

Knowledge powers development

Poor farming practices are among the numerous reasons for low productivity in sub-Saharan Africa. However, a major share of farmers only have limited access to information and knowledge, also owing to insufficient numbers of extension workers. The article below uses the example of the rice and cocoa value chain to show how mobile-based ICT solutions can contribute to closing this gap.

Sub-Saharan Africa is one of the poorest regions in the world in terms of living standards. Over 60 per cent of the population are considered extremely poor, earning less than two US dollars per day per person. The population in rural areas mostly engage in farming, and their agricultural productivity is generally low. Thus, enhancing agricultural productivity is essential for improving livelihoods and food security. Reasons for low productivity include biophysical factors (e.g. poor soil fertility, variable weather conditions), constraints related to policies, markets, and institutional arrangements and poor farming practices, the issue this article focuses on.

Having access to information and knowledge is a key driver for improving farming practices. But limited numbers of public extension workers in sub-Saharan Africa mean that farmers often have only poor access to extension services, or none at all. At less than 3,000:1, the ratio between farmers and extension workers does not allow intensive and individual assistance. With knowledge as a crucial development factor in the agricultural sector, interventions to strengthen and support these services are varied and long-standing. Alternative options for improving farmers' access to knowledge are increasingly found in

Charlotte Duevel, Stefan Kachelriess, Annemarie Matthes

*Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
Bonn, Germany*

Kazuki Saito, Kokou Ahouanton
*Africa Rice Center (AfricaRice)
Cotonou, Benin*

Contact: stefan.kachelriess@giz.de



The Rice Advice application is already being used by 17,000 farmers.

Photo: AfricaRice

information and communication technology (ICT) solutions. Mobile device-based ICT solutions play an important role, considering ever cheaper smartphones and the advancements of ICT in sub-Saharan Africa. These conditions have triggered the innovation of various ICT solutions in agriculture, enhancing the scale-out and dissemination of information and knowledge on recommended management practices for staple crops and export commodities at comparably low costs.

This article highlights ICT solutions in the agricultural sector (ICT4Ag), using the example of one staple crop and one export commodity. Rice is one of the most important staple crops in the region. Nevertheless, local supply currently only covers 60 per cent of local demand because of low yields. Expected increases in population during the next decades make the enhancement and expansion of local rice production essential for food security. Cocoa is one of the main export commodities in West and Central Africa. However, average yields

of this commodity remain far below what can be achieved under optimum management practices. Therefore, information and knowledge dissemination through mobile-based ICT solutions carries great potential in rice and cocoa value chains.

■ Mobile applications and services for more rice

The Competitive African Rice Initiative (CARI; see Box on page 15) builds its work on the provision of technical support and advisory. Long-standing extension services are complemented with various ICT solutions. Practical rice management guidance via a mobile-based application and voice messages on good agricultural practices and weather forecasts via SMS messaging are examples of innovative ICT components promoted and supported through the initiative.

One of these ICT solutions is *Rice-Advice*, an application developed by Africa Rice Center (AfricaRice). The



Recommendations of good agricultural practices in the form of 3D animations. (Source: 3D animation "Doing Good Business with quality Maize", SSAB, 2017)



The 3D animated characters Obi and Aminat, adapted for the English version in Southern Nigeria. (Source: 3D animation "Doing Good Business with quality Maize", SSAB, 2016)



The 3D animated characters Abdullahi and Amina, adapted for the Hausa version in Central and Northern Nigeria. (Source: 3D animation "Doing Good Business with quality Maize", Green Innovation Center Nigeria, 2016)

app is currently freely available for Android systems and provides support for improving yields and income of smallholder rice farmers in sub-Saharan Africa by offering personalised

advice on field-specific rice management practices, such as recommendations on fertiliser management, general good agricultural practices and provision of a specific cropping calendar. The improvement of rice yields can be achieved through the efficient use of fertilisers. Here, the app also promotes the reduction of soil nutrient depletion causing soil degradation. In contrast with general recommendations, the app takes into account farmers' practices, choice of crop variety, available fertiliser types in the market, fertiliser price, paddy price, farmers' resources as well as the rice-growing environment.

