

ICTs for **AGRICULTURE** in Africa



eTransform AFRICA



This document, on the use of ICTs for Agriculture in Africa, is the summary of the full sector study which was carried out by a team from Deloitte, led by Omri Van Zyl and comprising Trish Alexander, Liezl De Graaf and Kamal Mukherjee with assistance from Vikash Kumar. The full report is available at www.eTransformAfrica.org. This document forms chapter two of the publication edited by Enock Yonazi, Tim Kelly, Naomi Halewood and Colin Blackman (2012) “eTransform Africa: The Transformational Use of ICTs in Africa.”

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*Information and communication technologies (ICTs) have the potential to transform business and government in Africa, driving entrepreneurship, innovation and economic growth. A new flagship report – **eTransform Africa** – produced by the World Bank and the African Development Bank, with the support of the African Union, identifies best practice in the use of ICTs in key sectors of the African economy. Under the theme “Transformation-Ready”, the growing contribution of ICTs to Agriculture, Climate Change Adaptation, Education, Financial Services, Government Services and Health is explored. In addition, the report highlights the role of ICTs in enhancing African regional trade and integration as well as the need to build a competitive ICT industry to promote innovation, job creation and the export potential of African companies.*

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INTRODUCTION

The strategic application of ICT to the agricultural industry, the largest economic sector in most African countries, offers the best opportunity for economic growth and poverty alleviation on the continent. Food security is paramount for the survival of individuals, families and ultimately nations, yet Africa's agriculture sector has been in decline over the past 40 years. Poor farmers have largely remained poor with 73 per cent of the people living in rural areas subsisting on less than a dollar a day.

Like other sectors, African agriculture is disadvantaged owing to factors that include:

- under-investment in rural areas,
- inadequate access to markets and unfair market conditions,
- inadequate access to advanced technologies,
- weak infrastructure,
- high production and transport costs,
- gender asymmetry in access to assets and services,
- conflicts,
- HIV/AIDS,
- natural disasters,
- deforestation, environmental degradation and loss of biodiversity, and

- dependency on foreign aid.

African agriculture is largely traditional and practised by smallholders and pastoralists. This type of agriculture is predominantly rain-fed, has low-yielding production, and lacks access to critical information, market facilitation, and financial intermediation services.

The role that ICT can play in addressing these challenges is increasing as personal ICT devices – such as mobile phones or tablet PCs – are becoming more widely available. ICT, when embedded in broader stakeholder systems, can bring economic development and growth as it can help bridge critical knowledge gaps. Mobile technology, on the other hand, is increasingly being adopted as the technology of choice for delivery of ICT services and solutions.

The wider adoption of ICT in agriculture is of strategic importance to five main stakeholder groups:

- **Businesses:** businesses, associations, other organizations
- **Farmers:** individuals; organized and informal associations
- **Researchers:** researchers; educators and trainers
- **Government:** ministries of agriculture, and other relevant departments and agencies
- **Citizens,** both as consumers and as custodians of the environment,

for instance through civil society organizations.

