ICTs and National Agricultural Research Systems – The case of Tanzania

Barnabas Kapange
Department of Research and Development
Ministry of Agriculture and Food Security
Po.O. Box 266
Dar-es-Salaam
Tanzania

Introduction

Tanzania's main economic pillar is embedded in the agricultural sector, which supports over 33 million people and contributes 60% of the country's GDP and 61% of the export earnings and provides 84% of rural employment. The Tanzania Development Vision has set a target of achieving a level of general standards of living typical of medium-income countries by the year 2025. For the agricultural sector to fully contribute towards the sustainable development target, it should grow annually by 7%, implying more than doubling the current annual growth rate of 3.3%. Agricultural research has a major role to play in increasing productivity and profitability of the sector through development of scientific knowledge to generate improved technologies for the production systems. Agricultural extension complements this effort by transferring technologies developed by the NARS to the end-users.

Information and Communication Technologies (ICTs) are crucial in facilitating communication and access to information for agricultural and rural development. Since agriculture is the national priority sector, it is one of the potentially beneficial areas for the application of ICTs for economic transformation. Development of networks and use of low-cost ICTs enhance timely access to accurate and reliable information. It therefore calls for investment of part of the country's limited resources for ICT development.

Research in 2010

The current research and extension system in Tanzania is mainly public funded, although decentralizing and rightsizing the research establishment have relieved the government's budget strain through complete privatization of major cash crops. Decentralization has put extension under local government authorities to enhance greater client participation in Technology Development and Transfer (TDT) and making these processes participatory as opposed to the previous centralized, top-down set-up. It has, in addition, brought research and extension closer, to better serve the end-users. Research and extension services, which have enjoyed World Bank funding through TARP II and NAEP II projects respectively, wind up late in 2003.

Tanzanian NARS comprise public organizations, *viz*. the Department of Research and Development (DRD), Tropical Pesticides Research Institute (TPRI), universities, and Tanzania Forestry Research Institute (TAFORI), and private sector that includes crop research institutes for tobacco, coffee and tea. Preliminary findings of the recently commissioned Medium-Term Plan study show availability of training institutions for producing a steady stream of skilled scientists, institutional framework for technology development and transfer, and limited initiated mechanisms for resource mobilization. However, from the study, it has been noted that there exists shortage of appropriately packaged kits and messages for crop and livestock technology and a failure of the NARS to fully exploit the power of information technology.

The DRD of the Ministry of Agriculture & Food Security is the lead institution of Tanzanian NARS with the public role of conducting, coordinating, and directing agricultural research in the country. For operational purposes, agricultural research under the NARS is organized into seven agro-ecological zones managed under the DRD. Zones are the main action stations for research and have been given financial and operational semi-autonomy to carry out their mandate as opposed to the previous, centrally directed set-up. Zonal stakeholders have an effective voice in priority setting of agricultural research agenda, and zonal structures secure a demand-driven and cost-effective participatory research program.

Apart from DRD, many other organizations–public and private, participate in and contribute to research and dissemination of research findings to end-users. These include TAFORI, COSTECH, National Environment Management Council, universities, local government councils, NGOs, *etc*. Strong linkages between major institutional actors in agricultural knowledge and information systems have been given due recognition as being essential for an effective flow of technology and scientific information between research, extension, and farmers. A linkage between organizations is mainly through regional/international associations and networks, such as the International Center for Research in Agro-forestry, networks created by CGIAR member organizations, etc.

The Sokoine University of Agriculture (SUA) is a close collaborator and partner that has currently been mainstreamed into the NARS and is deemed a center of research status with both national and zonal mandates, including training of needed massive personnel, and conducting research appropriate to the farming community. The University of Dar-es-Salaam, through the Institute of Resource Assessment, contributes to agricultural research through training and collaborative research programs with other NARS institutions.

Tanzania is a member of sub-regional research organizations like *the Southern African Center for Cooperation in Agricultural Research and Natural Resource Management* (SACCAR) and the *Association for Strengthening Agricultural Research in Eastern and Central Africa* (ASARECA). Such membership provides it with access to the technologies required from regional collaborative programs and adapts them to meet the needs of its farming community. Tanzania participates in collaborative research, exchanges experiences with other local, national, regional and international organizations.

