

Chapter 5

ICT and Youth in Agriculture

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KEY MESSAGES

ONE

While the agricultural sector is traditionally not very popular among youth in Africa, notably because it lacks policy support, ICT innovations are contributing to improving its image. They advance value chains, providing new employment opportunities, and attract more young people to the sector.

TWO

Facilitating cheaper and more reliable access to ICT devices and connectivity is needed to accelerate ICT adoption among youth in agriculture, especially young farmers and agripreneurs. Efforts in this field must go hand in hand with increased capacity building in ICT use, tailored towards agribusiness development.

THREE

ICT entrepreneurship and innovation development in the agricultural sector is a recent development that offers new employment opportunities to African youth. It needs to be further promoted in all African countries and needs multi-stakeholder support to strengthen its profitability and effectiveness.

FOUR

African agricultural educational institutions should include or strengthen courses on ICT innovations in their curricula. This is essential to nurture a generation of young agriculturalists fully prepared to take advantage of ICT innovations in their professional career after graduation.

FIVE

There is a need to strengthen ICT use in agriculture by public and private institutions through awareness creation and capacity building. This involves improving equipment in ways that enhance work environments and make them more conducive to innovations by youth in agricultural professions.

Introduction

For a large proportion – more than 65% – of the inhabitants of sub-Saharan Africa, agriculture is the main economic activity and source of livelihoods. Presently, it contributes about 32% of the region's GDP (Oluoch-Kosura, 2013). Furthermore, due to the current structure of the economies of many SSA countries, it remains an important and a viable sector for development and prosperity.

Even so, agriculture and food production in Africa still largely rests on subsistence farming by smallholders, who are responsible for up to 90% of the food produced on the continent (Wiggins and Keats, 2013). Many of these farmers produce under rain-fed conditions in areas dominated by degraded lands – and being made less productive by climate change – with limited or no access to such vital inputs as robust, higher yielding seed, and chemical fertilizers that can improve soil fertility and increase production (Livingston, et al., 2011; Wiggins and Keats, 2013). Smallholder farmers in Africa also have low access to agricultural technologies that could enhance their production capacities, as well as reduce pre- and post-harvest losses through proper processing and storage. In addition, because of their poverty levels, smallholder farmers often lack access to adequate financing for investment in farming as a business, resulting in a vicious cycle of poverty and malnutrition.

These challenges, combined with persistently low levels of government investment in agriculture and rural infrastructure and discriminatory policies that prioritize urban development, have discouraged many young people from appreciating farming as a profession and pushed many youth off the land to seek 'better lives' in urban centers. For many youth, agriculture is seen as a backbreaking, low-output, and drudgery-filled profession that is not lucrative enough and cannot be depended upon for a sustainable livelihood (YPARD, 2011; Montpellier Panel, 2014).

However, in the last 10 years or so, riding on the back of increasing mobile and Internet connectivity in SSA countries, the use of information and communication technologies (ICTs) is changing the agricultural landscape in Africa. It is not only helping to bring more youth back into agriculture, but also retaining young farmers already involved in the sector.

This chapter aims to assess the current status and relevance of ICT use by youth (aged between 15 and 35 years) in the agricultural sector in Africa, with specific focus on the linkages between ICTs and the present realities (benefits) and future trends of youth involvement in agriculture in the region. The inherent challenges and opportunities in providing support for increased ICT use by youth will also be assessed and policy recommendations will be put forward to decision makers and other stakeholders.

Reaffirming the Relevance of ICTs for Agriculture and Youth

This section clarifies the relevance of ICTs in African agriculture and the status of its use in the sector. In

addition, it discusses the rationale underlying the use of these technologies by youth in agriculture.

Diversity of ICTs for agriculture in Africa

ICTs in Africa have conventionally been “based on indigenous forms of storytelling, song and theatre, print media and radio.” But the arrival of modern ICTs – especially mobile technology and the Internet – has changed the way information is shared and the speed of communication all over the continent (Conway, 2012). It has also reduced the cost of accessing information and new knowledge, and is creating many new opportunities in different sectors of African economies, including agriculture (Juma, 2011).

Traditional media, such as radio, TV, print, and video, are still relevant communication channels for

African agriculture. Apart from email and websites, the use of which are becoming commonplace, even in the agricultural sector, modern ICT devices and applications used in agriculture now include computers, tablets, mobile phones, TV, satellites, office software, short messaging services (SMS), social media, geographical information systems (GIS), and drones [the use of which is being explored in some African countries, such as Ghana (Newsghana, 2015)]¹. Not all forms of ICTs are yet fully applicable to agriculture in the African context. Some are more relevant than others based on factors like cost, accessibility, applicability, user profile, and so on.

¹ <http://www.detroitnews.com/story/business/2015/07/06/farm-use-drones-take/29792757/>

Below is a brief discussion of a few prevalent ICT devices and applications (others will be discussed in the section dealing with ICT uses by young farmers and agripreneurs).

- **Mobile phones and SMS:** The mobile phone is now widely used in Africa. The SMS is a messaging service of the web or mobile phones that enables users to exchange short text messages with their devices. SMS is hugely popular, in Africa and globally. Many innovative ICTs for agriculture in Africa are SMS-based²
- **Online TV and videos:** Videos have been traditionally used in Africa to disseminate agro-advisory information, if required in local languages, through a variety of channels. Online videos can be watched on a computer, a tablet, or a mobile phone via websites like YouTube and Access Agriculture³, provided there is good connectivity. Dedicated TV programs for (young) farmers, such as the 'Shamba Shape-Up' TV show in Kenya, are available in some countries.
- **Online radio:** The radio is perhaps one of the most effective ways to pass information (notably in local languages) to farmers and rural households in most developing countries, whether in Africa or elsewhere – provided the content of the message is packaged in an appealing way (Chapman, et al., 2003; Farm Radio International, 2008; Nakabugu, 2001). Agricultural audio files and programs can be downloaded from the Internet on many websites. Similarly, some community/rural radio stations that broadcast agricultural programs (among others) are providing online streaming (Ndiaye and Lohento, 2008).
- **Office software:** This refers to applications used to process text or analyze data, such as Microsoft's Word and Excel programs; OpenOffice Writer and Calc; and Apple's Pages and Numbers. Text editing software and spreadsheets are particularly useful for young farmers as they are widely available, sometimes embedded in new computers, can be free of charge and are indispensable for efficiently processing production data and finances. Still, in rural areas, many young farmers lack the literacy needed for them to use these basic tools.
- **Social media:** These can be defined as electronic information and communication platforms that enable users to easily create and disseminate content on digital networks and engage in interactive communications (Kaplan and Haenlein, 2009). Social media platforms like Facebook and Twitter are very easy to use and have become effective information-sharing tools for tech-savvy farmers, especially youth.
- **Blogs:** These are now widely used as primary external institutional communication platforms, and are easily created and published on freely available platforms⁴ when agricultural institutions cannot afford the time or cost of creating a proper website. Such social media tools are increasingly used as business promotion platforms (for example, in the marketing of agricultural products).
- **GPS and GIS:** Geographic information systems (GIS) enable the capture, analysis, management and display of geographical and spatial information (Maliene, et al., 2011). They can include the use of GPS (Global Positioning System) receivers, which connect to satellites to facilitate access to locations. The GPS has been notably beneficial to agriculture in monitoring climate variability, and for providing current weather forecasts for early warning systems that guide decision-making by farmers and relevant government agencies (Pearson, 2012). Digital cameras and mobile smartphones are now commonly embedded with the GPS technology.

This report will not discuss the use of traditional ICTs, such as off-line radio, TV, video, and printed newspapers. Rather, it will focus on the advent of more recent ICT devices and applications that are bringing new opportunities and challenges.

ICT development and status in Africa

The use of ICTs in Africa (the mobile phone and the Internet specifically) has consistently advanced over the last ten years. The number of people connected to the Internet via fixed or mobile devices is increasing rapidly. African farmers, especially the youth, have not been left out of this ICT explosion. The percentage of individuals using the Internet grew from 10% in 2010 to almost 20% in 2014 (ITU, 2014).