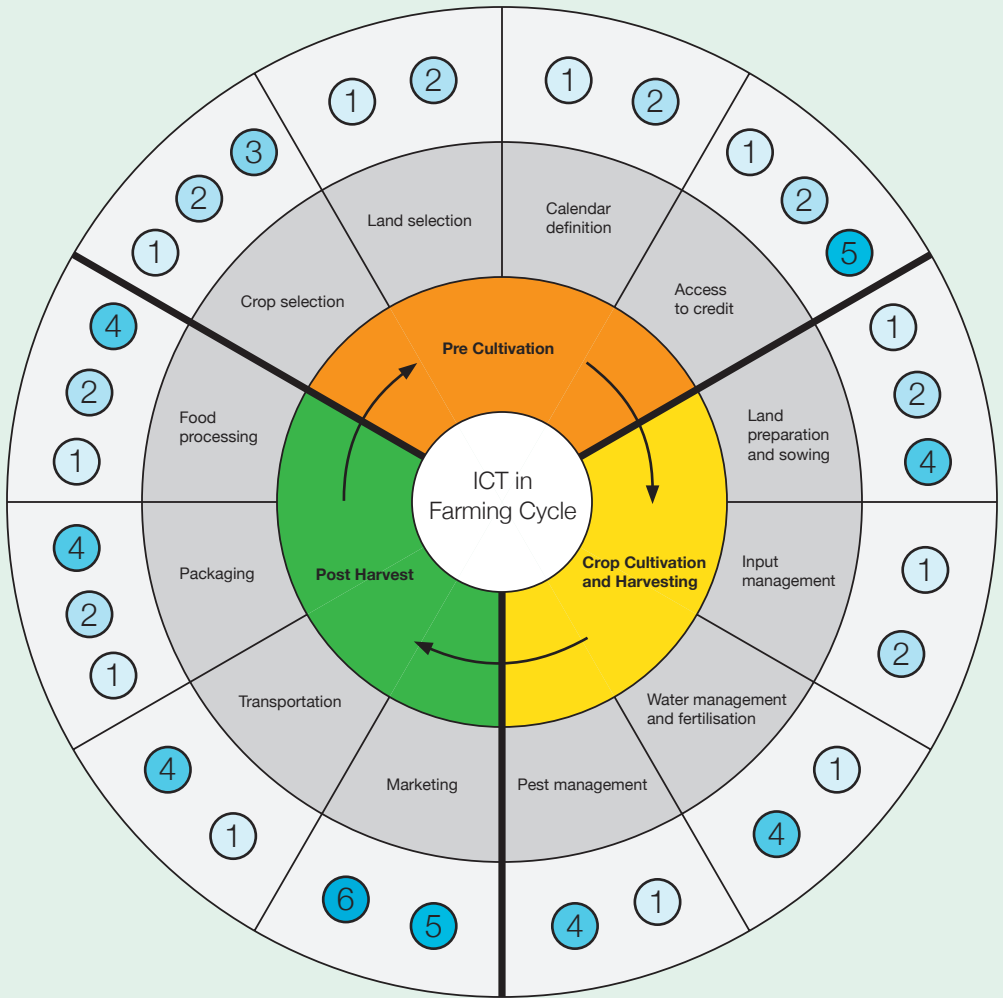
In identifying the ways in which ICT can help agriculture, it is useful to view the farming life cycle as a three-stage process (see Figure 1):

- Pre-cultivation: including crop selection, land selection, calendar definition, access to credit, etc.
- Crop cultivation and harvesting: including land preparation and sowing, input management, water management and fertilization, pest management, etc.
- Post-harvest: including marketing, transportation, packaging, food processing, etc.

Of course, some aspects of how ICTs can assist with agriculture are cross-cutting, like the use of geographical information systems (GIS) for land-use planning, while others are broader than agriculture, such as their use in climate change adaptation. Nevertheless, this framework provides a useful basis for analysis.

- 1 Information systems including DSS/MISS/GIS etc
- 2 ICT-enabled learning and knowledge exchange
- 3 Modelling solutions
- 4 Sensory and proximity devices
- 5 ICT-enabled networking solutions
- 6 Online commerce tools (eCommerce/mCommerce)

Figure 1 Information and service needs differ through the crop lifecycle



Source: Deloitte

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LANDSCAPE ANALYSIS

Scanning the global landscape highlights many examples of the successful use of ICT in agriculture enabling

the identification of trends relevant to Africa. These include:

Common platforms for agriculture stakeholders

An integrated information system for agriculture stakeholders minimizes the duplication of data and ensures consistency, improves integrity of the data and can address a wide variety of information needs. Although often complex, systems can be customized to ensure that the user experience is relatively simple. Cost and time spent on

maintenance is relatively low and the amount of user training required can be reduced. A good example of such a system is DrumNet, a network of support centres in Kenya that provides hands-on assistance through the delivery of financial, marketing and other information products and services.