At the national level, the research and extension counterpart have strong informal linkages in sharing and exchanging of information through their respective Information & Documentation Unit (IDU) and Farmers' Education & Publicity Unit wings which have the function of repackaging research and other agricultural information for end users. These partnerships have built up down to the zones where Zonal Communication Centers (ZCC), located at zonal centers serve the broad array of agricultural research information consumers with new scientific and technical innovations. They have vans, video/audio systems, and editing equipment, and are capable of making informative publications and leaflets for distribution to farmers. To strengthen research-extension-farmer linkages, a Zonal Research Extension Liaison Officer is appointed to work at the zonal offices to link the three. Quarterly and monthly training sessions at the district level motivate farmers to send their research and extension needs through Village Extension Officers who attend the sessions. Agricultural shows, public demonstrations, and the fact that Swahili is one language spoken by all in Tanzania add up to broad user outreach. ZCCs are, indeed, medium of excellence for disseminating research outputs to the grassroots clientele.

To ensure agricultural research financial sustainability, the government has privatized research of a number of commercial crops, introduced cess on commercial commodities to pay for the research costs, and established revenue retention accounts in all zonal research stations to

enable them to meet part of their recurrent costs. District councils are now funding research by providing contributions to zonal agricultural research funds (ZARFs) aimed at promoting extra-budgetary resources.

Scientific communication in Tanzania, like in many other developing countries, is gradually changing to the use of more effective and cheaper ICTs to connect scientists to the World Wide Web. Committed to continual advances in science and technology, Tanzanian NARS has a strategy to connect its scientists so that they can work together to create a communication network, specifically designed to empower individual scientists and scientific organizations with valuable knowledge and skills. Such networks enable instant communication at very low cost and exploitation of the Web to greatly expand the scope and quality of the free knowledge resources available for science and scientists.

The current status of agricultural libraries and the potential of electronic communications in disseminating agricultural information in Tanzania have been affected by poor communications resulting in provision of inferior information services to users. This is particularly between main information custodians like Sokoine National Agricultural Library (largest and relatively better resourced), COSTECH, University of Dar-es-Salaam, IDU, and other DRD research institute libraries.

Most NARS research stations are connected to e-mail, and some have access to the whole range of Internet services. However, owing to the high cost of telephone calls, access to e-mail remains out of reach to individual scientists and some institutions. This situation has caused some institutions to charge even for individual e-mail downloads because they cannot afford the phone charges. Sustainability strategies should include the use of fund retention scheme, ZARF, and realistic budgeting for research projects that accommodates communication costs. Fundamental issues like connectivity, access affordability and low Internet user skills are among issues being tackled to pave the way for the final target of integrating ICTs in R&D institutions in the country.

Tanzania looks forward to more hands-on, pro-active role of partnerships in applied and adaptive research as a result of the change towards integration of research and development responsibilities from the traditional institutional approach that separates research and extension. Direct engagement in the development process through strategic partnerships may quickly enhance food security, poverty reduction and environment protection.

The recent formation of the Tanzanian Internet Service Providers Association, a lobbyist group catering for sectoral interests and improved local data traffic, coincides with the need to create and operate a country Internet Exchange Point that will ensure affordable connectivity charges. Also, Simunet, a local data communication company, plans to provide its service to all regions by February 2003, and in the long run, delivering its service to every Tanzanian village. Complemented by establishment and development of community-based telecentres, zero taxes on ICTs and associated peripherals introduced by the government, and the growing mobile phone industry that offers additional connectivity, Tanzania stands a chance to effectively integrate ICTs in agricultural research. Introduction of free interconnection service that offers connection to the Internet within minutes from any phone in Tanzania is a solution to users without the equipment.

The inauguration of the Tanzania Development Gateway (http://www.tanzaniagateway.org) has provided opportunity for a rich platform of information, particularly relevant local content and interactive exchange of expertise and experience between scientists and other stakeholders.

Farmer-technology interface

As stated earlier, agricultural extension services have been decentralized in order to have them well nested at the lowest level of government machinery. This is expected to make the services cost-effective and responsive to farmers' needs, while demanding accountability from extension staff and other collaborators.

Public-funded extension service, which is facing many challenges, has a declining public support owing to financial crises; shift to private enterprises over government intervention as reflected in the structural adjustment program, and dissatisfaction with the perceived lack of impact by agricultural extension. Today, many NGOs and private agencies such as private commodity research institutes have their own extension staff/system delivering more effective and relevant service. Participatory research and use of expert farmers and farmer research groups promise to partially replace, complement, or at least relieve the conventional extension system.

Many urban consumers of information have access to communication facilities such as fixed lines and mobile phones at moderate costs, whereas reaching rural farmers is more costly because of their dispersion over space, and availability of facilities and infrastructures have just started taking shape. Poor connectivity calls for increased public and private funding to enable reach the current information have-nots, especially the disadvantaged rural population.