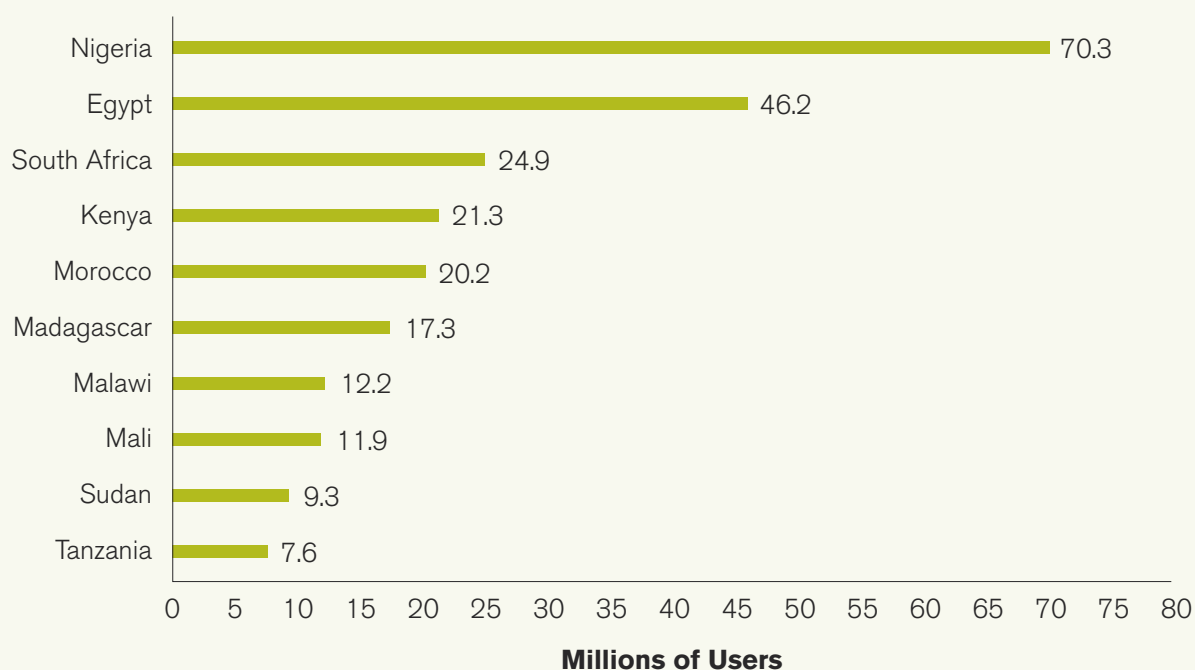
From a 2% penetration rate in 2010, mobile broadband penetration has grown to about 20% in Africa. Furthermore, by the end of 2014 mobile phone subscriptions reached about 69% in Africa according to the same International Telecommunications Unit (ITU) report cited in Figure 1. In 2014, there were 754 million mobile connections across SSA, served by over 35 mobile operators (Macharia, 2014). Africa Renewal,

² Currently in Africa, many mobile messaging services are actually based on the technology called USSD (Unstructured Supplementary Service Data) which may look similar to SMS for the non-technical user.

³ <http://www.accessagriculture.org/>

⁴ Free platforms such as www.blogger.com, www.wordpress.org, etc.

Figure 5.1 Africa's top 10 Internet countries, Q2 2014



Source: Adapted from internetworldstats/stats1.htm

an Africa-focused United Nations publication, reported an expected subscription level of 1 billion by the end of 2015 (Sambira, 2013). Ghana and Seychelles, for instance, have mobile subscription penetration rates in excess of 100% (Macharia, 2014). However, the number of subscriptions is not an accurate representation of the actual number of people who own mobile devices (many people own several SIM cards), but it does reflect the increased accessibility of mobile phones and other devices (e.g., tablets) across all population groups.

At the center of this ICT boom is increased affordability spurred by a proliferation of cheaper mobile phones, increased mobile and Internet infrastructure coverage (including in rural areas), decreasing access rates, and a growing market of ICT applications and content platforms (Deloitte, 2012).

Even so, it must be noted that the cost, and therefore the penetration, of these ICTs are still beyond the reach of a lot of rural dwellers and many agricultural stakeholders in Africa.

ICT Potential for Agriculture Along the Value Chain

ICT potential is discussed here in relation to four specific aspects of the agricultural value chain:

1) input supply and production;

3) marketing and trade;

and 4) access to financing that supports value chain activities.

Input supply and production

ICTs have the potential to increase farm productivity by supporting the efficient use of key resources like water, fertilizers, and land (Deloitte, 2012). Farmers can now use ICT tools to manage their farming activities, from crop selection to the monitoring of production (World Bank, 2011).

Instead of waiting for periodic agro-advisory services from overstretched extension agents, African farmers and

agripreneurs can now obtain needed information, such as weather forecasts and output market prices, directly on their phones. ICTs are also used to find the best locations and prices of such inputs as seed and fertilizers. In Nigeria, for example, the government's e-wallet program, which leverages farmers' access to mobile phones, enables farmers to obtain subsidized inputs that raise their productivity (Iboma, 2014; Okuseinde, 2014).

Box 5.1 Nigeria's e-Wallet for agro-inputs program

Under Nigeria's e-wallet for agro-subsidies program, "farmers received subsidized seed and fertilizer vouchers on their mobile phones – or e-wallets – which they use just like cash to buy inputs directly from the agrodealers. Within one year, the e-wallet reached a total of 1.7 million farmers. Fertilizer companies sold USD 100 million worth of fertilizers directly to farmers, instead of the government. Seed companies sold USD 10 million worth of seeds directly to farmers. Banks lent USD 20 million to seed companies, fertilizer companies, and agrodealers. The default rate under the scheme was zero percent... (and) targeted farmers produced an additional food supply of 8.1 million MT, which was 71% above the target set for the program in the first year."

Source: Adesina/IFAD 2013

Box 5.2 ICTs, youth and agriculture – Quick Facts

- 1.1 billion – estimated population of Africa
- 35% – proportion of total African population classified as youth (aged 15-35 years)
- 364 million – number of African youth aged 15-34 years
- 10 million – minimum number of African youth entering the labor market each year
- 65% – percentage of Africans engaged in agriculture
- 60% – percentage of unemployed youth in Africa
- 69% – proportion of Africans with a mobile phone subscription as of 2014
- 90% – percentage of young farmers using ICTs for agricultural activities (based on a survey done in western Kenya)

Source: UNFPA (2010), UNDP (2012), PRB (2013), IICD (2013), ILO (2013), ITU (2014b), Montpellier Panel (2014), AUC (2015).

Post-production – processing and storage

ICTs are also important to agriculture at the post-production stage. ICTs are employed at the processing stage in product identification and differentiation, smart packaging for appeal, and labeling and traceability to address food quality and safety concerns. Technologies like radio frequency identification (RFID) tagging are used for tracing and accessing ecological footprints in livestock production.

ICTs have also helped prolong the shelf life of products through proper storage. They underpin warehouse receipt and commodity exchange systems, in which farmers deliver produce to a warehouse just after harvesting, to prevent deterioration and to provide adequate time to get more favorable prices. Warehouses in such systems depend on ICTs to manage products and inventories, record movements, handle grading and sorting, and to develop consistent valuation methods for the products (Deloitte, 2012; CTA, 2013a).

Marketing and trade

One of the most prevalent uses of ICTs by African farmers is for marketing. They use ICTs to determine current market prices and gain access to markets, to bargain and conduct transactions, and to send and receive money. Having up-to-date market information on commodity and input prices, as well as demand trends, boosts farmers' negotiating positions and informs decisions about when and where to buy and sell, what to produce, and the quantity and quality of future production (Stienen, et al., 2007).

ICTs help farmers to improve marketing logistics and reduce transportation costs. This increases profitability by facilitating farmers' capacity to organize themselves into groups to achieve and leverage economies of scale. Aggregation of produce by farmer groups results in the marketing of larger volumes, which can improve access to bulk buyers and increase collective and individual profits (World Bank, 2011).

Many ICT applications that help farmers connect to markets abound in Africa. Examples include Esoko in Ghana and other countries, e-Soko in Rwanda, Google

Trader and Infotrade in Uganda, M-Farm and OLX in Kenya, and nanoCredit in South Africa.

Access to finance

One of the challenges with which African farmers have always had to cope is inadequate access to finance for purchasing inputs and to expand or commercialize their farms. ICTs provide novel means to access and manage agricultural finance (Babcock, 2015). Existing platforms include Mobis⁵, Musoni System⁶, Agritech (Farmer Mobile Wallet)⁷ and Mobipay.⁸ These solutions help smallholder farmers to mobilize credit through savings and credit societies, or by connecting farmers directly with funding organizations and investors. Fundraising from the general public via ICT platforms, dubbed 'crowdfunding', is also penetrating the African agricultural sector. Operated notably through Internet platforms such as Kiva,⁹ this practice is emerging as an innovative alternative modality to mobilize agricultural finance. This trend was discussed and documented during the international conference "Revolutionizing Finance for agri-value chains" (Fin4Ag), organized by the Technical Centre for Agricultural and Rural Cooperation (CTA) and its partners in Kenya in 2014¹⁰.

In the case of the e-wallet program in Nigeria, ICT access enables farmers registered in the scheme to obtain vouchers that provide a 50% subsidy for their input purchases (Iboma, 2014). ICTs make it easier for lending institutions to access farmers' credit history – from sources such as banks, SACCOS, and public registries – through the credit information sharing system (CIS), which can guide lending decisions (CTA, 2014). ICTs also increase farmers' access to agricultural insurance schemes and make it easier to verify claims for weather-related losses (World Bank, 2011).

Warehouse receipt systems and commodity exchanges referred to previously are also making increased use of ICTs, which is strengthening their performance and benefiting farmers and agrodealers, as well as those who operate the systems. Other crosscutting uses of ICTs in agriculture are related to records management and the management of farmer organizations.

Linking ICTs, Agriculture and Youth

ICT and youth

"The increasing adoption of ICTs in everyday life and the growing digital marketplace for goods and services are creating opportunities for youth that transcend traditional paradigms. Young people can now find and carry out work, launch their entrepreneurial endeavors and even get paid via their cell phone" (ITU, 2014b). These are views expressed by the International Telecommunications Union, the arm of the United Nations responsible for gathering information on global ICT status and indicators. For an increasing number of young people, ICTs have enabled key connections to markets, training opportunities, and capital, and provide an effective gateway to entrepreneurship and improved livelihoods (UNDESA, 2013).

Thirty percent of those under the age of 25 (globally) use the Internet, as compared to the 23% of those

over 25 years (ITU, 2011). Going by Facebook and other social network statistics, a sizable proportion of those over 25 who use the Internet are 'older youth' between the ages 25 and 35 (Sambira, 2013). Young people are pioneers and innovators relative to many ICT trends and applications. Because of their tendency to seek out new things, they are often early adopters of technologies and digital natives.

