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Digitisation
Game changer for rural Africa?

Photo: Jörg Bothling

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Dear Reader,

Whenever you visit a conference on global development these days, you will inevitably be confronted with two major topics: youth and digitisation. The European Development Days held in Brussels early in June were no exception, and neither was the G20 Conference organised by the German Development Ministry in Berlin late in April, which addressed the future of the rural world (also see the articles in our news & events section).

However, despite the close links between them, both topics deserve being treated separately. So let's start with digitisation. Four million people have no access to the Internet, and two million none to mobile telephones. The ones disadvantaged most are above all those who could benefit most from the new technologies: poor and marginalised people in remote rural areas who have limited access to information, knowledge and public services.

Digitisation offers a wide range of opportunities: recommendations on crop growing and veterinary extension services for farmers, weather forecasts for fishermen, vocational training for rural youth, health and nutrition consultancy for pregnant women and young mothers, mobile banking systems for those without a bank account ... With the aid of satellite-aided data gathering and the employment of drones, fields can be optimally farmed, enabling not only better yields but also a more economical use of our ever scarcer natural resources. Food and stored blood can be brought to crisis areas that can no longer be reached using the normal access routes. With the aid of digital data gathering, huge amounts of data can be concentrated, enabling social protection programmes to be optimised and early warning systems to be set up to mitigate the impacts of disasters. Moreover, the digital technologies bear their own potential for the promotion of entrepreneurship, above all for the young, technically-minded generation. And this means that they can also contribute to making working and living in rural areas more attractive for young people again.

So there is a big potential to lessen information asymmetries, promote empowerment and reduce poverty. However, there are warnings, too. Isn't there a danger of distances between different levels of development being widened since specific skills are required to handle and benefit from the new technologies? Will they close or narrow the gender gap? What kind of lifestyle is imparted to the young generation in particular when it is exposed to the flood of information coming from the

world-wide web without being accordingly digitally literate? How can data privacy and data security be ensured? What dangers of a relapse are there should access to the Internet fail for technical reasons or – as is the case in many non-democratic systems – be restricted for political reasons? Isn't there a threat that jobs will tend to be destroyed rather than created, for instance with community health workers being replaced by e-health services? And what happens to the tonnes of e-waste that the digital revolution churns out day for day?

This is an extensive field, and we can only have a look at some of the topics involved. We have asked our authors to keep an eye on the practical relevance of the examples they are presenting from their work – no isolated solutions but technologies and initiatives that bear a potential for up-scaling, are (or can be) locally adapted and can above all also benefit small-scale farmers and the young generation, which is more strongly represented in Africa than in any other continent. We also asked them to demonstrate why some solutions that seem promising at first glance are doomed to fail and which areas have a lot to catch up on if the rural digitisation potentials are to be unleashed in a manner that really deserves the attribute 'inclusive'.

Just one more remark. Since this edition addresses technologies, you'll have to put up with the odd technical detail now and then – after all, we want to give you the opportunity to find out the foundations on which the respective systems were developed and how they are interconnected. However, more in-depth information, also on a wide range of further initiatives, would have gone beyond the scope of the journal. You can find the relevant links in the online version of this edition.

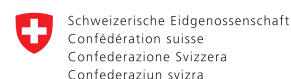
And last, but not least, here is a brief look forward: our next edition will feature the topic of youth.

We wish you inspiring reading.

Silvia Richter



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Photo: European Union



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European Development Days 2017: Investing in development

“Investing in Development” was the motto of the eleventh European Development Days, which were run by the European Commission in Brussels, Belgium, early in June. More than 8,000 participants from the international development community shared information and views on challenges and approaches in achieving Agenda 2030 in around 120 sessions. The panel discussions, lab debates and brainstorming sessions centred on three themes: ‘Investing in People and Planet’, ‘Investing in Prosperity’ and ‘Investing in Peace and Partnership’.

Opening the event, the heads of state and the UN representatives focused on five key topics: commitment to the Sustainable Development Goals with their mandate to leave no-one behind, sticking to the Paris Climate Agreement, the need to raise the potential of the private sector in order to sustainably finance development, the need of women empowerment and gender equality and – again and again – the demand to see to it that the millions of young people surging onto the labour market today and in the coming years be given a perspective for the future.

■ Skills and participation for young people

The problem is particularly serious in sub-Saharan Africa, the region with the youngest population in the world. Here, 18 million jobs must be created each year to absorb new labour market entrants. If this is not achieved, there will be a danger that young people try to make it elsewhere – at best as labour migrants in Europe, and at worst as members of extremist organisations. “African leaders hold the responsibility to create the conditions enabling young people to stay,” Malawi’s President Arthur Peter Mutharika reminded his colleagues.

This above all also includes imparting young people with the necessary skills and abilities for the labour



Alexander De Croo, Deputy Prime Minister of Belgium, and Mathilde, Queen of the Belgians, with young leaders from all over the world. Photo: European Union

market. But according to Apiyo Okwiri, President of the Erasmus Mundus Students and Alumni Association, Africa’s education system is “a little bit behind”, and would need changes to achieve this. Okwiri stressed the need to find cross-country solutions enabling students to move and gain experience in other countries. “You learn best what you see for yourself,” she told the meeting.

However, skills are just one side of the coin. Often, young people do not know what to expect on the labour market. This is why global player Nestlé launched its Global Youth Initiative in 2014 and offers traineeships and apprenticeships. “Today, many young people already hold a Master’s degree, but do not know a thing about the working life. They are supposed to see that working for us has long had nothing more to do with the old way of producing that they may still have notions of,” explained Frédérique Naulette, Project Manager of the initiative, in the session ‘Empowering young people through better skills and better representation’. But young academics have also been mentoring Nestlé senior leaders in digital skills, for example on how to

use a twitter account. “Not everybody was really happy,” Naulette noted grinning, given the shift in hierarchies this involved. But a win-win situation was certainly created.

Tibor Navracscics, EU Commissioner for Education, Culture, Youth and Sport, urged that the perception of education not be confined to formal institutions. “The most useful skills often do not come from classrooms, but from peer groups, the neighbourhood, the social environment,” Navracscics noted. What counted was to create a favourable social environment for the young people in which they had the opportunity to develop their personality. And one that also allowed them to become involved in political processes.

Currently, a mere two per cent of parliamentarians world-wide are under the age of 30. How can the voice of young people gain a greater audience? Côte d’Ivoire for example, which has its own Ministry of Youth, had set up a *Conseil National des Jeunes* (National Youth Council) in which all of the country’s youth facilities were represented, Youth Minister Sidi Tiémoko Touré noted. Romain Schneider, Minister for Development, Cooperation and

Humanitarian Affairs in Luxembourg, called on politicians to focus more on the youth parliaments which now exist in many countries. Leonardo Párraga, one of 16 selected Young Leaders whom the EU Commission had invited from all over the world to share their views and experiences, advised young people to become engaged in social businesses. Not only has this young Colombian co-founded several initiatives helping young people acquire and develop key skills for their future careers, but he has also helped set up some to support the reconciliation process in the context of the peace agreement with the guerrilla movement FARC. He recommended young people: “When you see a problem in your community, you can trigger a change. Political leaders will then lend you an ear, even if you are not one of them.”

■ Bridging the digital divide in Africa

Digital technologies and services can foster sustainable development and inclusive growth. But a major share of people across the world cannot make use of these technologies – for example because they have no access to the Internet, a state of affairs that affects half of the world’s population. Africa in particular is lagging behind. This is also, but not only, a problem of connectivity. For the technology solutions for bringing con-

nectivity to the continent exist, as the participants of the session ‘Bridging the digital divide in Africa’ stressed. Shortcomings regarding fair competition, transparency and stable regulation certainly were keeping many enterprises from investing. Red tape also represented a major hurdle. However, the basic problem lay elsewhere. “We have to convince the governments what digitisation brings in terms of benefits. Often, there is not sufficient awareness that digital development is important for the country,” said Michel Reveyard, who is in charge of international relations at the French mobile phone company Orange.

This does not apply to Uganda. This country has even had its own Ministry of ICT since 2006. According to Minister Frank Tumwebaze, the chief problem is developing a good national strategy. Clear milestones were important to steer investments in the right direction; but how should they be found if each sector – education, health, agriculture, to name just a few – had its own digital requirements? How could the piecemeal policies be brought together in one digital roadmap?

The private sector representatives recommended not to try and do everything at once. Instead of attempting to deploy a network solving every problem, the initial approach should focus on a handful of core applications using a system that could later

be applied to other areas. A key conclusion of the panellists was that any projects implemented had to become self-sustainable and scalable over time. Also, the private sector had to demonstrate readiness to enter long-term commitment – 15 years could be needed to recoup investment. So there was no room for people eager to make a hasty profit.

■ A matter of responsibility

Andreas Spieß, CEO of Solarkiosk, a company that sets up solar-powered kiosks in African communities where people can use or buy a wide range of equipment, called on all sides not to forget the issue of responsibility. “The new media give children a glimpse of the big wide world, and then they no longer want to stay at home and do farming,” Spieß warned. Especially in the employment of the new media in school education and vocational training, responsible handling of contents was important. He cautioned that the African governments should not make promises they could not keep, for this would only deter investors. And he called on the latter – be it from the public or from the private sector – to seek a good understanding of local customs and above all focus on local skills, organisations and businesses.

Silvia Richter

For summaries and videos of the sessions, see: > www.eudevdays.eu

Let’s revitalise the broken rural-urban linkages!

Urbanisation is growing in leaps and bounds. Whereas two thirds of the world population were still living in rural areas in 1990, this ratio will have reversed by 2050, with two thirds of humankind then living in cities. The impacts that this urban growth is going to have on food security and nutrition, how it is reshaping agricultural value chains and how small farmers can benefit from it were items discussed by the International Food Policy Research Institute (IFPRI) with Germany’s Welthungerhilfe and

the Dutch development organisation SNV in the run-up to the European Development Days held in Brussels, Belgium, early in June.

The organisers dispelled one myth right at the beginning. Urbanisation is not the same thing as megacities. In the Global South, it is above all small- and medium-sized towns that are driving growth. By 2030, they are expected to accommodate around 40 per cent of sub-Saharan Africa and Asia’s population. And it is vital to

find solutions for these people if they are not to suffer the same fate as the 1.5 billion people already living in urban slums today. These unique challenges faced by the urban poor were summed up by IFPRI Director General Shenggen Fan: limited access to basic services (access to good food is not enough if e.g. no sanitation is available), vulnerability to income and price shocks, an increase in malnutrition/obesity owing to dietary changes and a strong dependence on informal markets for food supplies.

■ Stop putting down informal markets

Informal markets are often associated with a lack of regulation, insecurity and poor quality, characteristics none of which we actually want to see in modern agri-food systems. So does the future lie with a formalisation of markets? Things aren't that simple, as Delia Grace of the International Livestock Research Institute (ILRI) demonstrated. For most of the fresh food in developing countries is produced and marketed in the informal sector (e.g. 80 % of dairy products in Kenya, 83 % in India and 98 % in Tanzania). These so-called wet markets have numerous advantages. Food is fresh and cheap, and local breeds are used. ILRI veterinary epidemiologist Grace also explained that the equation "informal = unsafe, formal = safe" was by no means correct, referring to the results of surveys in Vietnam as an example. There, 100 per cent of the pork samples from a supermarket counter did not meet the country's food standards; contamination with bacteria was not lower than in meat samples from the informal market.

Another aspect that must not be forgotten according to Grace is that women dominate food processing, where they ensure quality. A survey in Nigeria revealed that beef sold by women was much safer than the beef sold by men. Grace concludes: "If we only concentrate on risks and achieving formalisation in reshaping markets, this will have an anti-poor and anti-women effect."

■ A need for rural-urban recognition and investment

The conference participants agreed that the broken linkages between cities and rural areas had to be brought on track again. Not only because despite all the encouraging developments regarding urban agriculture, the amount produced would never suffice to feed the entire urban population. Pointing to cities like Beijing in China, Gerda Verburg, UN Assistant Secretary-General and Coordinator of

the Scaling Up Nutrition (SUN) Movement, noted that factors such as air pollution were jeopardising the production of healthy food. Moreover, supplying the urban population with food offered huge opportunities for small-scale farmers.

Rodney Mushongachware of the Agricultural Partnerships Trust (APT) presented an example. In Zimbabwe, a country with 15.6 million inhabitants, an urban population share of 32.4 per cent and a 2.3 per cent annual urbanisation growth rate, that is hit by periodic droughts and suffers from food insecurity, about 70 per cent of the population derive livelihoods from agriculture. In spite of this, most horticulture and fruits are imported from South Africa, also because the quality of the imported goods is valued more highly than that of goods produced domestically. For a long time, the economy was developed with the aid of cash crop cotton. A European Union-funded programme has now enabled several thousands of small-scale farmers to successfully shift from cotton growing to horticulture and to be linked to the urban markets. "Smallholders can supply the quality in demand. All they need is information on which crops to produce and in what quality," Mushongachware believes.

■ Challenges and opportunities for small farmers

Of course numerous other obstacles have to be overcome in addition to the information deficit if such success stories are to be scaled up. They include delay in payments by buyers, poor farmer organisation and low bargaining power vis-à-vis big companies on the farmers' side; high transaction costs, traceability questions and unwillingness to invest in and capacitate farmers on the private sector side; and poor infrastructure and transport to support storage of perishable fresh produce, the specialisation of formal agricultural extension institutions in traditional crops, low financial literacy and the competition from big suppliers who enjoy economies of scale as cross-cutting issues.

However, the wide range of opportunities for the involvement of small-scale farmers and rural areas as a whole should not be forgotten: increasing demand of the growing urban population, local markets benefiting from spill-over effects from production for urban markets with regard to new types of food with a high nutritional value, the growing demand for organic food with the prospect of higher profit margins, and value addition for rural areas, for example through processing on the spot.