The future demands the harnessing of ICTs from what researchers have developed in their laboratories and kept in shelves, to the needs of end-users - farmers. The current trend of many farmers and other agricultural information users frequently visiting research stations with specific technical and scientific queries, and the increased use of the Question and Answer Service, indicate the value attached to information. This reminds providers to put at farmers' disposal, a more accurate and reliable information system.

Access to ICTs provides information on prices, markets, technology, and weather. Community-based telecentres have the potential to empower rural communities and facilitate socio-economic developments in agriculture. It uses selected ICTs (e-mail, Internet, phone, radio, TV, print) to accelerate the wider delivery of appropriately packaged agricultural information. Mobile phones, mushrooming in Tanzania are increasingly becoming affordable, and they help overcome rural isolation and make communication easier. The wireless technologies that have entered remote rural areas have reduced reliance on costly fixed telephone infrastructures. These, put together, provide close linkages between players.

Where government services are weak, NGOs have often provided inputs and supported extension for fairly conventional programs such as in agriculture, environment, and agro-forestry. They have greatly contributed towards linking farmers and farmer groups to researchers and extension agents in a bid to have their needs addressed and to encourage development of technologies based on local resources and knowledge. NGOs have assisted researchers to identify and collaborate with particularly knowledgeable farmers, document and disseminate research findings, and facilitate exchange of information and ideas between groups. NGO research is mainly applied and adaptive, reflecting the determination to have rapid and tangible results.

Private enterprises like Business Care have a market development bureau that, among other things, reaches farmers and inform them of produce market prices countrywide and abroad. AGROMABU, an IICD-funded project, does almost the same thing. Market information empowers farmers to sell their produce at fairly rewarding prices, fetching more money to improve their living standards.

While electricity is basic to Internet access and ICT use, most of rural Tanzania is still in the dark, i.e. without power for lighting, let alone for running computers, TVs, etc. Although the national electric supply company has a long-term rural electrification program that will see rural areas provided with power in phases, alternative power sources such as solar and involvement of private sector must be explored and exploited particularly for the rural areas.

Future farmer-technology outlook relies on the emerging farmer associations and CBOs as training centers and access points for ICTs. It is from these points that farmers will be able to use computers for word processing and, making complex calculations and tables of their workplans and income and expenditure. The access points play the role of information centres where price lists, weather forecasts, will be available in any form –- print, digital, audio, video. The Tanzania Chamber of Commerce, Industry and Agriculture (http://www.tccia.co.tz) has facilitated its regional and district offices to act as Internet access points for the farmers and other users in their respective areas. Banking institutions such as CRDB Bank (http://www.crdb.com) have satellite links to all its branches, enabling customers, including farmers, to transact finances electronically between long distances.

Information and Communication Technologies help in record keeping, reflecting the expenses, profits, taxes, assets, and other farming activities. Today, computers are in use for monitoring and regulating air moisture in flower green houses in the country. With access to the Internet, farmers can buy or sell virtually anything, manage the land, perform any activity on the ground using GIS, do soil sampling operations and field mapping using the Global Positioning System. Also, the increased number of radio and TV stations give farmers the added advantage of accessing agricultural information through these media because they all have programs on agriculture and rural development.

Considerable progress in involving farmers through client-oriented and demand-driven research approaches is in sight. As a result, researchers are becoming facilitators (rather than leaders) and learners, while are becoming teachers. Poor subsistence farmers, given access and able to use Internet, will pose a constructive challenge to researchers for more current and accurate solutions and research agenda set-up, tapping directly into the latest technological innovations.

Research-research interface

Tanzanian researchers, like other countries' researchers, need to know what is happening around the world, as well as to let others know what they are doing. One of the most resourceful platforms where one can obtain and post information is the Internet. To access information in cyberspace, one first needs access to the corresponding electronic technology. Many Tanzanian scientists and scholars do not have access to the new information technologies, which seriously influences performance owing to lack of access to information. Limitations on full utilization of Internet include telephone calls that are prohibitively expensive, though many parts of the country have full Internet access today.

A good number of electronic networks already exist, and connectivity is steadily on the increase. At least, most scientists have e-mail accounts, an obvious indicator that Internet is used. Forecasts show increased number of scientist and agro-business users of Internet and other modern ICTs.

In terms of ICTs, established zone offices go without sufficiently trained personnel and scientists have low level of computer skills, a problem compounded with inadequate high-capacity computers and funding for information. These make the monthly subscription fee for e-mail and

Internet services unaffordable. Similar is the case with ICT back-up services such as anti-viruses, updated software, and supporting environment for ICTs.

Zonal institutes have been mandated to provide active linkages to other stations in their respective zones. NARS information managers are tasked to co-ordinate standardization of databases and software to facilitate data sharing, collaboration in training, inter-library exchange programs, joint schemes to index documentation, and joint development of tools and standards of sharing and accessing information.