Multi-stakeholder eAgriculture knowledge sharing in Africa

Multi-stakeholder research partnerships, including farmers, extension professionals, educators and scientists, have many benefits. They focus research on the most relevant topics, reduce the time needed to complete research, and improve the efficiency and effectiveness of the research process. Examples of applications of ICT in agricultural knowledge sharing include:

- ICTs for spatial analysis and targeting of programmes
- ICTs for better risk management
- ICTs and financial services for the farmer
- eEducation
- Virtual aggregation of small stakeholders

The role of mobile technology in eAgriculture

Mobile phones, GPS systems, barcode scanners, RFID readers and smart card readers are all examples of technologies that can be used to capture, read and store data. However, further components, such as the internet, communication networks and regulatory systems (to provide data security and standard systems for codes) are essential to complement the input and output devices. One example of the role of mobile technology is the GSMA's mAgri Programme, which aims to identify and fund opportunities for mobile communications in the agricultural value chain. For instance, the mFarmer Initiative Fund, launched in 2011 in partnership with the Bill & Melinda Gates Foundation and USAID, is designed to:

- Stimulate the development of mobile phone-enabled agriculture information and advisory services that are commercially sustainable;
- Build services that impact farmers' income and productivity;
- Reduce the barriers for operators to launch and improve mFarmer Services;

- Test and prove models for delivering agricultural information services via mobile phones; and
- Promote a culture of knowledge sharing in the mFarmer ecosystem.

The mFarmer Initiative Fund will support projects in Sub-Saharan Africa (Ethiopia, Ghana, Kenya, Malawi, Mali, Mozambique, Nigeria, Rwanda, Tanzania, Uganda and Zambia).

Another example of mobile technology in agriculture is a well-established service that has been operating in Ghana since 2005. The Esoko Ghana Commodity Index (EGCI) is a rural communication platform that publishes a cash market price index composed of data on physical commodities. The index is published weekly and tracks wholesale and retail prices and aims to improve farmers' incomes by building healthy markets. Currently Esoko is active in ten countries in Africa and has a variety of partnership agreements which include public sector agricultural projects, Esoko country franchises and licensed partners.

Traceability

Consumer demand for quality and food safety is placing increased emphasis on the traceability of agricultural production, particularly in the markets of the developed world. Traceability in the agriculture sector involves the recording of information on animals and food so that an item moving through a global supply chain can be tracked from its origin along the entire value chain. For instance, remote tracking among the coffee growers of Costa Rica and Mexico are examples of a successful implementation in developing nations.

The Coopetarrazú's processing plant uses leading-edge technologies for coffee drying, hulling, sorting and shipping. It also tracks hundreds of thousands of coffee purchases, worth US\$16 million annually from its 2,600 members, during the harvest and ensures that purchases meet certification criteria to ensure premium prices.

Traceability in livestock farming is also the focus of one of the detailed case studies, so these two cases provide two different views of traceability.

Agricultural insurance

Agricultural insurance is becoming increasingly important as extreme weather patterns generated by climate change are exacerbating volatility in food production and food prices. Crop insurance has long been used in developed countries to deal with weather uncertainties, but its availability in Africa, particularly to smallholder farmers, has been extremely limited. Agricultural insurance also applies to livestock, bloodstock, forestry, aquaculture and greenhouses. ICTs can play an important role in the agricultural insurance process by:

- facilitating access to information and services to stakeholders;
- providing advance information about weather and market price situations;
- providing better services and facilitate speedy claims servicing;
- monitoring and tracking premium repayments;
- ensuring a better interface between the insurer and the insured, particularly for field-based transactions;

- developing specialized and affordable rural insurance products; and
- improving complaints procedures.

ICT in rural development

Multi-purpose community centres can be used to provide remote populations with information and communication options. In Bhutan, for example, Community Information Centres (CIC) were established to provide services to a scattered population, who live in mountainous, forested terrain that has made wired internet and telephone connectivity prohibitively expensive. Their objective was to provide sustainable, commercially viable ICT services in rural areas. The state provides the equipment, and an individual from

the local community is employed to promote and maintain those services. Services available at the CICs include basic and advanced computer training, internet access, telephone facilities, government information and forms, and lamination and scanning facilities.

Broadband connectivity brings high-end services closer to the rural population and helps reduce poverty. As a result, the travelling time and cost for villagers and farmers is reduced while employment opportunities are generated.

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AFRICA SCAN

While the landscape analysis highlighted global best practices and sample cases, the Africa Scan provides a closer look at recognized eAgriculture successes in Africa.

