a website as part of its National Weather Service at <http://www.nws.noaa.gov/>. Here, two-day forecasts, with maps, can be downloaded by the farmer to help in work planning. At the same site there is a warning service for exceptional conditions. This type of service could be replicated in developing countries once Internet access is more widespread.

3. Masias L. *Final Report of the Project Communication for Rural Development in Latin America*, GCP/RLA/114/ITA, FAO, Rome, 1997.

4. *ILO Yearbook of Labour Statistics 1997*, International Labour Organisation. This figure, for 1995, is the latest available.

5. <http://www.fao.org/news/1998>

6. Fraser C. *Communication for Rural Development in Mexico: In Good Times and in Bad*, FAO, Rome, 1997.

7. Masias L., op. cit.

8. Richardson D. *The Internet and Rural Development: Recommendations for Strategy and Activity*, FAO, Rome, 1996.

9. Masias L., op. cit.

10. Balit S. *Listening to Farmers: Communication for Participation and Change in Latin America*, <http://www.fao.org>, FAO, 12 November 1998.

11. Valenzuela, unpublished report, World Bank, 1994.

12. Balit S., op. cit.

13. For more information on the Virtual University of the Monterey Institute of Technology contact Dr. Rafael Rangel Sostman
E-mail: rrangel@itesm.mx

14. <http://www.neonet.nl/ceos-idn/campaigns/ARTEMIS.html>. For further information contact F.L. Snijders at FAO
E-mail: Fred.Snijders@fao.org

15. The people who were involved in the prediction exercise were Dr. Assaf Anyamba NASA/GSFC & Clark Labs/Idrisi Project, Prof. J. Ronald Eastman, Clark Labs/Idrisi Project and Dr. Mahadevan Ramachandran, WFP & Clark Labs/Idrisi Project.

16. <http://www.fao.org.waicent/faoinfo/economic/economic.htm>

17. The FAO Desert Locust Bulletin is distributed by fax, e-mail, FAO pouch and airmail. It is also available on the Web at <http://www.fao.org/waicent/faoinfo/agricult/agp/agpp/locusts/default.htm>
AGP Division, FAO, 00100 Rome, Italy
Tel: +39 6 522 52420 (24 hour, daily)
Fax: +39 6 522 55271
E-mail: eclo@fao.org
<http://www.fao.org/news/global/locusts/locuhome.htm>

18. *Dimensions of Need*, FAO, Rome, 1995.

19. For further details contact Wolfgang Prante, Land and Water Development Division, FAO
Viale delle Terme di Caracalla
00100 Rome, Italy
E-mail: Wolfgang.Prante@fao.org

20. *New Technologies: Remote Sensing and GIS*, UNESCO Environment and Development Brief, 1992.

21. University of Cambridge Department of Geography, Marine Fisheries GIS Unit website: <http://www.cant.ac.uk/depts/acad/geography/fish/home.htm>

22. Shepherd A.W. and Schalke A.J.F. *An Assessment of the Indonesian Horticultural Market Information Service*, FAO, Rome, 1995.

23. For further information contact: L. Gaviria, Communication for Development Group, FAO
Tel: +39 6 522 53990.
E-mail: lydda.gaviria@fao.org

24. The Paris Club has become a popular designation for meetings between representatives of a developing country that wishes to renegotiate its "official" debt and representatives of the relevant creditor governments and international institutions.

25. *Dimensions of Need*, op. cit.

26. Volunteers in Technical Assistance (VITA)
1600 Wilson Boulevard, Suite 710, Arlington
Virginia, 22209 USA
Tel: +1 703 276 1800
Fax: +1 703 243 1865
E-mail: vita@vita.org
<http://www.vita.org>

Grameen website: <http://www.grameen.com/>

27. Garcia D.L. and Gorenflo N.R. Rural networking cooperatives: lessons for international development and aid strategies, in Paisley L. and Richardson D. *The First Mile*, FAO, Rome, 1998.