With very few exceptions, agricultural research institutes in Tanzania are faced with limited effectiveness of information networks owing to poor telecommunications and information infrastructure, low level of information management skills, insufficient financial resources, and poor linkage to extension services and farmers. However, public organizations like COSTECH (http://www.costech.or.tz) have been instrumental in networking and providing information and ICTs to scientists. Today, COSTECH has deliberately taken up the ISP role, mostly serving the public sector. It has trained individuals and groups of scientists in basic and advanced computer courses, networking, and data communications and was recently appointed to train and test for the International Computer Driving Licence program.

Conventional one-way transfer and dissemination of information is favorably moving to a two-way communication system, both within the NARS and between national, regional and international organizations, thanks to modern ICT tools and emerging better policies in the NARS. The Tanzania Global Development and Learning Center (http://www.tgdln.go.tz), housed at the Institute of Finance Management enables sharing of research findings and successful development-related experiments in video, electronic classrooms, satellite communications, and the Internet. NARS personnel have benefited from the center programs.

Publishing as a medium of research communication has been rendered ineffective by low funding and other factors. The scientists' poor writing skills, low staff morale, and narrow opportunities for professional development contribute to this. With the aforementioned poor Internet penetration, publishing remains the relatively affordable avenue for documenting and dissemination, and thus needs strengthening.

Scientists do not publish because they are not correspondingly rewarded, whereas academic staff of universities actively solicit funds, conduct research, and publish results, because their continued employment and promotions are based on active engagement in teaching, research, publications and community service. Academic staff are encouraged and rewarded for publishing in recognized journals, a rewarding system for publishing that can be emulated by other NARS organizations. Training of DRD and other NARS staff at SUA show the effective and rational resource utilization.

Information from research to extension, farmers, and other stakeholders is digitally distributed through databases such as the comprehensive collection of research information – the *Tanzania Agricultural Research Database*, which documents about 100 years of agricultural research in Tanzania. INFORM, a management information system, enables managers to plan, control, and evaluate the effectiveness and efficiency of research activities. An international cooperative network, CARIS of FAO, deals with information on agricultural projects currently carried out in, or related to, developing countries; and TEEAL CDs contain a full-text database of 130 important scholarly journals of the world. There are also CD-ROM databases by AGRICOLA, CABI, FAO, and ILRI. Crop Protection Compendium is especially relevant. A departmental website, which is accessible through http://www.drd.mafs.go.tz, provides basic information of the

DRD and the entire agricultural research system. Knowledge of existing information enables rational resource allocation and avoids duplication of research efforts in tackling problems.

The NARS priorities include electronic link-up of all agricultural research institutes to a network that will facilitate easy dialogue among Tanzania researchers and with scientists from other organizations. Other avenues for dialogue between scientists and with other scientists at home and abroad include *Tanzania Agricultural Research Newsletter*, *Tanzania Agricultural Journal of Agricultural Sciences*, book reviews, reports, *Question & Answer Service*, *etc*. All DRD publications will be available online soon. Currently, *Pages of Contents* and *Accession Lists* are already delivered by e-mail. Select announcements are communicated by e-mail and through departmental website. Selective Dissemination of Information provides customized information for researchers in developing countries, including Tanzania. To ensure that farmers have the information they need, 'old' technologies such as newsletters and radio and personal calling are used.

Contribution by scientists to international journals is hindered by the fact that some journals are available only in electronic form. Such journals do not prefer using referees from developing countries, regardless of competence in their fields, because it may logically be difficult to reach them electronically. For the same reason, many scientists from developing countries will not be able to publish their work in these electronic journals. The future will see such tendencies change as more scientists communicate electronically and shed the fear of full participation in electronic publishing.

Information officers and librarians will remain vital in systematic acquisition of local material and other publishing output from the rest of the world, provided they ensure its bibliographic control and are represented in their own databases.

Many regional and international organizations such as the ISNAR, CTA, CABI, ASARECA, SACCAR have been instrumental in and will continue supporting the task of providing information to researchers. This is achieved through paid-for and free journal/book/CD-ROM subscriptions, Internet connection, equipment purchases and human resource capacity building. Without them, a number of research stations would remain 'white elephants' with outdated literature, technologically cut off from the rest of the world.

As funding of agricultural extension and research is dwindling, the latter has to attract funding from sources other than the traditional ones. Research is therefore moving in new directions, 'where the money is', including such areas as food safety, biodiversity, and biotechnology. In addition, research needs to work together with extension as a continuum of technology generation, refinement, and transfer, as stipulated in the Medium-Term Plan.