The Africa Scan provides an overview of ICT solutions in the agricultural sector in Africa, identifying reasons for their success and the potential for them to be scaled up. These success factors emerged from studying examples of ICT use that are described in more detail in the full report, such as:

- Using ICT to bring together multiple stakeholders in the Kenyan agriculture sector – DrumNet
- SMS-based services developed by Zambia’s National Farmers’ Union
- Sissili Vala Kori – farmers’ use ICT to share new production, processing and marketing skills in Burkina Faso
- A mango traceability system linking Malian smallholders and exporters to global consumers
- Index-based agriculture insurance on agricultural inputs in Kenya – Kilimo Salama
- Using ICT to improve forest governance in Liberia – LiberFor
- Mobile technology as a “Game Changer” in South Africa – MXit
- Mobile technologies used by GSMA as an initiative to alleviate food

security related problems – mAgri

- Seeing is believing – unlocking precision agriculture in West African smallholder communities with very high-resolution imagery

The reasons for success identified in these examples are:

- Real economic value was added either because of savings resulting from the use of ICT or an increase in revenue or profitability.
- The language and medium used to communicate with the farmers were important contributing factors in the farmers’ response to the programme.
- Good conceptualization and execution was achieved by including multiple stakeholders in win-win partnerships.
- Trust was built with stockists, support centre operators and the government by using local champions as facilitators. This is an essential element for success in any project.
- Projects were often augmented by bundling many services together with the basic or original facilities to make them truly comprehensive.
- A government-recognized body used to implement a project provides the initiative with added credibility.
- Where mobile phone reception and signal coverage issues were problematic,

local alternative media uses emerged to circumvent the problem.

- Additional faith and trust in the system are created when a solution is developed locally.
- Community members find it particularly useful if farmers are directly involved in training and can demonstrate a solution.
- By increasing the scale at which knowledge and new techniques can be applied, and by reducing transaction costs, ICTs help to create sustainable business models, based on the private sector.
- In instances where farmers were able to identify personally with a technology solution they were more inclined to adopt it and continue to use it.
- In areas of low literacy and low ICT penetration rates, use of an appropriate medium was important to the success of the venture.
- It is important to establish a long-term interest and commitment amongst all those involved.
- In the precision farming case study, the adoption of satellite technology resulted in lower operational costs and increased yield.

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CASE STUDIES

Here we focus in depth on two major opportunities for increased use of ICT identified as key areas for a rapid increase in agricultural production.

These are, first, the improved traceability of livestock and products and, second, the increased efficiency of irrigation of crops.

ICT as a potential tool for increased traceability of livestock

Livestock production is the most widespread and generally practised agricultural activity on the African continent. If, as a result of intensified use of ICT in improving the efficiency of livestock and meat production in selected African countries, significant increases in production are possible at affordable cost and these methods are relatively easy to duplicate in areas with diverse natural landscapes, the potential for general increased wealth creation in all parts of the continent could be enormous.

The Namibian Livestock Identification and Traceability System (NamLITS), was studied in depth (see

Box 1). In this system official identification is done by means of animal identification devices as required by international standards. Both radio frequency identification (RFID) for automated data input and a visual plastic ear tag that supports remote pastoral production where there is limited or no technological support, are used. As a backup system, branding of animals will continue. Eligible cattle are tagged as part of a specific campaign and further tagging takes place during annual vaccination campaigns or community visit-based surveillance activities. In cases where handling facilities are in disrepair, mobile crush pens are used.

Box 1 next page →

Box 1

Namibia: Livestock traceability systems unlock wealth along the value chain

The results of the in-depth investigation in Namibia revealed that:

- The traceability systems employed by the commercial farming community and its downstream role players have unlocked wealth along the entire value chain;
- The experience gained by the commercial livestock sector can serve as a valuable platform to roll out traceability systems in under-developed rural areas where livestock production is heavily relied on to sustain the people;
- New, streamlined traceability systems which have recently been developed allow a wider spectrum of functions to be included so that many additional services can be rendered;
- The co-ordinated extension of comprehensive systems of traceability can improve the lives of multitudes of poor people and the long-term sustainability of the entire livestock industry. This has the potential to positively affect the economy of the country at large;
- The capital and operational costs involved in the roll-out of such a comprehensive traceability programme are relatively low compared to the benefits which can accrue to the livestock industry, the respective role players in the value chain as well as the government of the country;
- An enabling environment should be created by the government and all other interested parties to ensure maximum efficiency of an advanced traceability system;
- Should international organizations involved in the provision of aid funding wish to make a contribution of note to Namibia, consideration should be given to concentrating their funding efforts on the provision and maintenance of a comprehensive traceability system;
- Traceability systems can be rolled out in many other African countries where they can be expected to bring about similar wealth creation, but an enabling environment must be created first;
- Investment in the intensified use of ICT can offer more advantages than investment in possibly any other interventions that may be considered.