The app was tested, promoted and disseminated in collaboration with various partners, including national agricultural research institutes, international development partners, local extension service providers and private sector organisations. Pilots were conducted in various countries in West and parts of East and Southeast Africa. During the trial phase, these pilots indicated that the use of *RiceAdvice* increases rice yield by around 0.6 to 1.8 t/ha. Furthermore, in some countries, like Ghana, recommendations provided by the mobile application tended to have a lower nitrogen application rate than what farmers applied based on their own fertiliser management practices.

So far, *RiceAdvice* has reached more than 17,000 rice farmers. Although farmers are often highly price-sensitive and prefer to carry on farming as always, they have also realised the benefit of tailored management recommendations. Almost all farmers said they would go on using the mobile-based extension service to enhance their rice yield and increase their profitability. In Kano State, Nigeria, farmers seem willing to pay up to 14 USD per ha for the service provision. Similarly, in Mali, 44 per cent of farmers indicate a willingness to pay between 0.4 and 17 USD. This payment by farmers could potentially constitute a key income source and driver for the scale-out process of *RiceAdvice*. The challenge that not all farmers yet have their own smart-

phone to use *RiceAdvice* by themselves also holds opportunities. For example, an input dealer can provide farmers with guidelines generated through the app as additional service along with their products. This service will attract more farmers to purchase the input dealer's products once they see the benefit of the additional service. In addition to existing value chain actors, such as input dealers, millers, and extension service providers, youth could benefit. The use of the app seen as a business opportunity can also serve and empower Africa's youth through job creation and livelihood improvement, with the identification of suitable and local-specific business models. Since the launch of the app, more than 300 service providers including public extension services, youth, staff from development-oriented projects, NGOs, and staff from private sectors have been trained in the use and scale-out of the ICT solution.

Ignitia and *Farmerline* are two other examples of ICT solutions, providing weather forecasting and technical assistance regarding good agricultural practices in rice production, business skills and nutrition through mobile telecommunication, which are also promoted through CARI. By providing their services via SMS messaging, they take into account that not all farmers can afford a smartphone. *Farmerline* even goes one step further, offering voice messages to overcome illiteracy. Both modes of delivery enable them to reach target audiences on a larger scale.

■ 3D animations in agricultural extension

The Sustainable Smallholder Agri-Business programme (SSAB; see Box) also combines support of face-to-face extension services with ICT approaches. In a pilot in Cameroon, Côte d'Ivoire, Ghana and Nigeria, the initiative is embedded in a long-standing programme. Three-dimensional (3D) animations are used to enhance extension approaches on good agricultural practices. Based on well-proven experiences in the field of extension and

the production of extension materials, research-based knowledge is developed into audio-visual content. The far-flung network of local partnerships ensures a wide outreach of the videos.

Videos are an effective and cost-effective way to transfer skills and knowledge on complex issues to a large number of farmers in rural Africa. The extension message can be demonstrated by using this visual format. It can therefore be replicated easily even without the ability to read. The videos are used to support and enhance, but not to replace, face-to-face extension services provided directly to farmers. A very careful approach to the development of this content must be taken.