This global phenomenon is no different in Africa, where young people are well represented on the 'local' ICT applications landscape. Indeed, African youth are playing a vital role in the ICT revolution on the continent through the creation of various innovative ICT solutions, as the rest of this chapter will exemplify.

⁵ <http://ensibuuko.com/>

⁶ <http://musoni.eu/>

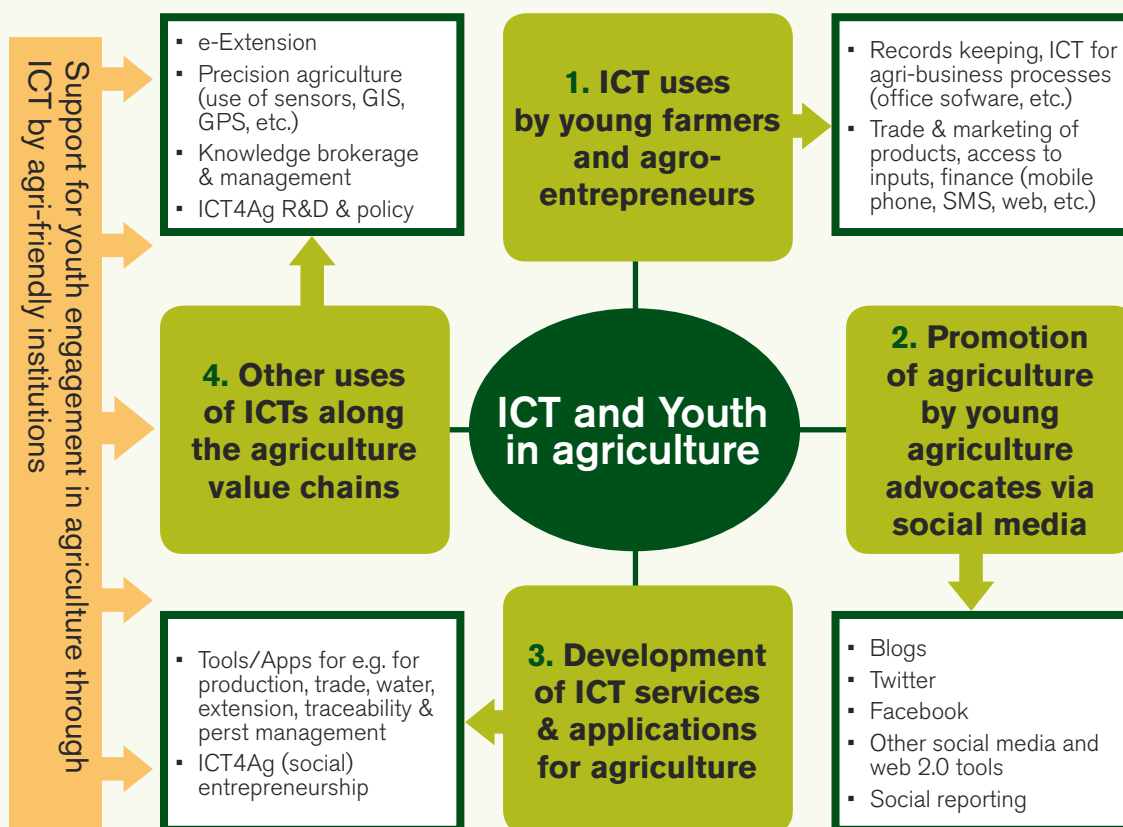
⁷ <http://www.agriculturetechnologies.org/>

⁸ <http://mobipay.co.ke/>

⁹ www.kiva.com

¹⁰ <http://bit.ly/crowdfunding-cta>

Figure 5.2 Framework for engaging youth in agriculture through ICTs



Source: ARDYIS Project

ICT and youth in African agriculture

Over 35% of the current African population is between the ages of 15 and 35, which is the youth age range according to the AU charter (AUC, 2006 and 2015). According to ILO estimates (ILO, 2013), 60% of Africa's unemployed are youth.

Agriculture presents a viable means to get many young people engaged economically. Even so, over the past few decades a growing number of youth have abandoned agriculture and farming because of its low productivity, its persistent negative image, the unappealing characteristics of rural areas, and other challenges in Africa (Montpellier Panel, 2014).

The advent and growing use of ICTs in agriculture, however, is helping to improve the image of agriculture,

and an increasing number of youth now see agriculture in a new light. In a study on "Youth, ICT and agriculture" conducted in western Kenya, researchers found that the application of ICT tools and skills by young farmers to their farming businesses generally increased their yields, incomes, and more importantly, their social status (IICD, 2013).

In addition, youth are now envisioning diverse roles that they can play to contribute to the promotion and enhancement of the sector (CTA, 2012a). ICT applications in agriculture are giving rise to a new generation of tech-savvy young African agripreneurs who now see farming as a business venture (rather than as a way of life) and have the ability to learn improved practices with just a click (Ajilore 2014).

Current uses of ICT by youth in agriculture

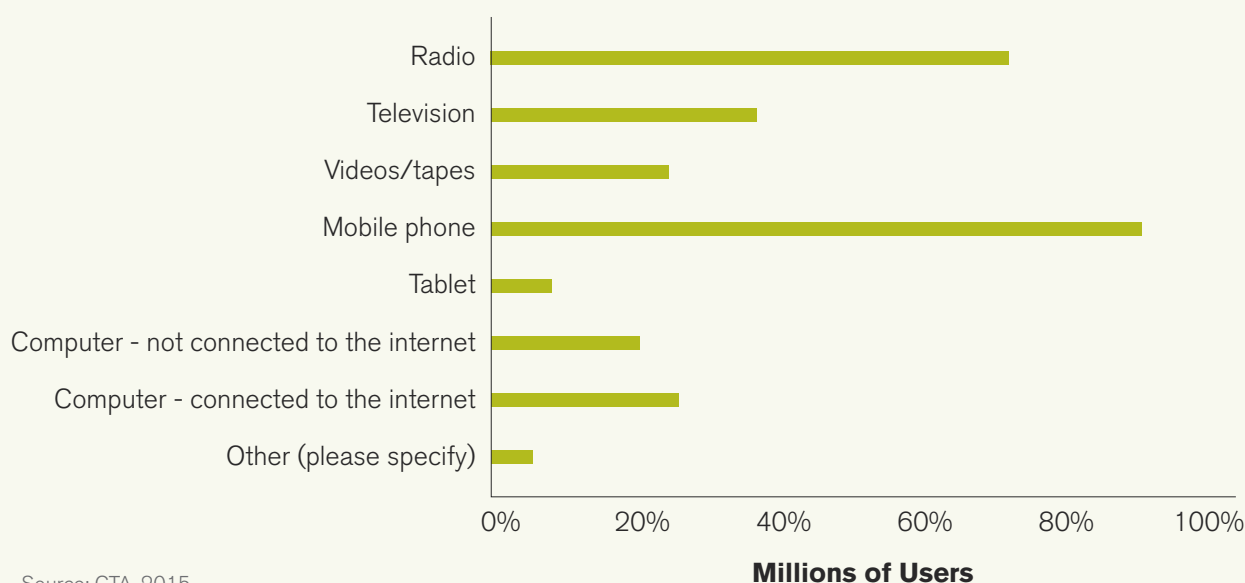
Youth are using ICTs in agriculture in a variety of contexts. In the framework of the CTA initiative "Agriculture, Rural Development and Youth in the

Information Society" (ARDYIS), which focuses on ICT and youth in agriculture¹¹, ICT use has been classified into four categories, as illustrated by in Figure 5.2.

¹¹ More information <http://ardyis.cta.int> - This program recently won a United Nations Prize for its work on youth and ICTs

Figure 5.3 Uses of ICTs by young farmers and agripreneurs in Africa

What communication devices do the farmers you work with use for their agricultural activities?



This framework appears comprehensive and the analysis presented here builds on it. The use of ICTs by farmers and agripreneurs, as well as the promotion

of agriculture via social media, are the most prevalent forms of use, and these are discussed in more detail below.

Some general observations

An online survey done by CTA, in part to inform this report, examined how young farmers and agripreneurs in Africa are using ICTs, the challenges faced, and the available opportunities. The research targeted two categories of stakeholders: first, young farmers and agricultural entrepreneurs who can individually use ICT, and second, institutions working with them (farmer organizations and other institutions, such as associations and NGOs)¹².

Figure 3 presents key insights on the variety of ICT tools used for agricultural activities and the importance of each tool. This information comes from organizations working with young farmers and agripreneurs. About 92% of them use mobile phones, 73% use radio, and 27% use computers connected to the Internet.

It appears that, in absolute terms, mobile phones are taking over radio as the most important communication

device used by young farmers. The mobile phone is also used as a means to access FM radio frequencies and more rarely to access the online radio. More 'traditional' channels, such as television, videos, and newspapers are still widely used. A growing number of young farmers and agripreneurs use smartphones.

We will now examine the use of these tools in key agricultural activities of young farmers and agripreneurs. Apart from insights from this survey, several other sources and references will be called upon.