■ A food system for everyone

The supreme goal for all activities had to remain that of making the food system inclusive and resilient, the participants stressed at the end of the meeting, taking up the keynote address by Brave Ndisale, Strategic Programme Leader for Food Security and Nutrition at the United Nations Food and Agriculture Organization (FAO). This also included that contract farming systems, which were generally desirable, did not jeopardise crop diversity, as FAO agro-industry expert Jorge Fonseca criticised in corresponding programmes in Costa Rica, or that concentrating on the high standards required for the export markets must not lead to jeopardising food safety in the local markets with inferior quality, as Clement Onyango, Director of the Consumer Unity & Trust Society Africa Resource Centre (CUTS ARC), pointed out in the case of Kenya. There was a need for strong consumer groups demanding safe products, the latter maintained.

Ultimately, everyone – men, women and youth, producers and consumers, the users of formal and informal markets, and the rural and urban population – were to benefit from these food systems. The prospects for this to happen are not bad, according to Ann Tutwiler, Director General of Bioversity International. "We used to be annoyed by the urban bias in political interests – now we ought to take advantage of it," she noted.

Silvia Richter

What rural youth really need: jobs, jobs, jobs

How can economic prospects be created for millions of young people in rural areas? This issue was at the centre of the G20 Conference hosted by the German Federal Ministry for Economic Cooperation and Development (BMZ) in Berlin, Germany, in late April 2017. The explosive nature of this topic is obvious. Today, 1.2 billion people are between 15 and 24 years old. By 2030, around 600 million young people will be surging onto the job market, including roughly 440 million in Africa. Often, however, jobs in rural regions are unattractive, which is why more and more youth are going to the cities.



The participants of the “Rural Future Lab” handing the “Berlin Charter” to Minister Gerd Müller. The Charter is to serve the G20 as a guiding concept for modern, innovation-friendly rural development.
Photo: phototek.net

■ The private sector is called on

“When it comes to job creation, the only people I can think of are in the private sector,” said BayWa AG Chief Executive Klaus Josef Lutz. This company has established a joint venture for the agricultural engineering services sector in South Africa. But according to Lutz, such collaborative schemes only work if the framework conditions in the partner countries are satisfactory – if there is political reliability, if corruption can be kept at a calculable level and, above all, if local people are well educated and trained. Here, the entrepreneur would like to see a system corresponding to Germany’s dual system of vocational training – in which young people can work and earn money but simultaneously learn and are therefore familiar with state-of-the-art technology.

“Our educational system was developed in the colonial era in order to create clans and clubs,” maintained entrepreneur and founder of the Mo Ibrahim Foundation, Mo Ibrahim, criticising the African education landscape. The continent’s continuing reliance on commodities was a further dilemma. For example, Nigeria had reduced food production in favour of oil production. However, Ibrahim states: “Mining, oil and gas do not create jobs!” The diversification of the economy was essential if young people were to have a per-

spective. Ibrahim again and again denounced tax evasion, corruption and mismanagement in his home continent. However, addressing the BayWa representative, he stated: “We cannot discuss governance in governments without taking a look at governance in the private sector.”

■ Promoting entrepreneurship

“In Africa, I would not look at job creation, but at entrepreneurship among young people”, said Muhammad Yunus, founder of the Grameen Bank in Bangladesh. All human beings were packed with unlimited creativity – regardless of whether they had just graduated from the university or were illiterate rural women who had never left their village. Digging up this treasure required money on the table. Yunus advocated creating new financial institutions that would award venture capital to young people. He called on the private sector to promote social businesses, i.e. businesses that solve social problems in the context of their activities. Joint ventures in the field of marketing and processing, e.g. in coffee or cocoa growing, were a good opportunity to retain adding value at local level and ensuring that people were reasonably paid for their work.

Of course reference had to be made to the opportunities offered by

the new technologies and the ‘digital revolution’. Here, Ibrahim mentioned one principle in particular: “Let us avoid white elephants.” E-commerce, e-learning, e-health programmes, e-weather forecasts for fishermen – all very nice. But useless without the corresponding infrastructure. Access to electricity continued to be one of the continent’s biggest challenges, as was stressed again and again at the conference. However, creating a power grid was unrealistic, especially in rural regions. Rather, simple adaptations of existing technologies should be considered. As a practical example, the mobile phone entrepreneur showed the conference a small solar lamp he had brought along that had been developed by a Danish artist and was available at a price of two US dollars in Africa. Children going to school can put the “Little Sun”, which is shaped like a sunflower, on their desks to do their homework, and women can wear it like a necklace and will then be safe from hazards on the way to where they fetch water or gather firewood. The “Little Sun” is supplied with a solar charger that can be used for all sorts of devices. It is produced by a company with the help of which local jobs are created and local profits are generated through a network of young African entrepreneurs. So this is a social business along the lines of what Nobel Peace Prize Winner Yunus suggests.

Silvia Richter



A GPS tool helps to optimise rice sowing.
Photo: Jörg Böhling

Unleashing the rural digitisation potential

Information and communication technologies have seen rapid advances since the beginning of the millennium. While they hold a huge potential for rural areas, new Internet developments such as the “Internet of Things” and “Big Data” are set to create further opportunities. However, our authors argue that there is still much room for improvements, especially by bringing the many IT initiatives together on user-friendly platforms for farmers and other rural small businesses.

Already in the early 2000s, when the rapid spread of the mobile phone was about to take off, our research identified the poverty reduction potential of information and communication technologies (ICTs) in developing countries. At the time, mobile phones were largely acces-

sible through fledgling, though fast growing phone rental services, for instance in Bangladesh and, in some cases, in Africa. Development planners were sceptical about ICT. Much has changed since then and ICTs have evolved far beyond what was imagined at the time. Today, we can safely say that digital technology will be a game changer for inclusive development and positive rural change.

that seek to improve access to inputs, financial services and markets, gather and disseminate information and facilitate social learning and exchange. The impacts are significant. For instance, farmers are better informed about market opportunities, for example in Ethiopia through digital display boards in 29 regional centres of the Commodity Exchange, or by SMS services in many African countries. Weather and food shortage risks can be monitored and responded to more effectively through crowd-sourced information. On the consumer side, digital technologies could soon facilitate the provision of targeted information related to malnutrition to mothers in need.

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■ Bringing advanced mobile technologies to rural Africa

Today, mobile technologies are being used to offer services to farmers

The transformative potential of mobile technologies does not lie in what is available today, however. Most of the current services offered in Africa still rely on SMS and voice-based systems to cater to basic phones, which limits the sophistication of the services that can be provided and leaves little room for interaction. The true potential will only be realised with the use of new mobile technologies that are currently emerging. Increasingly, people will be able to choose among a wide range of affordable devices to replace the simple phone handsets that dominate the rural African mobile landscape. The advent of smartphones opens up a whole new range of services to their users. The device allows for the provision of more complex content and functions, accessible through interfaces that could also be used by illiterate farmers.

At the same time, the nature of the Internet is changing. The so-called 'Internet of Things' allows to connect diverse devices through the mobile network which can collect huge amounts of data – big data – that can then be analysed through cloud-based technologies. The results can inform decision-making, such as site-specific management of fields or supply chain management, or trigger actions of other devices attached to the network, e.g. for irrigation or fertiliser application. Data collection can also capitalise on the large and growing network of users through their personal mobile devices that can deliver crowd-sourced information and facilitate the dissemination and exchange of information and knowledge. These developments are going to fundamentally change transactions costs, which is the basic cause of high costs of market participation in rural Africa. To the extent road and rail infrastructure is improved in parallel, the opportunities for small farmers and rural businesses will improve.

While these technologies may today seem far-fetched for rural Africa, existing examples show what is in the making. In Kenya, Virtual City's *Agrimanagr* and *Distributor* systems use mobile devices to collect data

on weight and location when farmers deliver the produce and track the produce throughout the chain to the processing plant. Also in Kenya, the company ACRE uses data from weather stations and remote sensing to trigger insurance pay-outs via mobile phones in case of severe weather events. In Nigeria, the Uber-like service *Hello Tractor* allows farmers to share tractors through a mobile app, a system already functioning well in India. The hardware to run these services, such as smartphones, tablets or sensors, is becoming cheaper, not least thanks to growing manufacturing capacities in emerging economies.

■ A reality check

Despite rapid technological advances and related opportunities for service delivery, we need to acknowledge that much of the potential still lies in the future. Our research shows that most of the existing initiatives still depend on external financial support, remain small, are often duplicates and have limited impact (*see also article on pages 14–16*). Indeed, in the ICT for Development (ICT4D) community, constructive scepticism and realism has replaced the initial euphoria. The reasons mainly are:

The myriad of small initiatives tend to be disjoint and highly diverse in their usability. As a result, users cannot easily access different types of services through their mobile device that could otherwise be complementary. To offer integrated solutions for farmers, too few service providers have started combining several functions in one service, such as the agribusiness management tool *mfarms* in West Africa.

Many initiatives are delinked from providers of agricultural information and other business actors in the value webs. Agricultural expertise is often not adequately taken into account during the development and operation of the service, frequently focused on one line of products, and not sufficiently adapted to local circumstances in the diverse African

farming systems. There tends to be little room for collecting information on the needs of users and for providing user feedback once the service is operational.

Mobile solutions are developed with insufficient regard for user capacities and the context in which they are provided. Too often, the services are technology-driven, instead of the problem determining the choice of solution and delivery channel.

As a result, many services remain small because external constraints prevent them from reaching scale which were not sufficiently taken into account in the design and marketing strategy.

■ ICT platforms – towards effective integration of mobile services and users

To address these constraints, overarching ICT platforms must be set up to host, connect and scale the dispersed individual applications. Similar to an app store, farmers and other businesses and traders should easily find and access different types of services through a single interface. Review functions would allow users to provide feedback on the service to suggest improvement and stimulate competition between providers of similar services. Service providers, on the other hand, could remain specialised in a certain area and profit from access to a large number of potential customers which would facilitate marketing and create incentives to develop new ICT applications. The platform would need to be modular so that it can cater to different technological and human resource capacities. Thus, while farmers would be targeted directly by some lower-tech services, they could also be reached and benefit indirectly through intermediaries, such as farmer organisations, or co-operatives. Investing in such ICT platform establishments is a key area in which development agencies and innovative private sector initiatives should join forces to actually unleash the rural digitisation potentials.



Training on the use of sensors for nitrogen efficiency.
Photo: CIMMYT

Doing more with less

Digital solutions can help to support farmers in their decision-making processes in order to achieve optimal farming systems of improved productivity while simultaneously minimising the use of resources and the impact to the environment. The International Maize and Wheat Improvement Center (CIMMYT) has been applying the corresponding technology in the context of its Sustainable Intensification Program for several years.

Over the next 50 years, the world will need to produce enough to feed 9.3 billion people, and global food production must meet expected demand despite climate change and without expanding the agricultural frontier at the cost of forests and wildlife. As a result, farmers around the world will have to produce more with the same amount of natural resources, or even less. This is not a distribution or a productivity issue. If we distributed the food produced in 2009 evenly among the population, we would still need to generate 974 calories

per day/person by 2050. In addition, agriculture is responsible for nearly a quarter of the global GHG emissions, and it accounts for 37 per cent of land use and 70 per cent of freshwater consumption. We need to do a lot more with less, and this quest will be a matter of life and death for many. Aiming to face these challenges, and given their scale and complexity, we have to assume that linear transfers by which technology developed by specialists is passed on to farmers by extension intermediaries or face-to-face communication will not suffice.

developed several projects in Latin America (including Mexico, Nicaragua, Guatemala, El Salvador and Haiti) where a strategy based on a systems approach to agriculture aims to offer practical solutions to these major issues. The strategy creates, validates and scales sustainable agri-food systems based on networks that promote innovation, technology transfers and adoption of improved maize seed, wheat and associated crops, as well as sustainable agronomic practices among small-scale farmers. When combined, these innovations lead to higher, more stable yields and increase farmers' income while reducing the impact of agricultural activity on the environment. The model lays special emphasis on the local context and actors by adopting a regional focus through innovation hubs, spaces for knowledge exchange, technology development, agronomic innovation

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■ Innovative solutions with a regional focus

Over the last five years, the Sustainable Intensification Program (SIP) at the International Maize and Wheat Improvement Center (CIMMYT) has

and information sharing among the different actors that participate in the agri-food chain. The word 'hub' refers to the centre that holds together the spokes of a wheel. The term also stands for the central connection for managing cybernetic information as well as the centre of an activity or network.

■ Supporting farmers' decision-making processes

Within this context, Monitoring, Evaluation, Accountability and Learning (MEAL) strategies including innovative data analysis methods and visualisation tools acquire significant relevance. Efficient data collection, dimensional analysis and dissemination of agri-food systems and their integrated pathways could help to overcome the challenges of the future. Since traditional MEAL systems in agricultural projects are not understood as knowledge management systems so far, they still tend to measure indicators related to increased production and productivity with little attention to institutional, environmental, contextual and social issues, i.e. systemic questions. Therefore, the main objective of any MEAL system in agriculture should be to bring in the latest research and technology along value chains regarding precision agriculture and conservation farming practices to farmers of all scales, and support their decision-making processes in order to achieve optimal farming systems of improved productivity, minimal use of resources and impact to the environment. The organised data could also serve donor purposes and regional decision-making for targeting public and private efforts.

In Latin America, CIMMYT has been collecting defined indicators directly from farmers and has around 36,000 registered plots with 500 variables per cycle. In addition, different tools for data collection, cleaning, analysis and visualisation have been tested and developed to support decision-making, monitor and evaluate project activities, which are described in the following.