SSAB has developed a process to capture research-based recommendations on good agricultural practices in training materials for farmers and extension agents. Once tested in the field, they serve as basis to create 3D animated videos. First a story line is created by filtering the most relevant information into easy-to-understand key messages that are divided into actions and audio for the protagonists. Using reference videos filmed with farmers, animation studios produce the storyboard and the audio track based on the script. In the second step, the characters are modelled and animated. These protagonists carry the key messages. They must be as specific as possible so that the audience can identify with them. At the same time, they should be unspecific enough to be applicable as broadly as possible. Special attention must be paid at this step of the production. One practical example is the promotion of women's participation in specific, economically viable farming activities that are culturally not considered as women's work. By appointing a female character to such activities, it is possible to influence and change the mind-set of the audience. This must be weighed up against the risk of reducing the number of viewers who identify with the protagonist. Even worse, it can also create conflicts with the audience. A very careful evaluation of the cultural situation and environment is necessary to avoid this effect. By creat-

ing easy-to-identify characters and doing reproducible actions, an imitation effect is created. The virtual protagonists can be given the commands to do specific actions via computer.

In the last step, the environment and surroundings are designed and adapted to fit the specific context of a country or region. The production process is concluded with fine-tuning of visuals and soundtracks based on pre-tests with farmers.

The Internet penetration and availability of smartphones in rural areas vary significantly in West and Central Africa. To ensure large-scale distribution of the videos, it is necessary to use different dissemination channels. One option is the usage of social media and message applications through the network of extension agents from our partner organisations. However, this strongly depends on Internet access and availability of smartphones.

The second strategy builds on the same partner networks, but does not depend on the Internet. Video screenings are organised in farming communities. Pocket-projectors are used, combined with solar-powered chargers to ensure independent power supply. On these occasions, Bluetooth technology is used to transfer the videos directly to the farmers' smartphone for them to save. This allows review and conjures up key messages and recommendations regarding good agricultural practices as needed.

The examples demonstrate opportunities ICT solutions hold as well as the increasingly important role they play in agriculture. They are a cost-effective means of delivering information to farmers as well as of contributing to farmers' capacity development. These efforts improve livelihoods while also undertaking steps towards the reduction of agriculture's adverse environmental impact.

The Competitive African Rice Initiative (CARI)

Ninety per cent of all locally cultivated rice in Africa is produced on small fields with an acreage of less than one hectare. On average, smallholders engaged in rice production earn less than 2.00 USD per day and person. CARI seeks to increase the competitiveness of African small-scale rice producers, millers and other actors along the rice value chain in Nigeria, Ghana, Burkina Faso and Tanzania and achieve a lasting reduction of poverty and food insecurity. In collaboration with more than 30 public and private partners as well as civil society organisations, the programme aims to

- improve productivity and quality of paddy rice based on sustainable and competitive rice production systems;
- increase efficiency of local rice sourcing, processing and marketing through structured value chain linkages, improved technology and process management;
- improve access to financial services for all value chain actors;
- enable the environment at national and regional level, including the policy framework, and strengthen rice sector initiatives.

What has been achieved so far: More than 370,000 beneficiaries have increased their income and improved their livelihoods regarding food security. Over 106,000 smallholder farmers have attended trainings in Good Agricultural Practices and Farmer Business Schools (FBS). On average, rice yields increased by up to 136 per cent.

The Sustainable Smallholder Agri-Business (SSAB) programme

Over three million smallholders produce 73 per cent of the world's cocoa supply. Yields for cocoa and food crops remain far below the potential of recommended techniques. On average, incomes are 1.50 USD per day and person. The SSAB programme seeks to help cocoa smallholders in Nigeria, Cameroon, Côte d'Ivoire, Ghana, and Togo improve their incomes and food supplies sustainably from diversified production. The programme supports over 50 public and private partners in

- strengthening smallholders' business skills following the Farmer Business School approach;
- providing inputs, technical advice, market information and agricultural loans;
- implementing cost-effective extension on Good Agricultural Practice (GAP) for cocoa and food production.

What has been achieved so far: 57 per cent of over 390,000 Farmer Business School graduates have opened saving accounts. 41 per cent have received loans for cocoa or food production. 45 per cent of trained groups have registered producer organisations. Cocoa yields have increased on average by 51 per cent and maize yields for instance increased by 50 per cent. Using skills and GAP, smallholdings achieve between 630 and 830 EUR more income per year from food production alone.