Record keeping – Young farmers/agripreneurs use Microsoft Office applications like Excel and Word for keeping records of their production activities, timelines, costs, revenues and profits. They may not need much training before using ICTs in that context. Although access to, or ownership of, a computer is necessary and can be a challenge, there are increasing possibilities to use

¹² The survey "ICT and young farmers and agripreneurs in African Caribbean and Pacific (ACP) countries" (CTA, 2015) was launched by CTA in April 2015. It was an online research effort. Responses from institutions working with youth offer knowledgeable information of the situation of young farmers and agricultural entrepreneurs, both in rural and urban areas. Responses from youth themselves offer very good pictures of issues faced by digitally literate young farmers and agripreneurs. Some 586 responses were received in total and 94% came from Africa. About one-third of respondents were organizations. Only responses in English from organizations supporting young farmers and agripreneurs in Africa have been analyzed in this document (but responses in French provide largely similar conclusions). There were 288 organizations that responded in English. The full report of the research will be available later in the year

Case Study: Use of ICTs by IITA Youth Agripreneurs (IYA)

The IITA Young Agripreneurs Program was designed by IITA to train and engage willing young people in modern farming practices and agribusiness. The program started with a group of young graduates – Nigerian national youth corps members – who chose to use their one-year mandatory youth service to develop modern farming skills and are now practicing as farmers and agricultural entrepreneurs. In an interview with a female leader of the group, Evelyn Ohanwusi, she said that for her and the members of the group, ICTs make agriculture interesting and easier; they make getting things done more cost-effective and provide access to needed information.

The IYA also uses ICT devices to “...capture data; develop databases for (their) value chains, ranging from production through marketing and sales; and to aid online marketing and capacity building.” Moreover, through ICTs like social media the IYAs share knowledge and experience with other young people interested in agriculture, and the group later trains some of the new would-be agriculturists.

Source: Authors (based on personal interview with Evelyn Ohanwusi of IYA)

Case Study: Use of ICTs by Savannah Young Farmers' Network (SavaNet), Ghana

Founded in 2009, the mission of the Savannah Young Farmers Network (SavaNet, www.savanet.org) is to accelerate Ghana's agricultural growth through the development of a vibrant youth component in the agriculture sector that spearheads productivity across the agricultural value chain.

For **record keeping**, literate young farmers in the network use Microsoft Excel and spreadsheet applications, videos, pictures, and audio recordings. Information records relate to farmland size, farm locations, type of crops and animals produced, prices for crops and animals at various marketing centers (especially those with favorable prices), venues for farmer meetings, times of planting, times of harvesting, yields, and production inputs used (e.g. seeds, fertilizer, capital invested during a production cycle, farm labor, etc.). Record keeping using ICT facilitates automation of business information analysis, as well as the ability to keep farming data for several years.

To improve agricultural extension services, SavaNet provides an **audio-conferencing platform** where farmers can call in to get the latest relevant agricultural production information. Traditionally, meetings would be held in person, requiring farmers to leave their farms to attend the sessions. With the dial-in platform, farmers are able to call from anywhere – home, the market, or from the field. In addition to the audio conference platform, SavaNet has a podcast series focused on topics that directly benefit farmers. SavaNet also has an agricultural GPS data service for farmers who want to better understand the geography of their farms.

In addition, SavaNet works to improve farmers' market access by **providing market prices through SMS**. In collaboration with Ghana's Ministry of Food and Agriculture, SavaNet aggregates the early morning prices from local markets and then sends them to interested farmers via SMS. This helps farmers to get the best prices, instead of being cheated by unfair middlemen or bargaining shoppers.

Source: Pers. Comm. between Moses Nganwani Tia, the leader of SavaNet, and authors of this report

computers in a shared environment, such as telecenters, or through the facilities of an agricultural organization.

Using ICT for keeping records can have catalytic impacts on small agribusinesses. It should therefore be systematically facilitated for all young rural farmers or rural farmer's networks.

Access to information on inputs and advisory services – By using their mobile phones or the Internet, young farmers/agripreneurs get information on the availability, location and price of inputs. Exploring multiple sources of inputs enables them to make better-informed decisions about where and when to buy (World Bank, 2011). Many young farmers have benefited from inputs via the e-wallet program of Nigeria mentioned earlier. Perhaps more inclined to innovate than their older counterparts, young agripreneurs can use ICTs to get tailored agro-advisory information. The audio-conferencing platform of SavaNet (see case study on SavaNet) is a good example, though it should be noted that many youth in rural areas cannot afford the costs associated with receiving and sending SMS for these purposes.

Marketing and trade of products – The Internet and social media have become highly useful marketing platforms for ICT-savvy young farmers/agripreneurs.

The young Kenyan farmers mentioned earlier in this chapter used ICTs to get market data and modern production information. In an interview with a female leader of the IITA Youth Agripreneurs (IYA) in Nigeria, conducted primarily for this report, she said that ICTs help the IYA in marketing their products and keeping linkages with customers (see IYA case study). The SavaNet case study also illustrates this point. In addition, youth-driven ICT platforms like Mkulima Young in Kenya use such social media as Facebook and Twitter, along with other ICT applications, to create a virtual marketplace where sellers and buyers of agricultural produce interact and conduct transactions (see Mkulima Young case study).

As also confirmed by the CTA online survey, the younger generation of farmers and agripreneurs regularly use social media for marketing and trade of agricultural products purposes. Facebook is very popular in this context and WhatsApp is starting to gain traction among them as part of their business-oriented communication.

More so than older farmers, young producers and agripreneurs use ICTs in innovative ways to connect to markets directly, cut out exploitative middlemen, erase the barriers of distance, make transactions and logistics easier, obtain the best market prices, and increase their profitability (Figure 5.4).

Case Study: Mkulima Young: Facebook farmer, with 52,000 likes

Joseph Macharia is the founder of Mkulima Young, and is known as the '*Facebook Farmer*' by 'ICT for agriculture' (ICT4Ag) experts and other enthusiasts, especially in East Africa. Loosely translated as 'young farmer' (Mkulima means 'farmer' in Swahili), Macharia says: "Mkulima Young is an online platform that engages young people who are interested, inspiring and [using] agriculture to generate income and employment". The platform focuses on assisting youth with three aspects of agriculture: 1) information, 2) market access, and 3) financing. Beyond providing services, Mkulima Young is building a community of young people working in agriculture and creating a space for them to connect.

To inspire and encourage young people to see the economic appeal of agricultural ventures, Mkulima Young tells the stories of 'Mkulima champion', youth who are into agriculture as a business and earning income from it. Also, on the platform there is a specific Q&A section that allows young people to ask questions relating to agricultural production and business, and where both Mkulima Young staff and fellow young farmers with the needed information can respond. Questions can also be submitted via SMS, and there is an organizational YouTube channel with videos on what others are doing.

Last, for the young farmers that come to buy or sell their products, Mkulima Young supports a free online marketplace, which is also integrated with the organization's famous social media presence on Facebook and Twitter. Currently, Mkulima Young has over 48,000 friends on Facebook, over 8,000 Twitter followers, and has produced an android app to facilitate connectivity within the network.

Source: Adapted from (Rahman and Fong, 2015) and interactions with the founder of Mkulima Young

Agricultural Promotion by Youth via Social Media

Social media are used by young agripreneurs to promote their businesses and by other youth involved in agriculture (students, researchers, ICT for agriculture enthusiasts, journalists) to promote and encourage youth to get involved in the sector. The use of social media, especially by young agripreneurs, has been discussed above. The following paragraphs focus on the activities of those youth, who by passion or profession, engage in advocacy for agriculture through social media.

Blogging on Agriculture

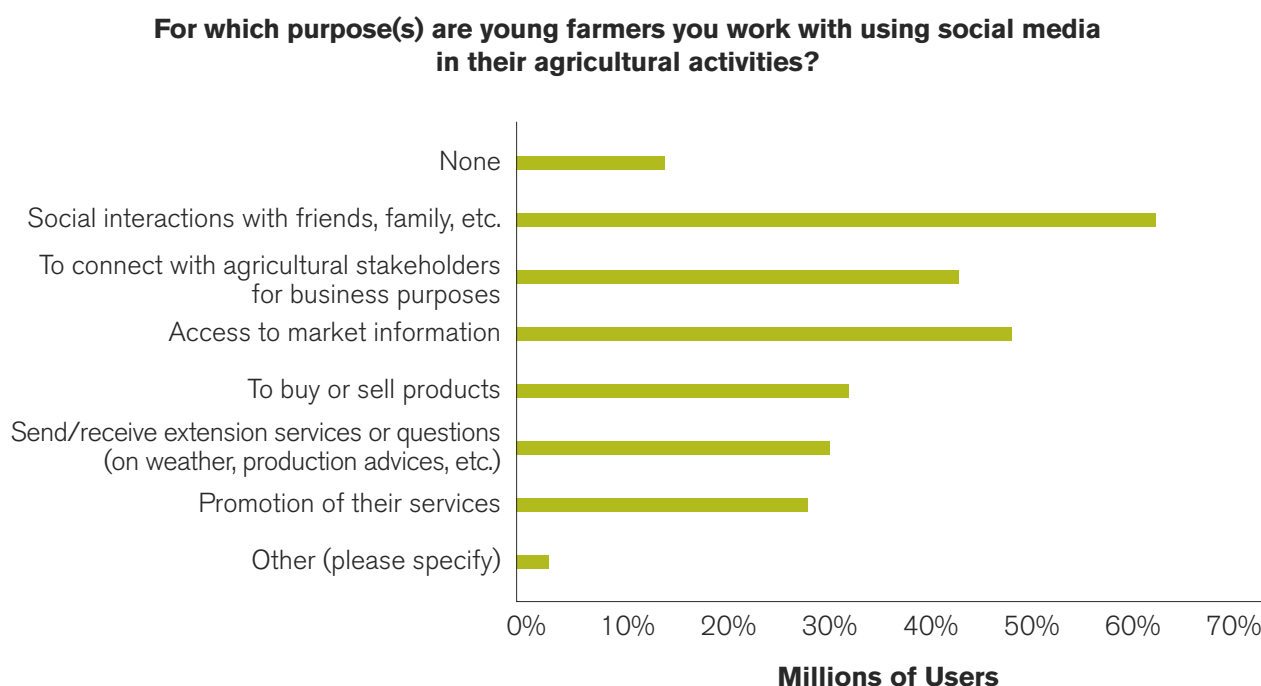
“Blogging is an interactive form of publishing content on the web.” It has become a dominant way of self-publishing in the digital media age (Mashable, 2015). Blogs are normally used to share information or opinions on a particular topic. A lot of African youth engage in agricultural blogging.