Intensified utilization of ICT for increased irrigation efficiency

It has been demonstrated in many areas of the globe that using good irrigation techniques can increase the efficiency and profitability of crop production as much as a hundredfold. Efficient irrigation practices provide a consistent moisture supply to crops, water deficiencies can be overcome during periods of drought, more than one crop cycle per year can be achieved and the effective use of all production resources can be improved dramatically. The pressure on the diminishing water resources can also be alleviated and, as a result, more land can be put under irrigation. The increased utilization of ICT could have a positive effect on irrigation efficiency.

Egypt depends almost exclusively on the Nile River for its water supply. Of this, 85 per cent is used for irrigation. Two separate aspects of the use of ICT in managing irrigation are highlighted through the case of Egypt. The first of these is an Integrated Water Resource Management Action Plan which the Ministry of Water Resources and Irrigation in Egypt has been implementing in response to the increasing demand for water while the options for increasing supply are limited. It is being implemented on more than 2,000 km² in the Nile Delta, covering the command of two main canals, Mahmoudia and Mit Yazid. The project aims at

improving the management of irrigation and drainage and increasing the efficiency of irrigated agriculture water use and services.

The plan aims to improve irrigation and drainage systems and the water management institutional structure. The first phase of the project has resulted in crop yield increases of 20 per cent, with drainage estimated to account for 15-25 per cent of this increase. A further benefit is the re-use of drainage water.

A second type of intervention is illustrated by the Magrabi Farms area which was a green-fields operation and has been developed from actual desert to the 8,500 acres that are now fully irrigated and underpin an export-oriented agribusiness. Magrabi exports produce to 38 countries. Magrabi is an ideal example of the development of a full-scale, economically sustainable unit that has used technology in order to reach its current status. They are completely independent in terms of being able to conduct all the functionalities required for good soil, water and multi-cropping management. There are fully equipped laboratories on the farm that form part of an integrated quality control programme and the whole complex has a fully-integrated, reticulated irrigation system which is managed by an

irrigation engineer. All water passes through filters and all bypass water is tested for purity as fertigation, i.e. application of fertilizers, is a normal practice. Efficiency of water usage is continuously

monitored. An on-site weather station, for temperature monitoring and evaporation pans to determine moisture loss, is used to facilitate the correct irrigation scheduling.

Box 2

Egypt: ICT use increases irrigation efficiency

In-depth investigation in Egypt shows that:

- Existing ICT systems employed by some of the commercial farming community in large-scale irrigated farming operations have increased the efficiency of water use and generated larger profits;
- The experience gained by the large and small-scale commercial irrigation sector can serve as a valuable platform for even more comprehensive ICT systems. Many more agrarian communities in Egypt can be reached and this will contribute towards the improvement of living standards;
- The intensified use of ICT can offer government organizations opportunities to diversify their services to all communities involved with irrigation farming;
- The capital and operational costs involved in the roll-out of a range of ICT-based functions are relatively low compared to the large benefits expected;
- The enabling environment which the government and all other interested parties create to ensure efficient use of irrigation water, can serve as an example to other countries;
- International aid organizations could make a serious contribution to Egypt by focusing funding efforts on the intensification of ICT-based irrigation systems;
- The systems can also be rolled out in many other African countries and can be expected to bring about a similar magnitude of wealth creation, provided that an enabling environment can be created;
- Investment in the intensification of the use of ICT for the improvement of crop production under irrigation, can offer more advantages than investment in most other areas.

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RECOMMENDATIONS

The following recommendations aim to assist policy makers, regulators and the donor community to:

- Gain insight into the benefits of ICT led interventions in their respective countries or regions;
- Implement interventions that would have a tangible outcome;
- Develop multi-country cooperation and best practices; and to
- Prioritize interventions that would be most beneficial

Recommendations for policy makers and regulators

RECOMMENDATION ①

Create partnerships with the relevant stakeholders

In many African countries, synergies between the different parties in the agricultural value chain are not exploited optimally. Hence, forums need to be set up to encourage dialogue, interaction and promote knowledge related to use of ICT in agriculture, such as the World Bank's ICT in Agriculture eSourcebook. Specific partnerships should be identified and be built

between stakeholders for identified eAgriculture projects with targeted outcomes, working with established partners, such as NEPAD or CAADP. These partnerships can play an invaluable role in the research, planning, problem solving, review of operations and in training relevant government officials and staff in the use of ICT in agriculture.