■ CIMMYT tools

Data collection

Field surveys: Farmers' data describing crop management practices, yields, costs, dates and crop status are captured in CIMMYT-developed field books that use two data collection tools: an in-house developed system (*Bitácora electrónica MasAgro*, BEM) and Geographical Open Data Kit (GeoODK) Collect. Both programmes allow for logic, entry constraints (i.e. ranges in the answers-input) sub-structure repetitions and geo-referenced information. Data collectors are extension agents who can work online and offline in the field, save submissions at any point and send them to CIMMYT servers. At present, GeoODK Collect uses an Android platform and supports a wide variety of question types: text, number, location, polygons, multimedia and barcodes.

Crowdsourcing: These tools collect data from other farmers and end-users who may not be working directly with an extension agent linked to the project. Typically, a crowdsourcing exercise would collect demographic information (e.g. geographic location, gender, field experience) and, in some cases, would include Entry Questionnaires to ensure that respondents meet the representative sample required.

Data cleaning and analytics

Several scripts have been developed in R-language (a language for statistical computing and graphics) which automatically obtain data from an Excel file, identify and separate outliers, and then graph for example, yield variation and net income per crop, region and production type.

In addition, other analytics are being tested. Farmers' data describing crop management practices, yields and crop status is pooled and combined with weather records and soil data at the field level. The data is subsequently completed by thorough characterisations of the actual conditions in which the crops grew and related to the yields achieved. Empirical modelling techniques are

then used to mine the databases for correlations and/or patterns that inform about the main limiting factors and optimal management practices for each context. Typically, clustering, Principal component analysis (PCA), regressions and machine learning approaches (such as artificial neural network and classification, and regression trees) are part of the portfolio of techniques that can be employed. This process is performed in collaboration with the International Center for Tropical Agriculture (CIAT) Decision and Policy Analysis group and can be described as a wide-scale benchmarking exercise where crop performance is compared in groups of fields that share similar natural conditions.

Visualisation and dissemination

Geographic information system (GIS) and dynamic analytics for visualisation: Conservation Earth – an open source platform – provides a way to store geo-referenced information, as well as a combination of tools to visualise, analyse and manipulate field data to map our field activities (monitoring), dynamically interact with historical/regional/thematic layers, and support decision-making processes of end users.

An SMS platform offering free, site-specific technical advice also contributes to the dissemination strategy, by targeting farmers and extension agents depending on the crop they work with, the region and their production system type.

■ ICT usage impact in agri-food systems: risks, advantages and trends

As stated by Hopkins et al. (2013), ICTs can be classified according to how they affect performance in the agricultural sector:

(a) **Systemic – indirect – impacts** on productivity, innovation and networking are generic and not unique to agriculture and affect factors like the flow of information, public policy-making and administration and risk management;

(b) **Enabling impacts** which improve efficiency and reduce transaction costs throughout the value chain, for example, improving access to markets, or processing financial transactions; and

(c) **Direct impacts** which encompass ICT applications that have a primary use in agricultural production processes, with clear impacts on the sector's productivity and efficiency.

Following this approach, an efficient digitisation strategy for agriculture would need to include a complete toolbox for systemic, enabling and direct impacts where not only linear processes but also systemic relations are taken into account (see Diagram). Functional data collection systems, able to gather real data on time integrated with data cleaning

protocols and analytics, can serve as decision support systems regarding any type of impact. In addition to the tools, a complete MEAL strategy aiming to return added-value information adapted to farmers and final users is crucial to achieve the potential of ICT usage in agriculture.

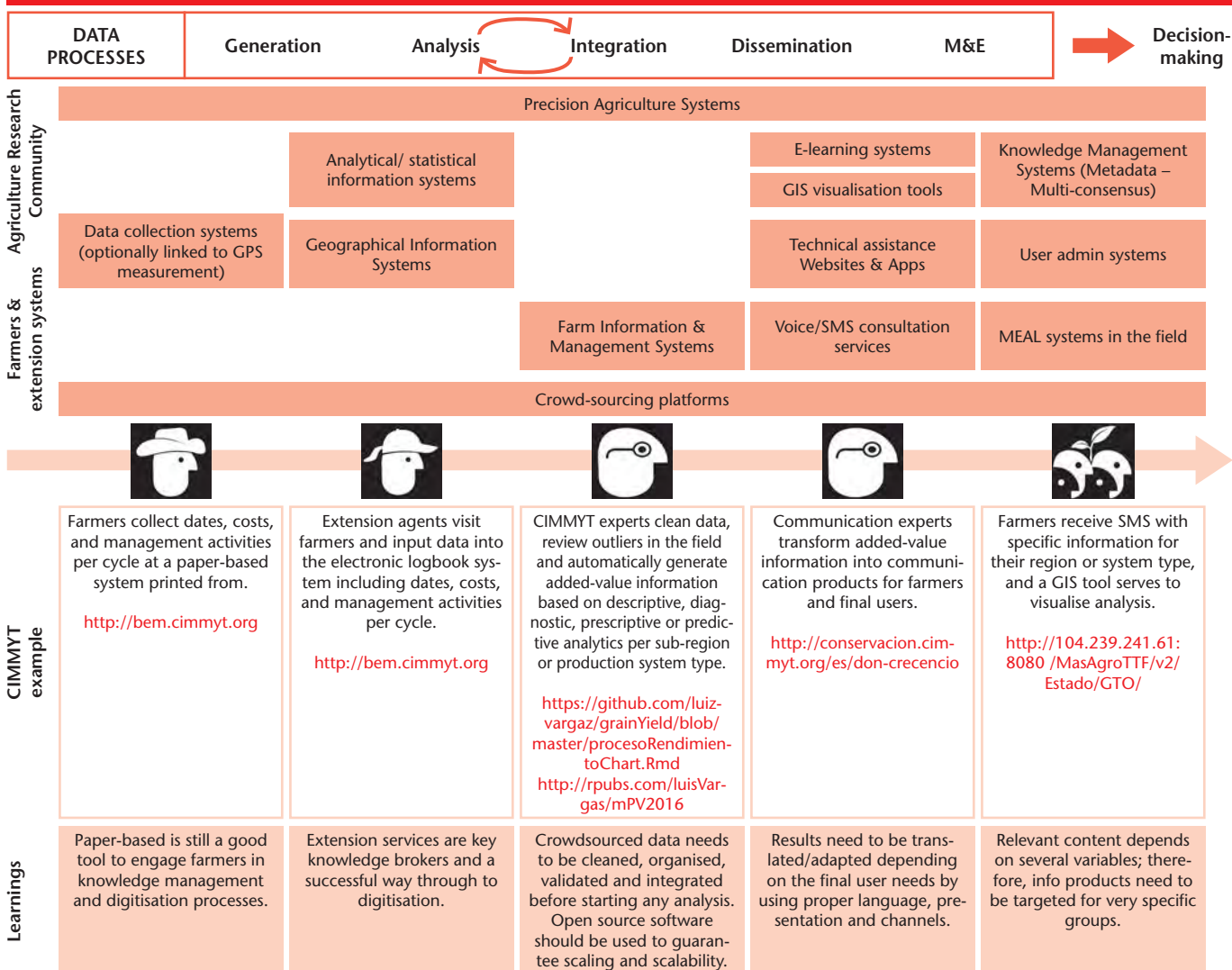
High costs and limited access to the Internet are still significant limitations. Sophisticated early warning systems, precision agriculture, and traceability strategies, for example, require the use of fairly costly and robust technologies and users with the requisite technical skills. Open source software adapted to development contexts, relevant capacity building targeted to innovative farmers able to replicate success and public policy alignment appear as solid paths that should be

developed and implemented in order to consolidate impact.

Finally, evaluating and measuring not only agri-food systems performance but also the digitisation strategies is essential to identify and manage risks efficiently. Risk and uncertainty aspects range from weather, pests and diseases through commodity prices to volatile market conditions and politics. Regarding ICT strategies, high investments with no evaluation processes can generate massive losses. Therefore, timely information to inform agricultural and project management at different levels is also a topic to be considered.

For a list of references and related links, see online version of this article at: www.rural21.com

How can ICT help farmers in decision-making? CIMMYT examples and lessons learnt.



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

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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.

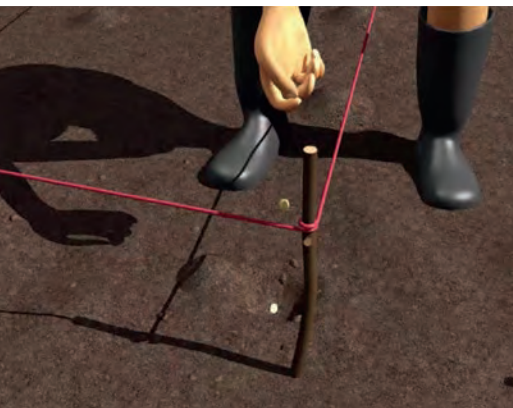
This article highlights ICT solutions in the agricultural sector (ICT4Ag), using the example of one staple crop and one export commodity. Rice is one of the most important staple crops in the region. Nevertheless, local supply currently only covers 60 per cent of local demand because of low yields. Expected 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.



The use of m-payment systems such as M-Pesa is spreading rapidly in many developing countries.
Photo: Heike Baumüller

How can the digital revolution benefit smallholder farmers?

It is a well-known fact that most of the farming operations in developing countries are small. This situation is unlikely to change anytime soon. How are such small farms going to benefit from digital technologies? Our author takes a look at various agricultural services in the mobile phone branch – from weather and price information through credit schemes to supply chain management – and shows which systems have the biggest prospects of success and why others are doomed to failure.

So far, the focus of digitally-based solutions offered to smallholder farmers has been on services through their mobile phones (referred to as **m-services** here), such as information on farming practices or market prices, training or links to potential buyers. However, most of these services have yet to take off. Many remain at the pilot stage, and hardly any are financially viable. Empirical evidence on the impacts of such services is scarce and inconclusive.

The limited success of agricultural m-services in developing countries is not entirely surprising. While smallholder farmers offer a potentially

lucrative market for such services because of their sheer number, they are difficult to reach due to their geographical dispersion, low purchasing power and limited digital literacy. M-services that are going to benefit these farmers are exactly those that aim to overcome these constraints by offering economies of scale, thus reducing transactions costs. The complexity of the system needs to be handled by the service provider or intermediaries with an economic interest in facilitating the service. Thereby, offering smallholder farmers services that larger farms enjoy while using delivery channels that are adjusted to their technological and educational capacities becomes viable for providers.

to highlight the importance of scale economies. For the private sector, the maintenance and human resource requirements to run information services are often too high to make such services worthwhile. Reuters Market Light in India, for instance, prides itself on reaching close to two million smallholder farmers through its mainly SMS-based information service, but after ten years of operation the service is still not profitable. In particular where service providers aim to deliver customised information to individual farmers through interactive systems, such as helplines or social media platforms, economies of scale are difficult to achieve because the addition of new customers also implies significant staff increases to manage the interactions.

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■ Promising (and less promising) areas for agricultural m-services

Information services, which are among the most frequently provided m-services, offer a good example

Instead, largely automated information systems with low maintenance requirements are needed. Weather updates, for instance, can easily be automated and offered at a sufficiently small resolution. Another example

can be found in Kenya, where livestock producers who register their cows with *iCow* receive (automated) advice specific to the animal's life cycle. Such services are relatively easy and cheap to manage on a large scale, but still offer significant benefits to farmers. Information or training modules on widely relevant and clearly defined issues can also be provided through recorded audio or video messages that farmers can then retrieve online or via their mobile phone. For the less tech-savvy farmers, intermediaries can help to access the content. *Digital Green*, for instance, takes projectors into Indian villages to show the recorded messages. Such services should use existing networks such as extension agents, agro-dealers or farmers' organisations to reduce costs.

In the area of **financial services**, opportunities for economies of scale have already been recognised (and in some instances realised) by mobile network operators. Banks are often hesitant to expand into rural areas since servicing small-scale farmers can incur high transaction costs. To fill this gap, m-payment systems are spreading in many developing countries. *M-Pesa*, run by Safaricom in Kenya, is the most prominent example. The m-service combines mobile technologies with its extensive network of agents to manage the monetary transactions and assist people who do not own a phone or do not know how to use the system. More recently, m-payment systems are increasingly being linked to bank accounts through mobile interfaces. These can be used directly or through agents, such as the Adarsh Credit Cooperative in India which employs 100,000 travelling field workers to reach farmers in remote areas via a mobile platform. M-payments are also a catalyst for other services that suffer from high transaction costs when dealing with large numbers of customers, such as managing water or electricity bills.

Mobile technologies can also be used to scale up **credit schemes** for smallholder farmers. Difficulties in assessing credit-worthiness, handling small amounts of money and moni-

toring repayments often deter financial institutions from offering loans to smallholder farmers. M-payments can greatly facilitate managing and documenting cash flows. Data recorded through the mobile phone or m-services can be used to assess credit-worthiness, such as phone usage patterns, utility bill payment history or records of m-payments (bearing in mind data privacy issues; *see also article on page 32*). M-services can also be employed to manage group loans, thus spreading the risk of default. The systems can be administered by the group leader and may not require any particular technological know-how among the participating farmers. Mufoni System in Kenya, for instance, offers a platform for microfinance institutions to manage interactions with their clients through SMS and m-payments.

Another promising example in the financial sector is **insurance schemes**. Smallholder farmers are less attractive for insurance companies because registering new customers, monitoring insurance claims and dispersing compensation is cumbersome and costly. Here, mobile technologies also offer opportunities to achieve economies of scale. Registration can be carried out through a simple interface on feature phones, administered through a network of agents that can build on existing networks such as agrodealers or mobile money agents. Interconnected devices, such as weather stations or sensors for measuring soil moisture, can be used to collect the necessary data to decide on the timing of pay-outs. The compensation can then be dispersed via mobile money systems. Such an insurance scheme already exists in Kenya, where it is operated by the company ACRE, which uses a network of weather stations to measure rainfall and disperses pay-outs through M-Pesa.