Various organizations encourage blogging about agriculture, not only to maintain the interest of youth in the sector and attract others to the cause, but also to disseminate information and innovations on agriculture. Appealing stories of successful young farmers/agripreneurs that have succeeded in building up profitable agribusinesses within the agricultural value

- **Daral Technology** facilitates livestock management (Senegal)
- **Farmerline** provides accurate and timely agricultural information to farmers and also provides technology to stakeholders to work better (Ghana).
- **M-Shamba** is an interactive platform for smallholder farmers and traders (Kenya).
- **Mobipay** provides technology solutions to various economic sectors to drive commerce and trade (Namibia).
- **Mobis** (Ensibuuko app) mobile platform for the management of credits and loans for smallholder farmers and agricultural cooperatives (Uganda).
- **Rangerland Solutions** is an online livestock marketing platform that directly connects buyers and sellers, reducing marketing costs.
- **Redcore Interactive** is a platform for online international money transfers to mobile money in Africa (Uganda).
- **SmartMoney** provides free-of-charge branchless mobile banking to unbanked rural communities in Uganda and Tanzania.
- **YieldUganda** sources high quality, traceable food products for local and export markets (Uganda).
- **iCow** App that enhances and facilitates livestock management (Kenya)

Source: Adapted from Village Capital Website 2015

Figure 5.4 Uses of social media by young farmers and agripreneurs in Africa (Respondents are organizations supporting young farmers and agripreneurs)



Source: CTA, 2015

chain are shared – along with captivating images – as examples aimed at burnishing the image of agriculture and attracting other youth.

The youth organization known as the Young Professionals for Agricultural Development (YPARD¹³), a global network that has active members in many African countries, provides an online platform or space within which young people along the spectrum of agricultural production and development can interact. They swap stories on the status and challenges of agriculture among youth in different countries and proffer solutions. YPARD even hosted a blog competition on its website to encourage information sharing.

Similarly, an initiative of the CTA ARDYIS project – the 'Youth in Agriculture Blog Competition' (YoBloCo Awards)¹⁴ – promotes blogging on agriculture. The objective is to encourage youth to promote agricultural innovations and local opportunities, interest other

youths in agriculture, and identify new opportunities for their own benefit (Lohento and Bellinzas, 2012). Two competitions have been organized so far, and participating organizations or individuals submitted a total of 296 agricultural blogs (each containing several articles). Many of the best participants in these competitions are now becoming well-known young agricultural advocates¹⁵.

Other frameworks or organizations that have been encouraging young people to blog on agriculture include the e-Agriculture Community of Practice led by FAO. They have offered opportunities for youth to publish blog posts on agriculture on their platform. Such international initiatives are generating similar activities at the national level. All these actions – whether national or international – are generating vibrant communities of young agricultural citizen journalists and advocates who promote information on agricultural challenges and innovations and encourage other youth to invest in the sector.

Twitter and WhatsApp as platforms for creating agricultural awareness and exchanges

Twitter, a popular social networking site, is a platform that brings together different individuals and organizations with disparate perspectives to share knowledge and ideas, engage in discussions, and sometimes find or co-create solutions to issues. Targeted twitter campaigns created around agricultural practices and innovations help agricultural organizations to increase their reach and amplify their messages among similar organizations, and in so doing may expedite further dissemination and use of their information.

The use of tools like tweet-chats has promoted the exchange of agricultural knowledge, and encouraged advocacy and engagement between agricultural stakeholders. An example of a popular agricultural tweet-chat is the #AskAg Twitter chats, hosted by the

USAID Bureau for Food Security (whose work focuses on developing countries, including many in Africa). #AskAg Twitter chats help agriculture and food security experts to engage online audiences in conversations on timely topics and issues. Since its inception, #AskAg has engaged more than 100 experts in over 20 Twitter chats covering a range of agricultural issues (Chmielewski, 2015).

The CTA survey on ICTs and youth in agriculture also revealed that literate young farmers and agripreneurs are increasingly using the application WhatsApp as a platform for networking and exchange (SMS and voice calls). This is mainly useful because it is free to use across regions and countries, once you are on the Internet.

Engaging youth in agriculture via online videos

Videos and animations, which can be published online on such international channels as Vimeo.com and YouTube.com, can be very effective not only in communicating with youth, but also in promoting agriculture. Mobile phones

make it easier to leverage this approach. Organizations such as CTA have been consistently using this medium to engage youth in agriculture, especially in the Caribbean¹⁶, and the approach could be replicated in Africa.

¹³ www.ypard.net

¹⁴ www.yobloco.info;

¹⁵ Examples include Marthe Montcho (Benin) <https://agricultureaufeminin.wordpress.com/>; Bob Aston/Laikipia Rural Voices (Kenya) <http://laikipiaruralvoices.blogspot.nl/>; Olawale Ojo/Agropreneur Naija (Nigeria) <https://agropreneurnaija.wordpress.com/>; Kalu Samuel (Nigeria); <https://kalusam.wordpress.com/>; Anne Matho (Cameroon) <https://graininfo.wordpress.com/>; Inoussa Maiga (Burkina Faso) <http://googolfarmer.info>; Keron Bascombe (Trinidad and Tobago) <http://tech4agri.com/>

¹⁶ Published by CTA <http://www.cta.int/en/article/2015-04-08/video-and-science-in-the-service-of-agriculture.html>

Social media reporting

Social media reporting is the use of social media tools and applications to disseminate live (real time) reports from such events as conferences and workshops (among others), individually or collectively by a group of reporters. Social reporters enable those who are not present to remotely follow live proceedings of an event and even contribute to the conversations. Social reporting uses various techniques, such as story telling, interviews, videos and still pictures, to communicate and provide a record of an event (Samii, 2009).

The benefit of social media reporting is that it enables the engagement of online audiences, who may have important, interesting, and informed perspectives to share. When well directed, it can also increase communication with target audiences and foster the kind of interaction and learning – based on real-time feedback – that traditional media do not (Kelly, 2014).

With the expansion of ICT access in Africa, the use of social media – especially Facebook, Twitter and blogs –

live reporting as events unfold has become increasingly common. The same is true for agricultural events. At the 6th Africa Agriculture Science Week, held in 2013 in Ghana and hosted by the Forum for Agricultural Research in Africa (FARA), a group of young Africans engaged in agriculture were there as social reporters, providing live coverage of various events during the week, amplifying conversations from the sessions online, and engaging those not physically present.

Similarly, social media reporting is now done regularly from CTA international conferences (e.g., the ICT4Ag conference in Rwanda and the Fin4Ag conference in Kenya, among others), with youth from Africa and the Caribbean and Pacific providing live online reports (both in English and French).

Also worth mentioning is the fact that many young people who have been engaged in social media reporting have received training and acquired new capacities that are proving useful in pursuing new employment opportunities (Kamukwape, 2014).

Development of ICT Applications for Agriculture

Opportunities exist for young ICT specialists in agriculture to develop innovative and useful ICT solutions for African agriculture. Because of their affinity for new technologies, and their seeming capacity to innovate with them, young people are well-suited to benefit from this emergent demand for ICT solutions in different spheres of African economies – including agriculture.

Already, youth in different African countries have been involved in developing ICT applications that help farmers solve some of their problems. Given the growing prevalence of mobile phones (and other mobile devices), there is a lot of interest in mobile applications and how the emerging 'app economy' might generate new employment opportunities for young people around the world (ITU, 2014b). Though not yet financially sustainable in most cases, these endeavors are giving youth new employment and entrepreneurship opportunities and thus producing a new generation of agripreneurs.

One well-known ICT for agriculture application developed by young people in Africa is 'm-Farm'¹⁷ (founded by three young Kenyan women), which provides information on crop prices and other

market information to farmers via SMS sent directly to their mobile phones. Another successful application developed by youth is MOBIS (initially called the Ensibuuko app), which was developed by a young start-up (Ensibuuko) that emerged from CTA's *AgriHack Talent initiative*¹⁸ (which includes agricultural 'hackathons', incubation of selected ideas and concepts, and promotion of the best applications developed). Ensibuuko is a web and mobile applications platform designed to help Ugandan Savings and Credit Cooperative Societies (SACCOS) of small rural farmers mobilize savings, and to receive and disburse loans more easily and quickly using SMS and mobile money. It was founded by two young Ugandans who grew up in rural farming communities and know well the barriers with which farmers must contend in order to access financing to expand their farming operations. The start-up has now reached more than 10,000 farmers through their agricultural cooperatives and savings societies.