RECOMMENDATION ②

Establish an agricultural hub

Leadership, communication and creative thinking are required to initiate and sustain eAgriculture projects that will have a significant impact. A purpose-built

management and support structure would enable communication between private sector and government and drive the strategic agenda of the state.

Designed to be non-bureaucratic and nimble, an agricultural hub would drive agricultural diversification, mega projects including eAgriculture projects, and initiate and coordinate

opportunities in the agricultural sector. These eAgriculture projects would in turn stimulate commercialization, diversification and job creation.

RECOMMENDATION ③

Implement legislation and regulations to govern specific opportunities

Legislation and regulations relating to ICTs must be revisited, to ensure that, amongst other concerns, information security is protected, the cost of communications infrastructure (e.g. broadband) is reduced and ICT infrastructure is accessible even from remote rural areas. Some programmes,

such as national irrigation schemes and traceability programmes, may require new, strong legislation and regulation. National legislative bodies together with Ministries of Agriculture and Ministries of Communications need to coordinate to ensure timely enactment of laws and regulations.

RECOMMENDATION ④

Consider adoption of traceability systems at a national level

Traceability systems have the potential to bring about an observable improvement in the well-being of large numbers of people on the African continent as export markets can be created when traceability systems are implemented correctly. Systems should address full traceability, from first contact to

market destination, since systems that do not cover the whole lifecycle create gaps in traceability, which may be detrimental to the industry and the consumer. It is essential that legislation and regulations are enforced and will also apply to other agricultural products.

RECOMMENDATION 5

Empower women in agriculture

In Africa, women perform 65 per cent of all activities within the agricultural sector. Not only do these women often have little access to finance, but also they have little free time to devote to their own interests or to rest and are physically at a disadvantage. Women in rural communities, and particularly those moving from subsistence farming to small-scale farming, can benefit greatly from ICT as these can save time and physical effort and equal access can be monitored.

Governments need to provide incentives to telecommunications service providers to expand money transfer services to rural communities as these enable rural woman to have more autonomy over their finances. Content providers need to provide health, nutrition and educational advice on eAgriculture web pages. Active monitoring of eAgriculture programmes by government is necessary to assess the degree to which these programmes take the interests of women into account.

RECOMMENDATION 6

Implement irrigation solutions in Africa

ICT can be used to reduce water consumption significantly using modern irrigation techniques and as a result enhance the quality and productivity of land and eventually increase farmers' incomes. Since technology that

has been used for a number of years in Egypt with great success may still be deemed as "new" in many other African countries, consulting with and learning from experts and those with extensive experience in ICT is recommended.

RECOMMENDATION 7

Implement integrated eAgriculture plans

Implementation of a comprehensive, integrated, long-term eAgriculture Plan for each country should involve all stakeholders and hence increase stakeholder ownership, bring about

economies of scale, and ensure that there is political and executive commitment to eAgriculture with the necessary budgetary allocation. The plans facilitate the design of single technol-

ogy frameworks for each country into which new hardware and software components, addressing different functionality and features, could slot. Single-window services and one-stop-shops naturally result from such plans.

There is also a need to strengthen African research and training institutes in the agricultural and environmental field, including those that play a role in monitoring climate change.

Recommendations for donors

RECOMMENDATION 8

Develop self-sustaining funding solutions

Since eAgriculture ventures, particularly those taken up by communities, must be sustainable beyond their initial funding periods, it is necessary that strong business models exist and that the community members can benefit directly. Some jobs related to eAgriculture can be

filled by local people and creating these jobs would address the rural brain drain to some small extent. Donors should publish the fact that a description of viable plans for ultimately making a project self-funding is one of their funding application's evaluation criteria.