As a last example, **supply chain management systems** can benefit from mobile technologies to manage deliveries from smallholder farmers. Many management systems to coordinate sourcing are not well adapted to working with numerous small and dispersed deliveries. As a result, farmers

miss out on opportunities to market their produce to large buyers. Technologies that use mobile networks and devices to collect and transmit delivery data can help to simplify such systems. *SAP* in Ghana and *Virtual City* in Kenya, for instance, are using such technologies to register deliveries from small-scale farmers at the collection centres. These systems enable farmers to keep a record of their deliveries, speed up processing of payments and allow other actors in the value chain to trace the product all the way to the farm.



Transport continues to be a big obstacle to smallholders' market access.

Photo: Heike Baumüller

Seen through the lens of scale economies, other m-services are less likely to succeed. M-services offering information about **market prices** are often cited as a promising service for smallholder farmers because they are expected to reduce information asymmetries between farmers and traders and thereby increase farmers' bargaining power. However, such a service will only be useful for smallholder farmers if the price information is very localised and timely. Gathering and verifying this information would be time-consuming and costly. In addition, even where local prices are known, smallholder farmers are often unable to take advantage of price information because of other constraints, such as lack of alternative buyers, existing trust relationships, poor road conditions or dependence on traders for credit or inputs.

While **virtual markets** may help to expand trading opportunities, qual-

ity control and transport are particular challenges when selling fresh farm produce. In Kenya, *M-Farm* has tried to address the first issue by setting up a verification point in Nairobi where *M-Farm* staff check the quality of the produce before it is collected. The use of the point is optional and subject to a commission, but many buyers nevertheless choose to use it. However, setting up such points around the country would require significant staff expenditures and in a sense undermine the point of an online trading platform. Transport is another bottleneck. If the business partners are responsible for arranging the transport, the online market is likely to remain fairly local. Trading on a larger scale would require setting up the necessary logistics infrastructure. Thus, virtual markets lend themselves better to goods where the quality is consistent and ideally subject to certain standards (e.g. processed agricultural products) and where the products can be transported (and sent back) easily.

■ Affordability, usability – and what the future holds

Economies of scale will have implications for the affordability of the m-services by reducing the costs to smallholder farmers, partly because of overall reductions in operational costs, but also because the costs may be differently distributed. Service pro-

viders, for instance, may be willing to bear a larger share of the costs because of the additional benefits they gain by reaching a large user base. *Safaricom*, for example, profits not only financially from *M-Pesa* through the transaction fees, but also because the m-service ties users to their network. Alternatively, another actor in the value chain may be prepared to carry the main cost of an m-service because of the business advantages it brings, such as large processors using supply chain management software, which cuts costs, increases efficiencies and assures supplies. Similarly, government offices may be willing to pay for an m-service that facilitates the provision of agricultural extension services.

The types of m-services described here are also attractive for smallholder farmers because the part that the farmer accesses is relatively simple while the more sophisticated issues can be handled by intermediaries. This aspect is particularly important when trying to reach less educated and technologically knowledgeable farmers. The key is to combine technologies with different complexities. Thus, the m-services take advantage of more advanced technologies to run the system, such as sensors or tracking devices in supply chain management, weather stations in insurance, or cloud-based systems to manage registrations or payments. Much of the technical work is carried out by the

collection points, processors, financial institutions, extension agents, agro-dealers or dedicated m-service agents. Simple delivery technologies, such as SMS and voice, or human intermediaries can then be used to cover the last mile to the farmer.

Farmers' organisations can also play a significant role as facilitators of m-service adoption and use. When working with established groups, the focus shifts from individual farmers to group leaders. Thereby, service providers can capitalise on existing structures of communication and co-operation for marketing, training and customer support. This approach reduces the need for interaction with individual customers because the m-service is either used by group leaders or they can conduct training, help with simple enquiries and bundle questions that they cannot answer themselves. Importantly, working through group leaders can help to build trust in the m-service, which can be a challenge in particular where farmers are not used to conducting farm-related business over the mobile phone.

It is also important to bear in mind that technologies and people change and, with that, the opportunities for providing m-services to smallholder farmers. Technological advances will impact which and how m-services can be delivered. For instance, interfaces combining touchscreens, symbols, audio and video may open up completely new ways of making content accessible to illiterate farmers. Also, as farmers climb the technology ladder, they will be able to use the more complex aspects of the m-services, such as handling their own banking business, setting up supply management systems on their farm or managing group loans. Participation in the m-service through an intermediary or simple interface can prepare farmers to use more complex services later on because they have already seen the practical applications, gained confidence in using the services, and realised that mobile technologies benefit not only the rich and highly educated.



The more technology advances, the more opportunities arise for farmers to benefit from m-services.

Photo: Heike Baumüller



Providing drone-based services – a business idea for young agripreneurs.
Photo: Nicole Melancon, www.thirdeyemom.com

From agricultural finance to drone operations: Starting off a new generation of agripreneurs

E-agriculture services are an important factor in unlocking the potential of agribusiness in Africa. And they offer huge opportunities for involving young people in the agricultural sector. CTA has developed numerous formats for engaging youth leveraging on digital technologies. Here, one focus is on promoting entrepreneurship.

October 2013, in Kigali, Rwanda. David and Gerald, two young people from Uganda, have just won a software competition organised by the Technical Centre for Agricultural and Rural Cooperation (CTA) with their agricultural finance management application *Ensibuuko* (now called MOBIS). April 2017, four years later, in Malawi and Zambia. With great anticipation, the two friends have launched a franchise service of MOBIS in the capital of Lilongwe. Thousands of farmers have already been benefiting from MOBIS's services in Uganda through agricultural co-operatives. Now *Ensibuuko* is an established business with several employees and generates revenues daily.

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The entrepreneurs are dreaming of scaling up throughout Africa, improving access to finance and increasing income for millions of farmers ...

This brief story illustrates part of the CTA vision regarding the multilevel benefits that can blossom from involving young people (aged up to 35 years) in the agricultural sector through ICTs. This vision has been framed in the organisation's Youth in Agriculture strategy, developed in 2013, which has defined four goals around which CTA has been supporting youth:

- promote coherent evidence-based policies on youth in agriculture and rural development;
- enhance the engagement of youth in agricultural value chains;
- enhance youth engagement in agriculture through ICT innovation and utilisation and knowledge management; and
- strengthen the engagement of young professionals in agricultural science and tertiary education.

■ Values and approaches for engaging youth in agriculture using ICTs

Indeed, it has become urgent to harness multi-dimensional strategies and efforts to increase the involvement of the younger generation in agricultural value chains. The aging population of the farming sector, coupled with the relative readiness of the agrifood sector, compared to other sectors, to provide a range of jobs to a significant share of the youth population, constitute key justifying factors. For example, 60 per cent of young people in Africa are either without work, not studying, or engaged in irregular employment (Global Entrepreneurship Monitor, 2015), while about twelve million of them enter the job market every year without many opportunities.

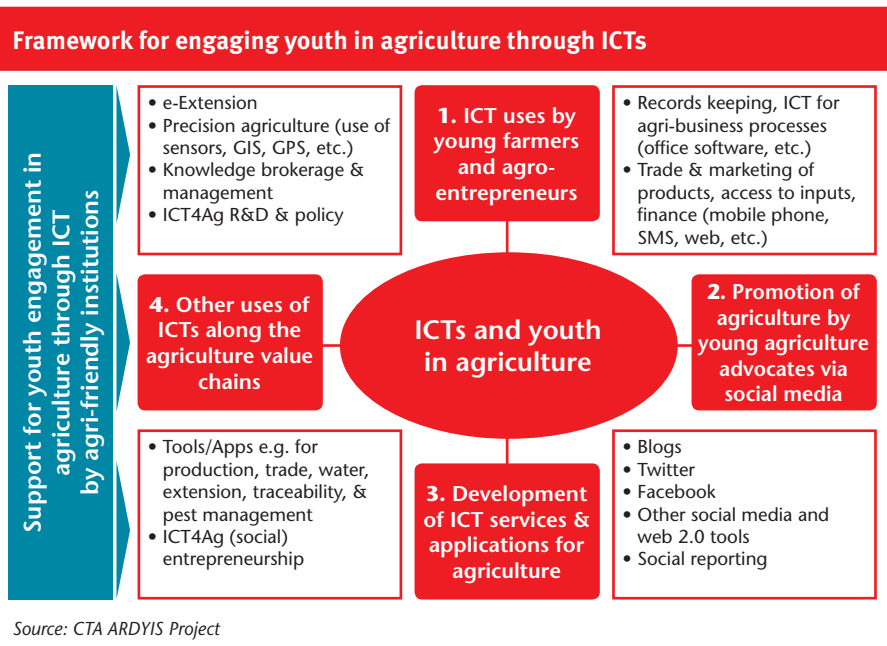
In line with the third goal of its youth strategy referred to above, the ARDYIS (Agriculture, Rural Development and Youth in the Information

Society) project of CTA, which has been promoting ICT use by youth in agriculture since 2010, has designed a four-pronged framework for engaging them leveraging on digital technologies. The first approach relates to the use of social media to promote agricultural opportunities, and the second one focuses on enhancing ICT use in youth-led farming and agribusinesses, in order to improve market access and business processes. The third approach relates to the development of ICT services targeting the agricultural sector by young entrepreneurs, and the fourth one encourages upgrading ICT use in all other agricultural professional areas in which youth can be involved, particularly in extension, agricultural knowledge management, etc. CTA has been implementing a variety of activities within that framework (AGRA 2015, Chapter 4).

■ The AgriHack Talent programme

An initiative of CTA which has been specifically supporting youth ICT innovation and entrepreneurship in agriculture is the **AgriHack Talent programme**. It includes five components: competitions to develop ICT applications for agriculture (hackathons) when there is a need, a start-up competition targeting companies already offering services, capacity building, mentorship and incubation opportunities, promotional and networking opportunities, and facilitation of access to grants and investments to implement and scale-up services offered.

Successful start-ups have already evolved from the AgriHack programme. For example, the Ugandan MOBIS platform referred to above was developed during the first hackathon organised by CTA. *FarmDrive* suite of applications, another platform that emerged from a hackathon, is now successfully operated as a business in Kenya. The start-up owner of this firm has helped farmers access to loans through improved creditworthiness and linkages with financial service providers. They are internationally recognised as an innovative financial service company.



After organising a series of hackathons, CTA decided to concentrate efforts on existing applications and services, in order to facilitate their maturation and scale-up. An e-agriculture start-up competition (dubbed **Pitch AgriHack**) focusing exclusively on youth-led companies was organised in 2016. Acknowledging the value of this activity, the African Development Bank (AfDB) decided to join forces with CTA and provided financial and logistics contributions for the event. Other partners involved included the ICT incubator mLab East Africa in Kenya, the venture capital firms ProHaus Group (from USA) and Devlabs (from Latin America), the African Agribusiness Incubator Network (AAIN) and many more. The competition was open in two categories: Early stage category (targeting prototypes at early stage) and Advanced stage category (targeting services already in operation and generating revenues). A total of 152 applications were received from 30 African and Caribbean countries, and eventually, 25 finalists were selected by an international panel (see Box on p. 21). The finalists took part in a boot-camp in Kenya in November 2016, and items they benefited from included capacity building in e-agriculture business operations, financial model design and tips on raising capital.

So far, some 600 young innovators and entrepreneurs have been in-

involved in the hackathons and start-up competitions. More than 20 ICT hubs or institutions from 15 countries have been involved (such as *Outbox Hub* from Uganda which supported *Ensi-buuko* or *Wenovation Hub* from Nigeria). The programme has engaged with institutions such as ministries in charge of ICT and agriculture, AfDB, regional organisations (including the Alliance for a Green Revolution in Africa, the AAIN, the Caribbean Agricultural Research and Development Institute (CARDI), the Southern African Confederation of Agricultural Unions) and the private sector (e.g. Microsoft, ProHaus Group and Telesur). The best start-ups involved so far have benefited from about one billion US dollars (investment and grants from various national and international parties). Several hundreds of thousands of farmers have been reached by the services provided.

■ Drone-based advisory services for smallholder farmers

There is a general consensus that smallholder farming needs to become more productive, more sustainable and more profitable. Unmanned Aerial Systems (UAS) – or drone-based systems – services can help make this possible by bringing some of the tools of precision agriculture to producers, which include large and medium-scale

holdings and associations of small-scale farmers growing the same crop in contiguous areas. Typically, UAS services are provided by entrepreneurs who invest in the equipment, learn the skills to use it, conduct or sub-contract data analysis, interpret the findings and advise their customers.

UAS can inform a range of services, including mapping and surveying (e.g. farm boundary delineations, crop area calculations, elaboration of digital elevation models and more), crop inventory (e.g. count of tree crops, yield estimations), crop scouting (e.g. identification of location-specific crop stress, assessment of biomass development, etc.), crop damage assessment (e.g. for insurance purposes), crop management advisory (e.g. nitrogen application – on selected crops where solutions are available), infrastructure inspection (e.g. irrigation systems, farm to market roads, etc.), and increasing farmers' credit-worthiness via the integration of far profiles with high resolution, accurate and up-to-date data sets.