Many other existing and new youth-driven agricultural ICT applications can be found across Africa. Various organizations, from telecom multinationals such as Orange, to national organizations such as the telecom regulator ARTP in Senegal, are supporting the

¹⁷ <http://www.mfarm.co.ke/>

¹⁸ <http://hackathon.ict4ag.org>

emergence of these innovators and their applications (more on this follows below).

All these applications are contributing to improving productivity, advancing advisory services, enhancing

access to markets, and promoting food and nutrition security. They are also contributing to revamping the image of agriculture, attracting new generations of young, creative service providers to agriculture, and generating new job opportunities for youth.

Other Uses of ICT by Youth in Agriculture

Young people in agriculture also use ICTs in many other ways along the value chains. Indeed, as described earlier in this chapter, ICTs help to modernize such agriculture activities as extension, soil testing, knowledge

management, and precision agriculture. This offers new opportunities to encourage youth to engage in the sector, provided adequate facilities are put in place to actually integrate innovations in these agricultural activities.

Youth, e-extension and ICT-enabled agricultural research

Instead of reaching out to farmers individually, young ICT-savvy extension officers use various forms of ICT-enabled e-extension methods to reach out to farmers. These include: direct mobile communication to individual farmers; using bulk SMS to reach groups of farmers/agripreneurs on a database; mobile applications like WhatsApp and Facebook; and sharing pre-recorded or live agro-advisory audio and video messages (Odera, 2014). ICTs also enable young researchers to reduce the feedback time on research outputs, such as improved varieties. ICTs have consolidated the research

feedback mechanism and have promoted participatory and collaborative multi-stakeholder research in which farmers are active stakeholders right from the stage of identifying the research problems to final outcomes (Pimbert, et al., 2010; Maru, 2004). Young researchers have also benefited from integrated information systems that reduce data duplication and help to ensure the consistency and integrity of data (Deloitte, 2012). In addition, young scientists engaged in biotechnology R&D regularly use ICT-enabled facilities, but this practice seems weakly documented in Africa.

Youth and agricultural knowledge management

The volume of knowledge produced in the various fields of agriculture is growing exponentially, and a culture of open access to that information is taking root globally. As a result, young agricultural knowledge/information managers require new methods and tools to deal with the rapid expansion of information across the agrifood system. Current and emerging ICT tools are

enabling information managers to better source relevant information, and to better organize, store, provide access to, guide and protect the use of information materials in responsive and responsible ways. ICTs also promote faster feedback from end-users to information managers, and facilitate knowledge sharing to a wider audience (Subashini, et al., 2012; UNDP Ethiopia, 2012).

Youth and precision agriculture

Site-specific crop management or precision agriculture is a new form of agricultural management that depends heavily on ICTs. These technologies are used to observe, measure and respond to possible variability within individual fields. Precision agriculture leverages on hi-tech solutions such as digital mapping of soil to determine

suitability, detection of weed growth in 3D images, and GPS-enabled farming equipment to better match farm practices to crop needs and improve resource use efficiency (Zhang, et al., 2009; Piron, et al., 2010). With their ability to quickly exploit ICTs, young people can help advance this novel practice in African agriculture.

Advancing ICT Use by Youth in Agriculture: Constraints and Opportunities

ICTs offer immense potential for youth in the agricultural sector. Even so, a number of constraints hamper expanding their use and realizing the benefits they can

provide. We first discuss general crosscutting limitations and then some 'context-specific' constraints to the use of ICTs.

Crosscutting constraints

High cost of ICT devices and access – One of the most important and fundamental barriers to the adoption or use of ICTs by young farmers/agripreneurs and other agricultural stakeholders in African countries is the associated costs. While increased infrastructure coverage and cheaper devices continue to reduce the cost of accessing ICT services, the cost of owning a device and keeping it connected still remains a challenge to many young people, especially rural youth.

Out-dated government policies and regulations that limit ICT investments, tax regimes imposed by governments, and comparatively high costs of mobile services make connecting and maintaining ICT devices difficult for many Africans. In Nigeria, for example, outdated laws like the National Mass Communication Policy of 1990, the National Telecommunications Policy of 2000, and the National Policy for Information Technology of 2000, are out of touch with the current realities of the modern technological landscape, yet they are still being used to govern and regulate the ICT sector (Macharia, 2014).

In Kenya, prior to 2009 the government levied a general sales tax on handsets that was as high as 16%. When the levy was scrapped to promote telecommunications access among the poor, the mobile penetration rate increased from just over 50% in early 2009 to around 70% in 2011, as shown in Figure 5.5 (Deloitte, 2011; Raval, 2012; Sambira, 2013).

Though governments need to levy taxes in order to meet the costs of public services, including public investments in agricultural development, many experts believe that taxes applied to telecoms seem high in many countries (Chéneau-Loquay, 2004). Similarly, many civil society experts and activists claim that telecom multinationals operating in Africa use African markets as cash cows, while the costs of services they offer in their home countries are low.

In the Youth and ICT in Agriculture survey conducted by CTA in 2015, the cost of connecting to the Internet was the first constraint cited by farmers' organizations

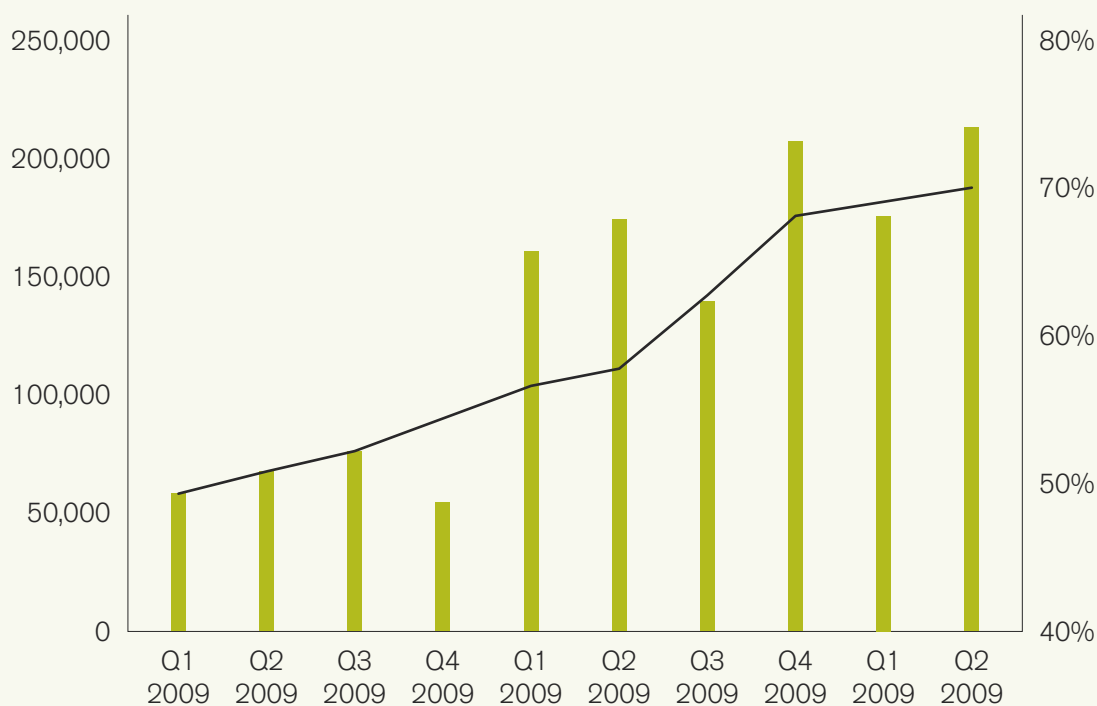
Case Study: Agritech Solutions-Kenya

Founded in 2013 by a group of young ICT4Ag entrepreneurs, Agritech Solutions is a youth-led agricultural software solution company based in Kenya. It provides ICT solutions for crop and livestock production, bringing together informational the way from planting dates of crops or birthdates of livestock, to the selling date. It then makes this information available to agricultural value chain players, including financiers, input companies, regulators, processors/marketers, and contracting companies (among others), to help guide their decisions.

For crop farmers, Agritech provides such ICT4Ag products as *eInputs*, which helps farmers to manage input orders and supplies and link them directly to input dealers, and also *eGrowers*, a software solution that enables them to manage their farming activities and calendar, including post-harvest traceability. For livestock farmers, it provides the *ePig System* and *eDairy Solution*. The *ePig* system helps pig farmers to manage their operations, plug into a network that gives them access to veterinary services and information, and to quality feeds, drugs and new markets. Its *eDairy* solution also enables dairy farmers to better plan production and more effectively access veterinary services and manage operations.

Source: Based on direct information by Agritech Ltd. and its official website

Figure 5.5 Mobile penetration rate and handsets sales in Kenya after handsets tax were removed



■ Number of handset sold - Safaricom (left axis) — Mobile penetration rate Kenya (right axis)

Source: GSMA/Deloitte Case Study on Kenya (2011). Adapted from Raval (2012)

and groups supporting young farmers/agripreneurs (65.57%). Other important constraints (see Figure 5.6) include a lack of technical skills (61.75%), bad Internet connectivity (56.28%), lack of access to a personal computer (53.55%), and unreliable supply of electricity (51.91%). At the same time, 88% of these organizations believe that access to the Internet is either 'indispensable' or 'very useful' to young farmers/agripreneurs.

Poor connectivity – Poor connectivity and high unreliability of Internet and mobile networks services, especially in rural areas are major constraints (Figure 6). Many rural areas still lack access to ICT infrastructure or have unreliable connections (ITU, 2014a). Network operators are usually less enthusiastic about investing in remote rural communities and this can keep farmers in these areas from harnessing ICTs to increase productivity. This affects all agricultural stakeholders, not only youth, and undermines farmers' access to knowledge and strategic information.