RECOMMENDATION 9

Focus on community ownership

Well-established community ownership assists projects to survive after donors move on and reduces long-term dependency on an external champion. Thus, programme designers and implementers of community-based projects should include community members

in decision making early in the project and progressively hand over leadership and operation of the project to them. As community owned projects are often resource-scarce, it is best to adopt approaches that make adequate use of the existing infrastructure.

RECOMMENDATION 10

Make eAgriculture technology robust and accessible

Systems are only valuable if they are used, but this can only occur in eAgriculture projects if the end users find the systems easy to use and the technology is cheap, available, reliable and can be run off-line when necessary. Backup and disaster recovery plans, as well as alternative work processes that can easily be linked into the primary system, need to be implemented so that systems are useable even if there is some failure of the technology. Systems designers and developers need to design system access through commonly

available technology devices, such as mobile devices, and include alternative communication options in order to include the largest possible number of end users. Voice is often a better option than text because users are often not fully literate. Multi-purpose telecentres not only allow internet and ICT access but are important centres for learning, listening and stimulating ideas. Initial donor financial support is needed until the number of users reaches a critical mass.

RECOMMENDATION 11

Build human capacity in rural communities

Rural communities urgently need basic education opportunities, including basic farming skills and business management skills. Complete reliance on eEducation is not recommended in communities made up primarily of smallholders or subsistence farmers but the internet can be a very valuable resource for the teachers who provide

classroom tuition. Donors and funders are urged to ask for an educational use component to be made a funding eligibility requirement for all projects. A good model here is the African Leadership in ICT (ALICT) component of the Global eSchools and Communities Initiative (GeSCI), based in Nairobi, Kenya.

RECOMMENDATION (12)

Encourage environmental responsibility through country agriculture strategy maps

Country specific agriculture strategy maps, using a variety of ICT tools but primarily imaging tools such as GIS and satellite technologies, can be used to encourage environmentally responsible farming as well as commercially astute practices. Donors are urged to

assist in developing the eAgriculture plan recommended to policy makers and regulators in Recommendation 7 above by providing access to the necessary technology and international experts required for developing country specific agriculture strategy maps.

Further reading

CAMPAIGNE, J. and RAUSCH, T.

(2010) “**Bundling development services with agricultural finance: the experience of DrumNet**”

Innovations in Rural and Agricultural Finance, Focus 18, Brief 14, International Food Policy Research Institute and The World Bank

http://www.ifpri.org/sites/default/files/publications/focus18_14.pdf

ECONOMIC COMMISSION FOR AFRICA and THE AFRICAN UNION

(2009) *Economic Report on Africa: Developing African Agriculture through Regional Value Chains*

United Nations Economic Commission for Africa

http://www.uneca.org/era2009/ERA2009_ENG_Full.pdf

GAKURU, M., WINTERS, K. and STEPMAN, F.

(2009) *Inventory of Innovative Farmer Advisory Services Using ICTs*

The Forum for Agricultural Research in Africa

http://www.fara-africa.org/media/uploads/File/NSF2/RAILS/Innovative_Farmer_Advisory_Systems.pdf

KORA, G. and KASSEM, M.

(2010) *The Application of Information and Communication Technologies in Agricultural and Rural Development in Egypt*

Food And Agriculture Organization of the United Nations, Rome

<http://www.fao.org/docrep/013/i1930e/i1930e00.pdf>

QIANG, C., KUEK, S., DYMOND, A. and ESSELAR, S.

(2011) *Mobile Applications for Agriculture and Rural Development*

The World Bank

http://siteresources.worldbank.org/INFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/MobileApplications_for_ARD.pdf

WORLD BANK

(2011) *ICT in Agriculture sSourcebook - Connecting Smallholders to Knowledge, Networks, and Institutions*

The World Bank, *infoDev* and ARD

<http://www.ictinagriculture.org>

www.eTransformAfrica.org

Publications for eTransform Africa include the Summary Report, Main Report which includes an overview chapter and summary chapters of the full reports, and the full reports themselves covering the following sectors and cross-cutting themes:

Sectors themes:

- Agriculture
- Climate Change Adaptation
- Education
- Financial Services
- Modernizing Government
- Health

Cross-cutting themes:

- Regional Trade and Integration
- ICT Competitiveness

For a more detailed presentation on the role of ICT in agriculture in Africa, see the full eTransform Africa sector report: <http://www.etransformafrica.org>.