UAS can thus help increase the returns to farmers and create knowledge-intensive new employment opportunities in rural areas, offering educated rural youth an alternative to migrating to the cities. CTA recognised these opportunities, partnered with leading private sector operators, and assisted ICT start-ups in Benin, Ghana, Tanzania, DRC and Uganda in acquiring the capacity for delivering UAS services. This materialised in 2017 via a series of activities including training in operating drones and mounted multispectral sensors, understanding safety and privacy principles and regulations, managing and processing remote sensed data, developing a business plan and networking. In addition, CTA provided some financial support for the acquisition of necessary equipment. Technically competent and entrepreneurial youth-led enterprises have diversified the range of their ICT4Ag services and are now in the process of entering into contractual arrangements with agro-enterprises, farmers' associations, development agencies, research institutions and seed companies to start

The winners of Pitch AgriHack 2016

Out of the 25 finalists, ultimately seven winners were selected, all of them already operating. Four main winners won grants offered by CTA (between 5,000 and 15,000 euros) to help them scale their services:

- **Sooretul** (Senegal) – a web marketplace for agricultural processed products offered by women co-operatives.
- **Brastorne Enterprises** (Botswana), with the **mAgri** platform – a USSD application that gives farmers access to relevant information and to a mobile marketplace. It is already serving 150,000 users.
- **Daral Technologies** (Senegal) – a livestock application which provides alerts and a management system.
- **MobFit** (Uganda) – a GSM-supported agricultural supply chain software connecting smallholder farmers and buyers.

Other winners were selected by the partner ProHaus Group, and they will benefit from investments and capacity building opportunities: **Kuza** from Kenya, **Agro-Centa** from Ghana and **FarmAfriQue** from Nigeria.

For links to the projects and more CTA initiatives, see: www.rural21.com

with. A growing community of practice (UAV4ag) and dedicated social media spaces on Twitter and Facebook underpin the initiative.

■ ... but still a need for support

Unfortunately, but quite understandably, the ICT4Ag business sector in developing countries in particular (and beyond) is still emerging and requires a lot of support. In general, entrepreneurship is a challenging endeavour in those countries, as illustrated notably in the *Doing Business Reports* of the World Bank. A large share of the young entrepreneurs there have not studied or do not have knowledge of business management. Business ecosystems, including government support facilities, are weak, and access to capital is a daunting issue that severely limits growth potentials. More

specifically, the market (customers) for ICT4Ag services, though young and developing, is to an important extent not solvent when only farmers are targeted. Conversely, as reported in the World Bank report *Growing Africa: Unlocking the Potential of Agribusiness*, the African food market will create a one trillion US dollar opportunity by 2030. E-agriculture services are part of such opportunities.

For all these reasons, and also to address the crucial employment issues faced by the younger generation, more support is needed at national and international level to encourage innovators to design successful business strategies and help them access resources that would enable growth attainment. It is only in these conditions that they can effectively contribute to the development of productivity and growth in the agricultural sector.



E-learning courses made in West Africa, for African youth

For most young people, getting information via the Internet is part of the daily routine. But who can guarantee that such information is of high quality, trustworthy and useable? Our authors describe how they use the Moodle e-learning platform for development, deployment and management of e-learning courses for vocational training of African youth in agriculture and agro-business.

While agriculture is expected to produce more food and create more employment in Africa, a large pool of young people are struggling to find employment and are often tempted to leave rural areas and agriculture. Of course this situation has many causes, and it is not our endeavour to solve them all ... but we do want to solve one set of issues that lock a large group of youth out of employment in agriculture: traditional teaching and curricula are not always well adapted to the reality of day-to-day farming. Through under-funding of the education system, agricultural teaching is all too often done in an old-fashioned, top-down manner, centred on unaffordable technological solutions that are not appropriate to the environment, by too few teachers who are markedly underpaid and often under-trained. Agricultural colleges lack the funds to update curricula, invest in teaching resources and even hire enough qualified teachers. Also, agricultural research organisations often lack incentives, opportunities or interest in transferring the results of their research into teaching and training material.

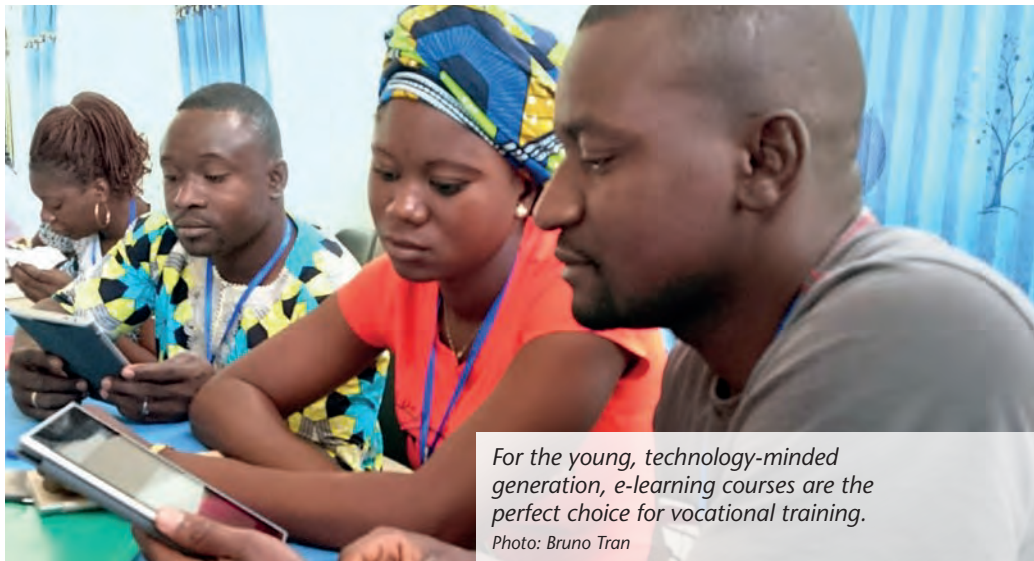
Providing free online courses that are of good quality as far as their tech-

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For the young, technology-minded generation, e-learning courses are the perfect choice for vocational training.

Photo: Bruno Tran

nical content is concerned as well as being attractive and easy to use from their format can reach a young audience via the Internet in ways and at a scale that no other teaching format can. From cybercafés to hotspots and personal data plans, Internet access is going through a fast revolution, coming with a high level of interest from young people who belong to the first generation finding information on YouTube or Google as easily, or even more easily, than in any other traditional way. Although there are large variations between countries, urban youth is certainly at the forefront of this Internet revolution in Africa.

■ About us and our target group

We are a small team within the Knowledge Management unit of AfricaRice – the CGIAR Centre for rice research and development in Africa – and AKM-Services, an ethical consul-

tancy firm from Germany specialising in IT support for the agricultural development sector. Since 2016, we have developed and offered e-learning courses on basic agriculture – production and transformation, business development and extension skills – to an audience of young people who know little about agriculture, are comfortable with using ICTs and the Internet and want to develop their skills in agriculture and agri-business.

In our current projects, funded by Germany's GIZ, we offer these courses to young people in Benin who have completed an agricultural technical course and whom we have recruited to work alongside national agricultural support services with farmers' groups, to disseminate agricultural innovations. We cover several value chains of importance to farmers in West Africa, starting with rice, maize, soya, groundnut, cassava, shea nut, cashew nut, palm oil and poultry.

■ Content: quality counts

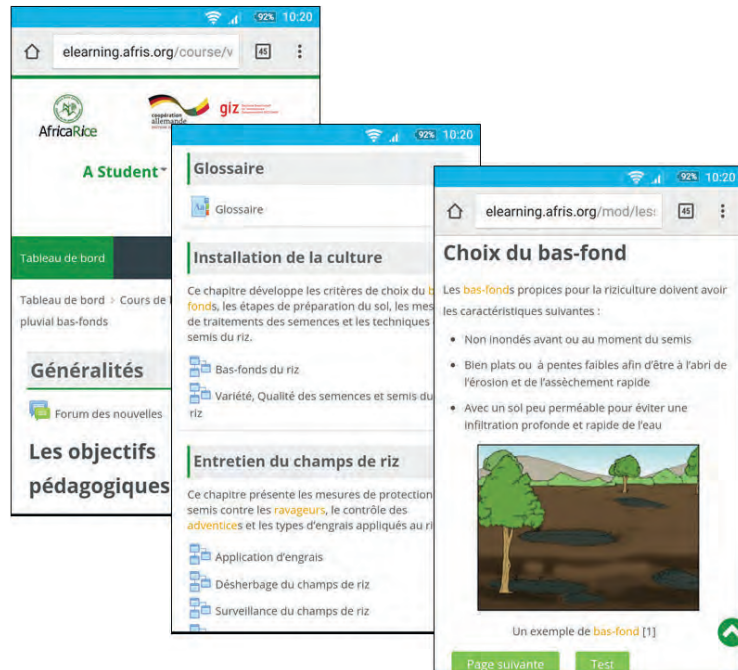
It is crucial that the scientific and technical content of agricultural training courses be vetted for its accuracy and its appropriateness to agro-ecological zones, climates and agronomic situations. Also, it must have been tested for and adapted to farmers' needs, constraints and preferences. Lastly, training courses must also comply with and reinforce national recommendations and complement the country's extension services' message.

In order to ensure high quality scientific and technical content that is appropriate to the reality of farming in-country, we work with agricultural experts from the National Agricultural Research Systems (NARS) as well as scientists from international institutions. We have found in particular that recently retired NARS scientists are available, are willing to use their vast knowledge and experience of agriculture, and constitute an ideal pool of experts on which to call for sourcing appropriate material, advising on course content and reviewing course material from a scientific and technical standpoint but also in terms of appropriateness.

■ Easy to use

The high quality material is then packaged in an attractive, simple and logical format in order to make it easy to use by our intended audience. We pay particular attention to the language, which must be simple but specific. The number of technical words is limited to a strict minimum, and they are defined in an interactive glossary in each course.

Courses are designed to be studied in 30 minutes to one hour. They are divided into chapters, themselves subdivided into sections. Each section is made of a few pages, each page consists of a short text and a visual aid – a photo or a cartoon. Ideally, one simple concept is covered by one page. A page also contains navigation buttons for within-section navigation, but a navigation panel is always available



and allows chapter- or course-level navigation (see screenshots above).

Each section ends with a short formative test which helps students verify their learning. An erroneous response results in the question being asked again and a chance to review the material if so desired. At the end of the course, there is a summative test that covers the full course content, where students are given only one chance to answer each question. They are then given a mark for the overall test; a pass mark results in a course certificate being awarded automatically. Students can retake the course – and therefore the final test – as many times as they want. The content of the course is available to download as a PDF file for later reference or for use when working with farmers groups.

■ Technological foundations

The collaborative approach to planning and writing the course material takes place within the Extranet used by AfricaRice's Knowledge Management Unit, which is designed for collaborative work on documents, sharing and archiving. When the implementation of the e-learning courses started, the required IT infrastructure for the course preparation was already in place and established. The Extranet mainly con-

sists of the following IT components: a) an enterprise wiki (Confluence by Atlassian), and b) a task management system (JIRA by Atlassian).

AfricaRice has been using Atlassian software successfully for a number of years now, enabled by their community programme which grants unlimited licenses to not-for-profit NGOs and open source software projects, with a saving of tens of thousands of dollars of licensing costs each year. The Extranet is hosted on multiple virtual hosts in a data centre in Germany to provide a secure and robust environment.

The e-learning platform chosen for this project is the free and open source software Moodle by Moodle HQ PTY Ltd. The software is written in PHP, the most widespread cross-platform framework to develop dynamic web applications. Like the Extranet, Moodle is hosted on a virtual server in a data centre in Germany. The currently active number of about 550 students accessing the platform places only modest demands on the server infrastructure and does not require more advanced setups that may be needed in the future, such as a load-balanced installation.

To change the visual appearance and better support mobile end-user

How courses are developed

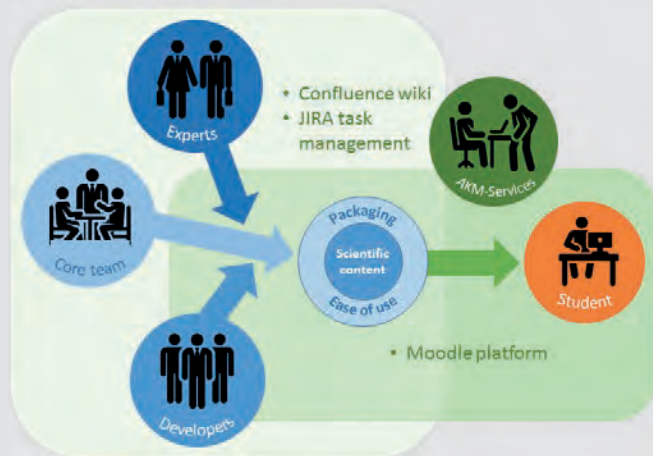


Diagram: Bruno Tran
Icons made by Freepik from www.flaticon.com

To develop our e-learning courses, the core team decides the curriculum and manages a group of experts, and a team of course developers. The experts advise on the curriculum and locate or develop the scientific or technical material used to develop the course. If needed, the experts simplify the material, or source additional material.

The course developers re-package the material in short and simple pages, aggregated in sections and in chapters with a logical flow. The core team reviews this work iteratively until the structure is ready. Course developers, experts and the core team ensure that the language is simple but precise. Course developers design the formative tests and the final, summative test. They also source visual aids when they are not available, or insufficiently so, in the original material. They then transfer the course material in the Moodle platform, create the tests and their logical flow and set the course's parameters. Once finalised, after a last review cycle, a course is made available to students on the web platform: the course is live.

devices, a commercial styling (also known as a theme) was purchased at minimal cost and installed. Today there is a large marketplace for ready-made themes for a range of platforms that provide modern, stylish and customisable web designs for a shoe-string budget.

■ Keeping access as simple as possible

Our Moodle platform is available on any modern Internet browser, and as we have kept the course interface simple and clean, it is not particularly demanding in terms of bandwidth, especially compared with video-based online courses. Internet access is required for studying our courses, and this can be achieved via a good cyber-café's network in-country, emerging Wi-Fi hotspots and, more and more importantly, personal mobile data plans. In addition, within our projects, we have rolled out a network of over 20 dedicated offices across the country, where, amongst other services like access to agricultural knowledge archives, meeting of colleagues or of more experienced field agents, our students can use a reliable, free, Wi-Fi connection and even a couple of laptops.