Absence of or limited digital literacy – For many young farmers and agripreneurs, ICT adoption is held back not by a lack of access but rather by digital illiteracy.

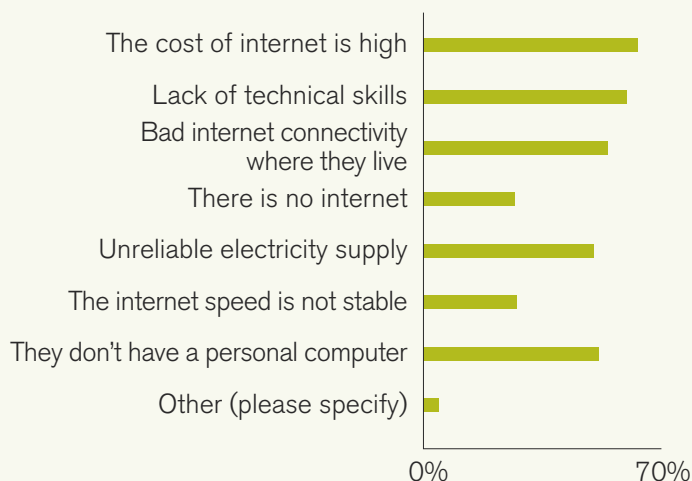
This is the lack of capacity, knowledge or skills needed to use digital devices like computers and smartphones for communication purposes or to send and access information. Digital illiteracy also sometimes has a gender undertone (see below).

Weak awareness of ICT potential and applications in agriculture – In general, there is a limited understanding of the relevance and benefits of ICT applications for increasing the productivity and profitability of many stakeholders in the sector. This adversely affects ICT investment in agricultural education, in agricultural institutions, and in the sector as a whole. Some successful agripreneurs, because they do not understand the additional benefit that ICTs can bring to their activities, do not see a reason to use or invest in them (Kimbowa, 2013).

In addition, not properly tailoring ICT solutions to young farmers' needs may discourage adoption (Stienen, et al., 2007). This requires extension workers to help farmers understand the relevance of ICT to strengthen their operations; it also requires that ICT developers have a robust understanding of farmers' needs in order to better design demand-driven ICT solutions.

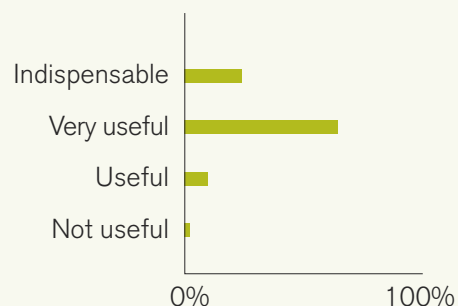
Figure 5.6 Internet usefulness and ICT constraints faced by youth in agriculture

What are the most important problems that young farmers you work with face using the internet?



Source: CTA 2015

To what extent do you believe that access to internet is useful for young farmers?



Specific constraints

Social factors (gender, marital status, land ownership, culture and traditions – In conducting the western Kenya ICT surveys, researchers found that, while 80% of young male farmers surveyed use ICTs in their farming businesses, only 20% of the young women do the same (IICD, 2013). That means young male farmers in the region are four times more likely to use ICTs for their farming businesses than their female counterparts. Researchers realized that gender, marital status, education level, and land ownership, influence the purpose for which young farmers adopt ICT tools, as well as the extent of adoption.

Because of their limited access to land in many African communities, young women in rural areas often do not feel they have strong enough incentive to learn to apply ICT tools in their farming activities. Also, because of their busy schedules and domestic routines, married women have limited time available to use community ICT centers (Kimani, 2012; Yeboah, 2014; CTA-AYF, 2015).

Absence of effective public ICT access spaces in rural areas – Public ICT access points such as telecenters that offer Internet access, are still the first gateways to Internet connectivity for young farmers, especially in rural areas. This was clearly demonstrated by the CTA survey (Figure 5.7). However, because of exorbitant costs and management issues, public Internet centers in remote rural communities often require government or institutional investment and support that may not be available (Lohento, 2003). This can prevent young farmers in such communities from adopting ICTs and exclude them from the associated benefits.

Apart from illustrating the key importance of telecenters, Figure 5.7 shows that mobile Internet access through smartphones is becoming a reality for some young farmers/agripreneurs who have the means and knowledge to take advantage of these new devices.

Lack of ICT adoption and connectivity in agricultural institutions – Important barriers may exist in the form of inadequate ICT infrastructure at the institutional level (for example in research centers, laboratories and ministry offices), or poor network and ICT coverage when engaged in fieldwork. Extension services have been undertaken in traditional ways for decades, and public providers have often failed to anticipate or quickly adopt ICT innovations. While some countries have tried to align their extension services with evolving ICT innovations, as in Kenya for instance (with KALRO), others have not been able to do so (CTA, 2012b).

More innovations in extension, involving the use of interactive ICTs (SMS, GPS, digital mapping, digital soil testing devices, tablets) would give incentives to young extension officers, as well as attract new ones.

Apart from the availability of these ICTs, institutional rigidities may prevent actual effective uses by youth.

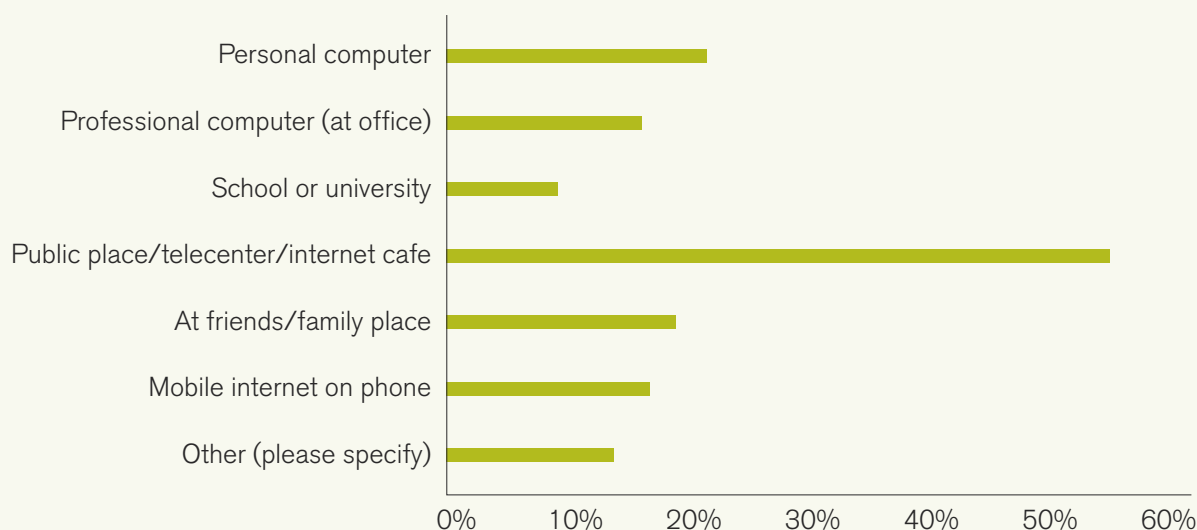
Lack of ICT training in agricultural education – While progress is being made, there are still limited ICT training opportunities and limited inclusion of ICTs and their application in agriculture training curriculum, including at the university level. This may be due, among other things, to inadequate financing for the acquisition

and maintenance of ICT training infrastructure by educational institutions – many of which are funded by governments. Another causal factor is that many

universities, just like the public extension providers, have not been able to keep their agricultural curricula in line with fast-changing ICT trends and demands.

Figure 5.7 Internet access points for young farmers

What is the regular internet access point(s) for young farmers you work with?



Source: CTA 2015

Opportunities

There are a number of opportunities available for leveraging ICTs to strengthen youth engagement in agriculture and make their participation more effective.

Increased awareness of ICT opportunities among agricultural organizations

Agricultural development organizations are increasingly recognizing the power of ICTs to assist them in achieving their goals of helping African farmers improve their productivity, market access and food security. The recent *e-Agriculture 10 Year Review Report* illustrates

this point (FAO, 2015). This positive trend should be consolidated in the coming years and, as it comes to full fruition, will benefit youth involvement and the entire agricultural value chain.

Increased ICT penetration and affordability

As noted earlier, the growth rate of ICTs in Africa has been exponential. According to the International Telecommunications Union, the mobile broadband penetration rate in Africa rose from 2% to 20% between 2010 and 2014. With increased penetration, the cost of connection to ICT services is falling in many African

countries. This trend will only accelerate as ICT service prices decrease and as awareness of its potential increases.

It is therefore crucial that agricultural stakeholders decisively invest now in ICTs, in order to fully capitalize the opportunities they provide.

Increased support for youth engaged in ICT for agriculture-related activities

Among agricultural organizations, there is a rising trend of support to ICTs for agriculture in relation to youth. Many organizations now have programs that focus mainly on

supporting youth in the various spheres of ICT use in agriculture, be it social media reporting, developing ICT for agriculture apps, or e-Extension and farming activities.

CTA, for instance, supports youth in agriculture through the *YoBloCo Awards*, *Plug and Play Days* (showcasing ICT4Ag innovations), the *Web 2.0 and Social Media Learning Opportunities (Web2forDev)*¹⁹ and the *AgriHack Talent initiative*. AGRA supports various ICTs for Agriculture projects in relation to youth, such as the 2013 *AgriHack* activities in Rwanda. The Global Forum for Agricultural Research (GFAR) supports young people in agriculture by facilitating access to capacity building, and to contributing to policy discussions through the

YPARD network. Other organizations, such as FARA, IICD, and IFAD, have also developed past or existing youth-focused programs that leverage ICTs to support youth engagement in agriculture.

Moreover, many initiatives have emerged at national levels, such as those implemented in various African countries by *Agri-ProFocus*, an initiative begun in 2005 by the Netherlands to rally professionals, expertise and resources around a joint interest in farmer entrepreneurship.

Stronger interest in ICT application development in the agriculture sector

Regarding ICT4Ag application development, opportunities are also emerging. Telecom operators such as Safaricom, MTN and Orange, regularly run competitions (for example, the *Orange African Social Venture Prizes*, or the MTN app competition challenges), and are increasingly including agriculture as one of the themes for which applications can be developed. Organizations supporting agricultural development can collaborate with them to facilitate the launch of relevant agriculture applications. While some youth target developing applications that those institutions

might buy and deploy, others aim to win the competitions in order to launch their own ICT4Ag services. Maintaining relationships with these very large telecom companies, however, may become challenging for young entrepreneurs to manage.

National governments are also active in this area. Examples include initiatives of the Ministry of Youth and ICT (MYICT) in Rwanda and competitions launched by the telecom regulator ARTP of Senegal through the Universal Telecommunications Service Development Fund (FDSUT).

Emergence and growing role of ICT innovation centers (ICT hubs)

ICT hubs bring together communities of ICT developers, entrepreneurs and development stakeholders (Khalan, 2013). They have been at the heart of many of the ICT4Ag applications that have been developed so far on the continent. At present, there are about 100 ICT hubs across Africa (Sturgis, 2014), where young people with innovative ideas come together to exchange knowledge and collaborate to

develop ICT solutions to various problems. Agriculture has benefitted (and continues to benefit) from this drive and creative innovation of the youth across Africa. Collaboration with agricultural institutions is growing. Examples of ICT Hubs promoting agriculture include Outbox (Uganda), kLab (Rwanda), mLab East (Kenya), IceAddis (Ethiopia), CTIC (Senegal), and BuniHub and Kinu (Tanzania).

Recommendations

Specific recommendations

Facilitating affordable access to ICTs for young farmers and agripreneurs – Facilitating cheaper access to ICT devices and connectivity is important for improved ICT adoption by young farmers and agripreneurs, notably in rural areas. This can be achieved in various ways.

For example, reducing the taxes levied on mobile and ICT devices is a promising approach. Some African

countries have high taxes on ICT devices. Deloitte (2011) observes that, “of the top 20 countries where mobile-specific tax as a proportion of TCMO (Total Cost of Mobile Ownership) is highest, ten are in Africa”. Reducing sector-specific taxes could bring down the costs of purchasing ICT devices and access, encourage increased acquisition of mobile/ICT services, stimulate the agricultural economy, and generate more tax

¹⁹ This is an important capacity building opportunity. More than 3,000 agricultural and rural stakeholders, 53% of whom are youth, have been trained in 42 African countries (Source: CTA Web2forDev Program www.web2fordev.net). Interestingly, besides CTA's own funded training sessions, a number of organizations have followed the model and have trained agricultural stakeholders, including youth on social media, in a franchise mode with little CTA logistics support, or fully independently

revenue for the government. Another option is to link tax reductions for network operators to increased infrastructure investment and coverage in rural farming communities. However, many ICT regulatory bodies in Africa are weak, and this approach has not so far been very successful (Saibou, 2005).

Telecom Universal Service and Access Funds, which most African governments have put in place and which are supported by taxes collected from telecom operators, could specifically devote a proportion of their resources to directly address the agrifood sector's ICT use and development needs.

Governments and the various organizations supporting the sector could put in place favorable and dedicated financial schemes for young farmers and agripreneurs who are seeking (micro) credit to invest in ICTs that will help them develop their activities and businesses.

Finally, it is important to mention the strong political will that has been demonstrated by the Nigerian government, which distributed free mobile devices to farmers under the e-wallet program. Many agricultural stakeholders expect that this approach will be replicated in other countries.

Develop digital literacy programs for young farmers and agripreneurs – Facilitating access to ICTs must go along with the capacity to put the devices to effective use. Digital literacy programs that train youth to understand and use relevant ICT devices and applications are critical.

Capacity building programs must be tailored to young farmers' level of knowledge and exposure to ICT devices. Also, though it may require significant resources, training programs should be location-specific and materials provided in local languages to serve as community knowledge repositories and encourage later consultations.

Support the sharing of success stories on ICT and youth in agriculture – Youth (and older people as well) can be inspired by and learn from success stories and examples

General recommendations

Strengthen awareness of ICT for agriculture – While promoting awareness of ICT for agriculture has improved in general in Africa, as illustrated by the *e-Agriculture 10 years report* published by FAO (FAO, 2015), this work should be strengthened, especially in less well-connected African countries. Such promotional efforts also need to be directed towards all stakeholders involved in all segments of the agrifood value chain (extension officers, agricultural researchers, information

of best practices. Many people, however, see agriculture in an unflattering light, in part because successes in the sector generally do not capture headlines. Still, sharing best practices, innovations and success stories relating to ICT and youth in agriculture could be decisively inspirational. We recommend the development of an online database of innovative success stories on ICTs and youth in agriculture, covering all segments of the agrifood value chain.

Support ICT for agricultural research, innovation and youth entrepreneurship – This recommendation is in line with at least two of the ten recommendations that came out of the international ICT4Ag Conference organized in 2013 by CTA and its partners (including AGRA). As illustrated in the report, youth ICT innovations (software and hardware) are advancing agricultural value chains, while at the same time providing employment opportunities and attracting more youth to agriculture – in large part by improving its image. Entrepreneurship in this domain, however, is in its early days and needs to be fully supported in order to develop and become sustainable. ICT4Ag (social) entrepreneurship is at the intersection of three different areas that face their own challenges in Africa: business development, ICT service and product development, and agriculture entrepreneurship. Financial support should be readily available (via innovation funds, seed funds, venture capital organizations, and other financial mechanisms) to support the emergence of prototypes, the development of proofs of concept, and the scaling up of entrepreneurial innovations. Multi-stakeholder support in this area is crucial to sustain successful ICT4Ag business models and (social) entrepreneurship in Africa.

Strengthen ICT incorporation into agricultural curricula – Governments and policy makers should encourage or mandate the expansion and reinforcement of ICT training into the agricultural curricula, particularly at the university level. This is essential for nurturing a generation of young agriculturalists prepared to take full advantage of ICT innovations in their professional work immediately following their graduation. This was the first recommendation in a call launched by youth engaged in activities of the CTA ARDYIS project in 2011 (ARDYIS, 2011).

managers, food processors, agrodealers and, very importantly, agricultural decision makers and farmers themselves). Currently, there is little promotion of the use of ICTs in activities such as food processing, soil fertility work, biotechnology, and land cultivation (for example, with 'smart tractors'). Strengthening multi-faceted awareness promotion will prepare decision makers in particular to favor strategies that will eventually facilitate youth engagement with ICT in the sector.

Increase ICT use and equipment in agricultural institutions – Two key constraints faced by young agricultural researchers, extension officers and other young professionals are the lack of capacity to apply modern ICT tools to their work and inadequate access to necessary ICT facilities. An internal enabling environment that provides better access to the necessary ICT infrastructure in their institutions must be ensured. Strong intervention in this area will not only benefit young professionals but also the institutions themselves.

Promote the development and implementation of sound e-agriculture strategies – It is important that African countries rationalize their integration of ICT in the agricultural sector by putting modern strategies in place. This strategic approach should take into account the entire sector (including fisheries, livestock and forestry) to ensure that no key agricultural activity is overlooked, duplications of projects are avoided, economies of resources and of scale are achieved, and that crosscutting issues such as connectivity, ICT costs and capacity building benefit from holistic solutions (CTA, 2013b).

Conclusions

Agriculture holds substantial promise for economic growth and development in Africa. Considering the level of youth unemployment, as well as the prevalence of hunger and malnutrition across the continent, agriculture presents a vital pathway to job creation for the burgeoning youth population, and opportunities to lift many people out of poverty and resolve food security problems.

While African youth have long shown a lack of interest in agriculture, the emerging trend of applying ICT solutions to agriculture, plus the limited availability of livelihood opportunities in other sectors, are attracting an increasing number of youth back to agriculture.

These young people often bring their energy, creativity and tech-savviness to agriculture and are changing its landscape in Africa. This is being done through various initiatives, such as better integrating ICTs in record keeping, promoting agriculture among other youth via social media platforms, creating virtual markets that help

farmers/agripreneurs connect to markets more easily and get better prices, developing ICT applications for livestock management, and engaging in crop and livestock production itself. These youth are gradually generating additional livelihood opportunities from their engagement with the sector. Youth are also helping to advance new ICT-enabled practices, such as precision agriculture.

Young people are, however, constrained by a host of factors, including the relatively high cost of access to and connection of ICTs, inadequate capacity, unreliable connectivity, and limited access to the financing needed to expand their activities. African governments, institutions and development organizations will do well to expand opportunities for youth in agriculture by facilitating access to ICTs and finance, building youth capacity, providing targeted interventions, strengthening youth engagement, encouraging the incorporation of ICT training into agricultural curricula (especially at university level), and supporting all with the necessary infrastructure.

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