But in order to offer the most flexible and adapted access to our e-learning courses, we have equipped the

young people with whom we work – 124 of them this year – with cheap, locally sourced Android tablets. They can currently use the browser on the tablets to study our courses, but the next release of the Moodle Mobile app for Android is due to offer the ability to download a course and study it offline, which is expected to be of great appeal to our target audience. In preparation for this, our courses were designed to be well adapted to small screens, and responsive to touchscreens.

■ Sustainability and scaling up

To maintain a good level of control on student access, we decided to automate the course flow and management of certificates but not the original registration of students. We can, for example, allocate students to cohorts for later reporting of progress for specific groups. The platform's database of students and courses management can be interrogated by the core team using SQL queries coded by AKM-Services, which means that reporting on access, usage, progress and success is easily achieved.

We believe that our courses, supported by the systems we use, offer the sort of vocational training in agriculture and agricultural entrepreneurship that the African youth need to complement their formal teaching and better prepare them to take their place in African agriculture. Our course development and management model was designed to be up-scaled, and we carefully record everything we do so that our approach is easily replicable. Such an approach can be used for other domains such as health, nutrition or citizenship development.

Our projects are currently based in Benin, West Africa, and therefore, our courses are offered in French. But we are starting to translate our courses into English and aim to eventually offer all courses in both French and English, with dedicated bilingual course and student management

Updates from Moodle upgrade both course developers' and students' experience, and we are adding new courses to our portfolio on a regular basis.

For more information on Moodle, see online version of this article.

The e-learning platform is at ► <http://elearning.afris.org>, and if you want to try it, just request a test login on elearning@afris.org.

The authors would like to thank all team members for their support in preparing this article: Natacha Agbo, Marie-Michelle Gbaguidi, Frejus Gnanvossou, Constance Kohounko, Jacinta Achuzia, Hendrik Pöhl and Marc Bernard.



The students watched the videos in the school's computer lab.

Photo: Maximo Torero

Combining kid power and new media for agricultural extension and better health

There is an increasing interest to adopt Information and Communication Technologies (ICTs) to provide farmers with agricultural advice. However, large levels of ICT illiteracy among farmers in developing countries are frequently an obstacle to implementation. The article shows an innovative approach to bypass this constraint by channelling information through children of the households.

In many development programmes, children are looked at only as potential beneficiaries. A research programme called 'Happy Faces', however, is studying how children themselves can be the catalysts for change. The programme explores how giving schoolchildren information can improve the health and welfare not only of children themselves, but of entire households. The advantage of working with kids is that they have a higher level of education than their parents, and it is therefore easy to transfer information to them and from them to their peers. The project team hopes that by directly targeting kids, its strategies will improve children's and their families' wellbeing through increased access to information. Here, we are making use of the insight that children have had a strong impact on

marketing and other information dissemination strategies, such as a Thai anti-smoking campaign. But while children's influence on adult decision-making has been studied in other disciplines for a long time, until recently, the subject has remained largely unexplored in development economics.

■ Level 1: From kids to kids

In the project's first phase, researchers were curious to see if children change their own behaviour in response to simple messages given to them at school. The team found that showing public service announcements – particularly those featuring well-known personalities like soccer players – increased children's consumption of iron supplements. The results got researchers thinking. Getting complex public health messages to rural households can be difficult and costly, often involving door-to-door campaigns. We thought, instead of going to about 100 households per

village, what if we could use another way to disseminate information? Going to schools is a much cheaper way to spread a message.

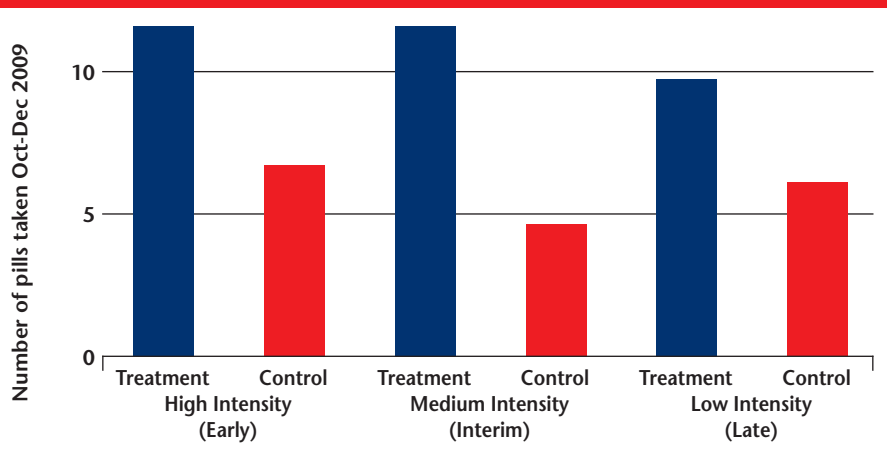
To assess the causal influence on using these messages through access to computers in school of one of the most widespread micronutrient deficiencies, supplemental iron pills were made available at a local health centre in rural Peru and adolescents were encouraged to take them up via classroom media messages. In order to create experimental variation, the study used an encouragement design that randomly varied students' exposure to promotional materials emphasising the benefits of supplementation and encouraging them to visit the clinic daily to take an iron pill. In particular, over the course of the ten-week study, students were exposed several times to one of the following three videos that lasted one to two minutes: the first video showed a popular soccer player encouraging iron supplements to maximise energy;

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the second showed a doctor encouraging iron supplements for overall health; and the third “placebo” video did not mention iron at all and instead featured a dentist encouraging oral hygiene. The first two videos served both to explain the benefits of iron to the children, and to remind them to take the iron pills. Each video lasted between 70 and 100 seconds, and on average, students viewed the same one of the three videos 5.75 times over the ten-week period.

Results from school administrative records provide novel evidence that reducing iron deficiency results almost immediately in a large and significant improvement in school performance. For anaemic students, an average of ten 100mg iron pills over three months improves average test scores by 0.4 standard deviations and increases the likelihood of grade progression by eleven per cent. Supplementation also raises anaemic students’ aspirations for the future. Furthermore, our results indicate that brief media messages are a highly effective means of encouraging adolescents to take advantage of supplements made available through public clinics. In 1993, the World Health Organization (WHO) recommended actions for the development of assessment, advocacy, prevention and control initiatives in most countries to reduce anaemia among adolescent girls. Yet, while effective, national Weekly Iron-Folic Acid

Pill take-up by number of video sessions



Source: Chong, A.; Cohen, I.; Field, E.; Nakasone, E.; and Torero, M.; (2016). Iron Deficiency and Schooling Attainment in Peru. *American Economic Journal: Applied Economics* 2016, 8(4): 222-255.

Supplementation (WIFS) programmes are extremely costly to implement and thus out of the question in many resource-poor settings. Furthermore, even when such programmes are put into place, it may be difficult to reach adolescents who are not in school. Our results demonstrate that the passive distribution of iron supplements through health clinics can achieve very high rates of compliance among anaemic adolescents with the addition of simple, low-cost media messages delivered on a regular basis. Similar programmes could be implemented at scale in sub-Saharan Africa at a fraction of the cost of current WIFS recommendations.

■ Level 2: From kids to parents

So far, the idea has worked. In the second phase of the project, researchers looked to discover whether children effectively transmit information to adults in their household, and whether those adults then change their own behaviour and household decisions based on the new information. Children received lessons on diagnosing and preventing cysticercosis, an infection spread by tapeworms in raw or undercooked pork. The disease is endemic in rural areas of the northern coast of Peru and is the leading cause of adult-onset epilepsy in much of the developing world. Although many people are aware of the link between household livestock and

cysticercosis, they often don’t know that the disease can lead to seizures and death or that contamination can be reduced by proper hand washing. Project researchers launched a community health campaign involving posters and free access to testing and treatment. At the same time, they used games, slideshows, and other visual aids to teach schoolchildren about the importance of testing for and preventing cysticercosis.

The results show that children talked with their parents about what they had learned, and in turn these adults demanded more testing compared to those adults who only received the community health campaign. This growing demand could lead to a fall in the levels of infected livestock and could substantially improve cysticercosis prevention.

Now, Happy Faces has again tried the same mechanism, with children being shown simple Internet messages that teach low-cost solutions to common agricultural problems found in their households’ plots. The idea behind this is that if children pass on these messages to their parents, they could play a vital role in resolving these problems and in improving their family’s agricultural productivity and nutrition at a very small cost. This is especially interesting where traditional extension programmes are plagued with high costs of reaching isolated areas.



The adolescents being tested for Anaemia. Photo: Maximo Torero

Example of an agricultural extension video: the molasses trap for the corn army worm

A total of eleven videos were prepared with agricultural advice for corn (4), potatoes (3), guinea pigs (2), and chicken (2). As an example, the Figure presents some screenshots of the video with advice about corn armyworms. First, we explain how to recognise the presence of armyworms in a plot. Then, to provide some background, we explain the reproductive cycle of an armyworm. After this brief explanation we introduce molasses traps as a simple technique to prevent infestation. The procedure to set up a molasses trap is pretty simple: fill three quarters of a bucket with a mix of one part molasses with one part water, support the bucket on four sticks and place it in the surroundings of the corn field. The smell of the molasses attracts the adult armyworm moths, which get stuck in the bucket and cannot lay eggs on the corn plants.

How to identify the problem?



Simple solution (molasses trap)



Explain the problem



How does the solution work?



For this purpose, we set up a field experiment in a rural high school of Peru where half of the students were assigned to watch agricultural extension videos explaining simple and inexpensive farm management practices. The other half of the students in the school were assigned a placebo video encouraging oral hygiene and provided a control group for our intervention. Students watched these videos (individually) in the school's computer lab during eight months. By the end of our field experiment, we collected a survey among the managers (usually the students' parents) in charge of the students' household farms. The survey gauged farm managers' knowledge and adoption of the agricultural practices taught to the students through the videos.

We found that farm managers of households with students that were assigned to watch the extension videos were more knowledgeable. On

average, their probability of knowing about agricultural practices increased by 33–50 per cent, compared to farm managers with students in the control group. Even when parents did not directly receive information about agricultural practices, students were able to convey the information they had received.

Albeit more modest, we also found positive effects in the adoption of agricultural practices taught in the videos among households with students who were provided with extension advice. And we investigated whether our intervention had heterogeneous effects, and found that increases in knowledge and adoption rates were significantly higher among younger and more educated farm managers. We also found some support for stronger flows of information between children and parents of the same gender (i.e. fathers-sons and mothers-daughters).

Due to the high costs of traditional extension systems, there is an increasing interest to adopt Information and Communication Technologies (ICTs) to provide farmers with agricultural advice. However, large levels of ICT illiteracy among farm managers in developing countries have thwarted this interest. Our research shows an innovative solution to bypass this constraint by channelling information through (more ICT-literate) children in their households. Additionally, while Happy Faces has focused on the potential role of upper intergenerational transmission of information to provide agricultural extension, this mechanism can potentially have many other applications. While more research is required, ICT-based information campaigns that target children are in principle suitable to indirectly provide adults with information and alter their decisions, and we are now convinced that this could be scaled up to sub-Saharan Africa.

One for all – creating a Unified Register for Social Protection Programmes in Malawi

Social protection programmes are increasingly making use of integrated IT solutions in order to register and reach beneficiaries. The benefits of these solutions and how their integration into comprehensive systems can be accomplished while maintaining government ownership can be learnt from the case of Malawi.

Social protection interventions need to capture, store, and process large amounts of data in order to identify eligible beneficiaries. Malawi's Social Cash Transfer Programme (SCTP), for instance, collects a variety of information on households in order to determine who is most in need of support. It gathers information on the type of housing materials used (e.g. the type of floor, roof or latrine), whether the household owns land and how many meals its members eat per day, among other things. The data are kept in an electronic management information system and can be accessed by various users; this system also uses an algorithm to select beneficiaries.

But the SCTP is not the only social protection programme in Malawi. In fact, it constitutes just one of the five pillars of the country's social protection system; the other four are the Public Works Programme (PWP), the School Feeding Programme, Village Savings and Loans Associations and Microfinance. Furthermore, there is a large Farm Input Subsidy Programme and an annually recurring emergency response for food insecure households operating in the periphery.

The PWP, which provides employment to ultra-poor households, has similar eligibility criteria to those of the SCTP. Nevertheless, it maintains a separate data collection process. What if both programmes could ac-



A community meeting to verify the households to be included in the UBR, Dedza District, Malawi.

Photo: Mc Neil Mhango

cess the same database to select their beneficiaries? This is the idea behind the so-called Unified Beneficiary Registry (UBR), which was developed by the Government of Malawi with support from GIZ and other development partners. The UBR is designed to contain data on at least the poorest 50 per cent of the Malawian population, also capturing, despite its name, households that are not beneficiaries of any programmes.

■ Fostering government ownership and ensuring sustainability

Following broad-based consultations with various government and other development stakeholders, the first step in creating the UBR was to develop a software platform for the registry. Donors often task external consultancies with the development of software for their partner countries.

The drawback is that the government has little ownership of the project and is often unable to take over implementation and maintenance once it is completed.

Therefore, a different approach was followed in creating the UBR. The Government of Malawi put together a taskforce comprised of IT experts from different line ministries and government agencies involved in the implementation of the Malawi social protection system. This taskforce was trained in the latest database technologies and then supported in the development of the software by IT specialists from the consultancy firm Development Pathways. To enable the group to work together, a collaborative workspace was rented in Malawi's capital, Lilongwe, and the software was developed in two 'sprints' of several weeks. Thus the collaboration successfully brought together local expertise and interna-

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tional experience. In the early stages of its operation, Development Pathways will provide technical support for the UBR, but is expected to eventually leave the project entirely in the hands of the Government.

■ Collecting the data

As the software is now ready for use, the collection of data for the UBR is currently underway in 10 out of Malawi's 28 districts, with the rest to follow shortly. Gathering data from half of Malawi's households is no small task. Other countries that have implemented such a registry already had programme databases that could be merged. If households were registered in two different databases, the two entries could be matched using national IDs to avoid double registration. In Malawi, no national ID system is currently in place (although one is being introduced), which means that the existing programme databases could not be used for this purpose. Hence, in Malawi, rather than the registry comprising data from individual programmes, data is being newly gathered for the registry and will be shared with the individual programmes.

The government is heavily involved at all levels in both the process of data collection and in the development of the software. District staff are being prepared to train the lower-level 'Traditional Authorities'. Communities are then sensitised and elect a committee to create a list of households to be included in the registry. Tablets or paper-based questionnaires are subsequently used to collect data on these pre-identified households. Based on the information collected, households are ranked according to their level of poverty. This ranked list needs to be approved again by the communities before it can be used by the different social protection programmes, should they desire to base their targeting on poverty ranks. However, it is entirely up to the different programmes to define their targeting criteria and to extract the relevant data from the UBR.

■ Using UBR data for programme targeting

Once the data is collected, it can be used by the different social protection programmes, which are thus freed of the burden of collecting their own data. Through this centralised system, programme implementers can also gain an overview of which households are receiving which intervention(s). On the one hand, this avoids unwanted overlaps. Households already targeted by one programme might not be in need of another. On the other hand, a policy-maker might also want to direct several programmes at a particular category of households in order to address multiple needs. And, if a household ceases to be eligible for one programme, it can easily be assigned to another. For instance, if an able-bodied member of a household that participates in the PWP becomes unable to work through illness or injury, the household might instead receive a social cash transfer.

■ Not a one-way street

Data flows from the UBR to individual programmes, which have their own information systems that transform the data based on their needs. In turn, the programmes feed information on who they have reached back to the UBR. Thus, the UBR collects information on who was meant to benefit from a programme, as well as on who actually benefited. After all, eligible households might fail to participate due to implementation issues or lack of access to the programme, for example.

This feedback loop opens up the possibility to monitor the success of a programme, or combination of programmes, through the UBR. Policy-makers can potentially trace which programmes – by themselves or in conjunction with others – were successful in achieving which objectives (e.g. alleviating poverty, improving food security or opening up new ways of making a living). For example, a policy-maker might want to link social cash transfer beneficiaries with

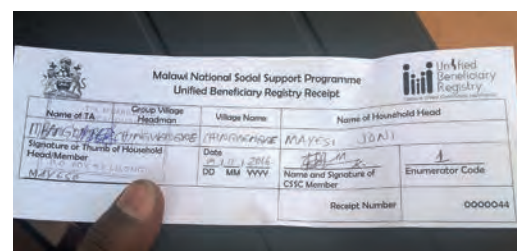
a local savings group to enable them to access financial services and financial literacy training. The local group, by allowing a beneficiary to save and access credit, can then facilitate his or her access to funds in times of crisis. By being able to monitor these linkages, the UBR improves accountability and the possibility of learning from programme implementation.

■ Beyond targeting – spatial data & payment systems

The UBR can be used for more than the harmonisation and streamlining of social protection programme targeting mechanisms. Malawi is envisioning a link between the UBR and a planning and co-ordination tool for community-level projects based on geographical mapping software. The GIS tool will replace current paper-based systems and allow communities to create, for example, village-level action plans (VLAPs) to generate local assets. The PWP can take up these plans and support them by providing additional labour. The UBR also stores the location of households so that they can be assigned to public works projects in their vicinity.

Geographical data can also help harmonise payment mechanisms for the different programmes. Through the GIS tool, programmes will be able to identify areas where the need for a payment point for beneficiaries overlaps with that of other programmes.

In sum, the UBR provides a much-needed link between the different social protection programmes in Malawi by allowing for the harmonisation of different implementation procedures and avoiding duplication.



Receipt certifying inclusion in the UBR.
Photo: Mc Neil Mhango

The power of open data

Empowerment comes from the capacity to make better choices. However, people can only make a sound choice if they have had access to the necessary information. This is where the GODAN initiative comes in.

The Global Open Data for Agriculture and Nutrition (GODAN) initiative seeks to support global efforts to make agricultural and nutritionally relevant data available, accessible and usable for unrestricted use world-wide. The initiative is a network of partners that join GODAN voluntarily; the only requirement for becoming a member of the initiative is to agree that open access to research and open publication of data are vital resources for food security and nutrition. The network includes farmers, farmer organisations, researchers, extension experts, policy-makers, governments and other private sector and civil society stakeholders, which all participate in 'innovation systems' and along value chains. GODAN gives these stakeholders a community of practice to exchange their knowledge and experience. With a shared agenda enabling an increase in the supply, quality, and interoperability of data, alongside action to build capacity for the use of data by all stakeholders, we can make open data work for agriculture and nutrition.

■ A focus on South-South exchange of experience

The trigger that led this initiative was a discussion that took place at the 2012 G8 Summit. While these world leaders were debating the various challenges faced by our populations, food security was identified as one of the most serious and pressing threats

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to humankind. It was then mentioned that by 2050 the world would need to increase the availability of food by 60 per cent compared to its current production levels. Yet it was noted that already, some of the most important resources such as fish were fully or over-exploited in many parts of the world. The discussion also looked at the issue of water becoming scarce, making agriculture production more and more difficult, a problem exacerbated by global warming, climate change and inefficient practices.

However, it was emphasised that the two regions that are being most affected by rapid population growth and climate change are precisely those with the greatest potential for food production increase, namely Africa and Asia. Therefore the conclusion was that a global solidarity effort should be made to share best prac-

The GODAN initiative

Launched in October 2013, the GODAN initiative today includes more than 500 members across the globe, representing governments, international organisations, the private sector, research and civil society, united by the common pledge to work together, share knowledge and innovate beyond the traditional silos. The voluntary association focuses on building high-level policy and public and private institutional support for open data, the ultimate purpose of this effort being to stimulate innovation as key for the world to meet the food security challenges emerging in light of demographics and climate change.

For more information, videos on the examples mentioned in the text as well as on further specific partner initiatives, please take a look at the GODAN website:

➤ www.godan.info

tices, data, knowledge and expertise in all its forms with them. That was the original concept. However during the two years that followed, and until the actual GODAN inception in 2015, the idea evolved towards a global knowledge/data sharing network of partners emphasising south-south experiences as one of the fastest routes towards adoption of improved agricultural practices and innovation.

■ The partnership in practice

The many initiatives that GODAN partners are involved in are diverse as the composition of its network is; data integration projects, for instance, involve satellite experts, drone operators, governments, farmer associations and insurance companies, aiming at improving predictability and hence the capacity to better protect the agriculture sector, mitigate the impact of climate change and enhance economic activity in the sector. Other examples noted by GODAN sometimes arise from its working groups, virtual gatherings of global experts such as the working group on soils, with experts from Japan, China and India, looking at ways to improve soil quality and, as a result, agricultural productivity. Other groups look at interoperability, either from agricultural standards (so that data and knowledge becomes interoperable and can flow and be understood) or technical means (improved search engines, dataset protocols, etc.).

■ What difference can this make?

A lot. Recently, in Hyderabad, India, the representative of a co-operative announced the results of an assessment done across its members, comparing their productivity/yields one

The app designed by Abalobi shows the fishermen where best to fish. It also helps them keep track of their expenses and daily income.

Photo: Serge Raemaekers / www.abalobi.info



year after they had made weather and market data available through mobile phones, as compared to how it had been three years before, without open data. The difference was a 30 per cent increase in the yields and income of these farmers.

In Africa we have many similar examples, where again weather, market and also geospatial data allow farmers to use fewer resources to produce more and better crops, pay less for their inputs and get more revenues from their products. Esoko, an initiative from Ghana illustrates this; started as a non-profit NGO sharing weather data with farmers, it now includes market and other information that helped increase farmers' income by 10–25 per cent. As a result of this success, the Esoko concept is now used by thousands of farmers across more than ten countries in Africa.

Another example is a fishermen's co-operative in South Africa (Abalobi),

which had the same problem that most subsistence farmers face: never having had a payroll statement (they are self-employed), the fishermen have little or no access to credit in the traditional banks. The co-operative they joined forces in had a basic app developed for them, allowing them to know when and where best to fish, keep track of their expenses and daily income and print the results on a formal income statement, well-received by local finance institutions.

Access to information is often also a question of literacy. Especially among illiterate people, the way and shape of providing the data is crucial. For example, the Government of Ethiopia created a hotline for farmers, where a person speaking their language directly provides them with important knowledge as weather, market data etc. During its first three months, the hotline received more than half a million calls and currently has more than a million subscribers.

■ What does the future look like?

The mission of GODAN is to contribute to making open data the standard. We believe that open data is the right approach to empower people, be it consumers, merchants, farmers or political or private leaders alike. Empowerment comes from the capacity to make better choices. GODAN also understands that open data is challenging and is working on tools and advice to ensure that data is opened responsibly.

This is what GODAN is all about, and this is why so many partners have joined this alliance in true record time. We believe that this trend is there to continue and in fact snowball in the coming years as more and more 'champions' emerge in all corners of the world, sharing freely how open data have made a positive difference in their lives and those of their communities, business, regions and countries.



Photo: David Cheshire/Loop Images/taif

Privacy and data security in development projects

Nowadays, the development context would be quite inconceivable without the collection and use of large sets of data. This also raises the question how such data should be handled and protected. Our author insists that the same standards have to apply in the North and in the South.

The right to privacy is a human right which was first enshrined in the Universal Declaration of Human Rights in 1946 and reiterated in the International UN Covenant on Civil and Political Rights in 1966. Privacy is therefore not merely a “first-world problem” (Kate McKee) although there are cultural differences of what people around the world consider to be private information. Furthermore, it is not just privacy that is at stake today in an increasingly digitised environment: since more and more personal data are collected in cities as well as in the rural context, the question is: who is in charge of these data collections, and does the individual citizen, consumer or farmer have any chance to learn about the processing of his data, let alone to control this processing? It would certainly be true to say that farmers in Africa have different and bigger problems than protecting their data. At the same time this statement is somewhat patronising in view

of the guarantees on data protection which people in developed countries enjoy. Therefore, aid agencies based in Europe or e.g. Canada have to comply with the rules on data privacy and security of their respective countries when they are engaged in development projects in Africa and elsewhere. At the same time, manufacturers of agricultural technology should not be allowed to undercut data protection standards established in developed countries when selling their hard- and software to African farmers.

■ Data protection

Data protection (sometimes called “data privacy”) goes beyond the concept of privacy because it gives the data subject rights to access and rectify his personal data and have them deleted once their storage is no longer necessary. More importantly, the developed and developing countries have agreed in the Organisation for Economic Co-operation and Development (OECD) framework on Guidelines for the Protection of Privacy and the Transborder Flows of Personal Data (1980, revised in 2013). These Guidelines demonstrate that governments consider eco-

omic co-operation and development – the right to an adequate standard of living is enshrined in the International Covenant on Economic, Social and Cultural Rights since 1966 – and data protection not to be contradictory but complementary values. This is particularly important in view of the fact that personal data are processed globally and services requiring the collection of such data are offered on a worldwide basis.

Why are privacy and data protection important in the development context? In many developed countries (e.g. in the European Union, North America, Australia, Japan) legal frameworks for data protection have been established with certain differences but with some main commonalities: personal data shall be collected in a transparent fashion, the data subject has a right to access these data and find out for what purposes they are used and how long they are stored by governments and industry. As far as the private sector is concerned personal data should only be collected with the informed consent of the data subject and only to the extent which is necessary for a specific purpose. In view of digitisation evolving at break-

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neck speed, it is crucial that the data subject can trust that the data he discloses to make use of certain services or machines with data-processing capabilities are not used for different purposes (e.g. marketing). Data privacy is a key element to create this trust.

Three examples may illustrate this. Smart farming (or as it is also called: precision farming) requires the collection and use of large sets of data on the status of the soil, weather, resources, cultivation and management of the farm. These data are, in most cases, personal data of the farmer and only occasionally data referring to a co-operative (non-personal data). The farmer who uses equipment with the capacity to store these data will often want to process and analyse his “digital crops”, i.e. the knowhow he has gained while engaging in smart farming. These “digital crops” are of economic value to him, and he may not want to share them with his competing neighbour. He may also think twice if a foreign company offers him the use of cloud-based services for smart farming because the farmer wants to be sure that he stays in control of these data. What happens if the company goes bust or is sold to another company which does not seem to be as trustworthy as the original service provider? Therefore the farmer may prefer to use hard- and software which allows for the local storage of his data.

Secondly, a company selling electronic farm machinery with data storage may not allow the farmer to extract the data if he wants to switch to machinery of another manufacturer. Europe is introducing the “right to data portability” in 2018, which would prevent this “lock-in” effect making farmers dependent on one particular technology or corporation and thereby preventing competition. This is at least just as important globally and in relation to developing countries, where foreign companies often dominate the markets.

Finally, access to financial resources (financial inclusion) is another area where privacy and data protection are increasingly seen as issues which need

to be addressed in order to make sure that digital financial services do not have an exclusive instead of an inclusive effect on farmers and other persons applying for microcredits. The G 20 High Level Principles of 2016 therefore call for the establishment of responsible financial practices and a “sound consumer and data protection framework” which is “essential to building trust and confidence in the acquisition and on-going use of digital financial services, especially for consumers with limited financial literacy or the resources to absorb losses” (Principle 5). The G20 governments are continuing discussions on how to put flesh on this rather general statement. Obviously, financial institutions have a legitimate interest to check the financial status of potential customers as to their capacity to pay back credit and at the same time to protect from over-borrowing. However, this does not justify the excessive collection of personal data with no relevance to this purpose. Since persons in need of capital may agree even to illegitimate forms of data collection, consent is not a sufficient legal basis. What is needed is sensible regulatory restrictions on the collection of personal data at national and international level. The revised OECD Guidelines (2013) and the European Data Protection Regulation (2016) are possible blueprints here.

■ Data security

Data protection limits the collection and use of personal data. Data security is the other necessary component of informational autonomy: It requires the controller (i.e. the farmer or the provider offering the farmer services including the processing of personal data) to take the necessary technical and organisational measures to ensure the security and integrity of the processed data. This includes the protection of these data against unauthorised access by governments, hackers and identity thieves. The rise in the number of personal data breaches is staggering, as has become obvious in countries where the law prescribes security breach notifications in any case

to the supervisory authorities and in certain cases to the data subjects. African farmers should not content themselves with lower standards of data security than farmers in Europe or in North America. Anyone should be offered state-of-the-art encryption tools for storing and transmitting their personal data at no extra cost. The European Union is embarking on a novel concept in this context by supporting the idea of certification and seals in their Data Protection Regulation. Products and services which are developed following the principle of privacy by design and by default should be certified and given a seal demonstrating to the user that the technology has been designed and manufactured according to the relevant legal standards. Such products and services will have a competitive advantage especially if they are to receive preferential treatment in development projects and public procurement. This does not exclude completely possible abuses or leaks when deploying this technology, but it may create the necessary trust-based architecture for using digital services and devices.

■ Conclusion

A crucial issue in many development projects is the question how to balance the human rights to privacy and data protection with the human right to an adequate standard of living. But it would be a mistake to assume that there is a trade-off between the two rights. Adequate living standards can be achieved while respecting farmers’ privacy and ensuring that they can stay in control over their personal data. The OECD Member States generally agreed on this when they adopted the revised OECD Guidelines on the Protection of Privacy and Transborder Flows of Personal Data in 2013. As Albert Schweitzer put it in his Nobel Lecture in 1954, “For any enterprise, trust is the capital without which no effective work can be carried out.” He was speaking on the issue of peace at the time. But the same is true for development projects. Data protection and security are cornerstones for building trust.

Healthy scepticism is called for

Digital technologies no doubt hold a great potential to trigger changes in African agriculture. But the euphoria over digitisation must not eclipse the issue of who actually benefits from new developments and whether they are not increasing pressure on those who are already marginalised instead of supporting fair participation, our author maintains.

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As a rule, governments, federations and business representatives paint a rosy picture of what the future of African agriculture could look like with the aid of digital technologies. It is understandable for people to hold such hopes. After all, over the last 40 years, digitisation has changed many societies and business fields world-wide to an extent that hardly anyone would have predicted – albeit not necessarily in a fairer and more sustainable direction. Given the major challenges that many rural regions in Africa are facing, fundamental changes really are appropriate and needed. There, efforts to reduce rural poverty and hunger have met with less success than elsewhere, and the impacts of climate change and dwindling natural resources are going to further aggravate the situation that smallholders are in. In addition, more than 60 per cent of Africa's population are younger than 25 years of age. From today up to 2035, around 350 million young people will be entering the labour market. Only about a third of them are going to earn a reasonable income in sectors other than agriculture. This is why strengthening the agricultural sector in its multifunctional role is absolutely paramount.

■ Do digital technologies strengthen participation and ownership?

So there can be no question that changes will occur. And whatever they may look like, digital technologies are going to play a role in them. But only one role in a cluster of political, social, legal and technical innovations and measures required to implement the targets defined in the context of the Sustainable Development Goals (SDGs).

Any technology can only be as good or as bad as the social and political context in which it is embedded. Technologies form our environment, change or consolidate power structures and thus crucially influence future developments, all of which also applies to digital technologies. This is why it is important to have the right tools available to critically assess the respective impact on different groups of the population. Do digital technologies strengthen participation and ownership, and do they open up new opportunities for those who have so far not been optimally integrated in social and economic processes? Or do they exacerbate existing power structures and increase pressure

on those who are already marginalised today? Both versions seem possible. But given the existing power structures in the agricultural sector, I do not see why digital technologies should be applied in a manner benefiting particularly smallholder producers instead of agro-industrial corporations with considerable capital resources.

From the angle of the Gates Foundation, digital technologies provide a remedy for exactly what African agriculture is suffering from. Technologies link producers, many of whom are presently isolated, with upstream and downstream levels of the value chain or the end user and optimise the rural knowledge systems. For example, mobile telephones are to replace or optimise insufficient agricultural extension systems with online tutorials or regular news briefs while simultaneously improving the quality of advice since they facilitate information exchange in both directions, i.e. also from the farmer to the consultant (or the researcher). In addition, the digital services could communicate market information on fertiliser, seed or pesticide prices to the farmers. Last but not least, they provide information on sales markets, thus improving marketing opportunities and revolutionising the award of credits and subsidies.

So far so good! No doubt new communication technologies do hold a considerable potential for African producers – provided that they have a mobile phone. Currently, an extremely large number of mobile phones are going into operation in Africa's rural areas. But alone the fact that the farmer happens to be a woman reduces the prospects of owning a mobile phone by 50 per cent – a poor state of affairs given that a very large share of African smallholder farms are run by women. And yet mobile phones, which support networking and the integration of women farmers in further education programmes, bear a considerable potential to at least narrow the gender gap in what tend to be patriarchal societies.

■ New technologies and markets for old familiar players

Let's have a look at another weak point. What happens if above all those technologies assert themselves that

strengthen the productivity of large-scale farms while small and medium-sized farms are pushed from the market? Both the developments in the agricultural engineering sector and those in the seed sector indicate this variant.

Just a handful of corporations have already divided a major share of the market among themselves. For example, together with CNH Industrial, the US corporations Deere & Company and AGCO hold more than 50 per cent of the market for farm technical equipment. With its 29 billion dollar turnover, even Deere, fleeced by a two-year sales crisis, exceeded the 25 billion dollars worth of accumulated sales of seed and pesticides by Monsanto and Bayer in 2015.

Since 2013, with its 137 billion US dollar turnover the best year of the agricultural engineering branch on record, sales of tractors, baling presses, milking machines and all the other technical equipment in demand in the agricultural sector have been on the decline. The most important and only truly promising market is that of digitisation in the agricultural sector. Some takeovers and joint ventures have already shown this trend in the past few years. In 2014, AGCO and pesticide manufacturers DuPont announced that they were co-operating in digital data transfer. In the same year, CNH and Monsanto's "Climate Corporation" branch signed an agreement on the development of a precision-planting technology. One year later, Deere agreed to develop equipment with the Climate Corporation enabling the Deere farm management system access the giant Climate Corporation data sets online.

These are exciting collaborative schemes between the giants at the respective value chain levels. And since this is all about the management, analysing, storage and administration of giant volumes of data, these new markets are of interest not only to the traditional agricultural corporations but also to firms such as Google, IBM or Microsoft.

■ "Digitise or perish"?

Unlike India, South America and China, Africa is not in the focus of these developments. Not yet, that is, for the 2015 economic review of the VDMA (*Verband Deutscher Maschinen- und Anlagenbau* – Mechanical Engineering Industry Association) states that Africa is increasingly gaining importance as a sales market. According to the VDMA, collaborating with Germany's Federal Ministry for Economic Cooperation and Development is working very well as a door opener to the African markets. It explicitly refers to the "One World No Hunger" initiative. Even though the collaborative schemes currently focus on technologies for smallholdings, this certainly won't be interesting for the branch in the long run. At any rate, it anticipates significant structural change and sees its market opportunities in new digital services for the large-scale enterprises.

Once one thinks through corporate power and strong imbalances in African agriculture, the rosy picture of the

digital agricultural future becomes murky, and the "grow or perish" motto looks likely to turn into "digitise or perish". For no matter how much they may benefit from the new communication tools offered by the digital world, smallholdings simply do not dispose of the resources needed to make use of the capital-intensive new agriculture technology tools.

Rather, a vision of the future is emerging that would entrench a more large-area and industrialised agriculture and in which both environmental and justice issues would remain unsolved. Structural change would be promoted, and instead of more of the many million young people seeking employment on the continent, fewer of them would tend to be able to earn an income in agriculture.

Things don't look very different in the seed sector. The technologies of the first "transgenic" generation seem rather crude compared to today's options to directly edit DNA building blocks. The seed corporations have quickly drawn up contingency plans to benefit from the new technologies. Today, more than 1,000 research centres are generating the data of genome sequences. By 2025, more data will be available on genomes than on astronomy. The resulting inconceivable volumes of data are often stored in publicly accessible data banks. But it is only businesses with substantial capacities in bioinformatics that can tap their potential.

What is really new in genetics is not so much the ability to read genomes but being able to write and transcribe DNA. This means that the DNA codes of crop plants, animals and microbes can now easily be modified with the aid of digital and laboratory instruments. DNA synthesis, i.e. the ability to "print" new strands of artificial DNA, is already being vigorously used. And the power struggles to secure varieties and processes and acquire patents that will protect the profits of the seed giants for decades are in full swing.

So the digital technologies are not resulting in a democratisation of our food system or in breaking down power structures in the seed sector, either. On the contrary. These structures are being entrenched and extended.

■ There are alternatives

Still, digital technologies do have the potential to promote fair and sustainable structures in African agriculture. I could for example imagine digital tools being employed to interconnect people whose land rights have been violated more effectively with solicitors providing legal support for them. The "open source" debate is also exciting. It is a term that all those campaigning for free software are well familiar with. Now, some pioneers have transferred this debate to seed and introduced the first open source-licensed tomatoes on the market. This is a clear step against corporate power that one would like to see taken in many other areas of digital agriculture.

Organic and Fairtrade cotton – a way out of rural poverty?

Helvetas, with the support of the Swiss State Secretariat for Economic Affairs SECO, has implemented organic and Fairtrade cotton projects in West Africa and Central Asia for over 15 years. More than 22,000 farming families have benefited from a diversification of the agricultural production system, increased incomes as well as a healthier work environment. However, a number of problems occurred as well, such as contamination from neighbouring GM crops. So what can be learnt for future engagement in the organic cotton sector?

Helvetas set up its first organic and Fairtrade (O&FT) cotton value chain project in Mali in 2002, followed by projects in Burkina Faso, Kyrgyzstan, Benin and Tajikistan. Despite the diverse contexts, a majority of conventional cotton farmers faced similar challenges in these countries: Long-term monoculture and exaggerated use of subsidised chemicals led to health problems, depleted soils, and thus reduced yields. In many places, the low yields and volatile cotton world price resulted in negative gross margins and increased indebtedness of farmers. Despite the low profitability of conventional cotton, constricting policies and a lack of experiences in other cash crop production and alternative markets made farmers stick to cotton production.

In this context, organic agriculture offered a way out of indebtedness and increasing health problems of the farming families by providing an alternative production method doing without expensive and harmful chemical inputs, as well as by offering premium sales prices.

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Since the concept of certified organic and Fairtrade products was new in these countries at that time, the projects focused on developing competences of producer organisations and external service providers to offer relevant services, such as rural advisory on organic production, supply of production inputs applicable in organic, the organisation of internal control and external certification, and marketing of certified crops (please see online version of this article for the organisational structures of the three value chains and the services that the producer organisations offer themselves or buy from external service providers).

■ Impact of the organic and Fairtrade cotton value chains

By 2016, there were around 12,000 cotton farmers. However, both their numbers and harvest yield fluctuated considerably. On average, 9,007 farmers produced 2,621 tonnes of seed cotton annually plus rotation crops such as sesame and vegetables. This accounts for a total of 33,200 t O&FT seed cotton, or 291 kg of sold seed cotton per farmer and year. Assuming that farmers participated in the value chain for five years on average, more than 22,000 farm families benefited from the O&FT production. The fluctuating number of farmers (see also Figure) reflects the serious challenges the organic value chains faced:

In **Burkina Faso**, Monsanto and the national cotton companies in-



roduced genetically modified (GM) cotton on around 70 per cent of the productive cotton lands in 2008/09. The consequences and costs for the O&FT value chain were manifold: The first contamination of organic cotton in 2009 led to a wide de-certification of organic fields. In order to prevent further GMO contamination of organic cotton, the producer organisation UNPCB had to cease collaboration with farmers in these areas and shift organic cotton production to less fertile areas. Additional investments in the training of the new farmers were necessary. Transportation costs from the new areas to the ginneries were comparably high. Now that GM cotton seeds were available, the seed farms no longer bred local varieties at scale, and the farmers' cotton seeds for replication were mixed up with GM seeds. Therefore, in the subsequent years, seeds for organic production were scarce and the farmers union had to import non-treated seeds from Togo, which proved to be a complicated bureaucratic venture. In addition, ginneries had to be cleaned before processing organic cotton owing to the risk of contamination. Ginning of organic cotton was thus scheduled only at the very end of the season, and O&FT cotton sales were delayed. All in all, GM cotton raised seed prices, complicated production, processing and certification and demotivated some farmers to continue with organic production.

An institutional crisis that had developed within the farmers union in

Social benefits were the primary reasons for the farmers to adopt organic practices.
Photo: Simon Opladen



Burkina Faso (UNPCB) for political reasons as well as the termination of a long-term and highly beneficial sales contract with the main buyer affected the farmers' motivation and their adherence to the value chain.

In **Mali**, cotton sales and processing are concentrated within the parastatal Malian cotton company (CMDT). Therefore, the National Federation of Organic and Fairtrade Producers (FENABE, MoBioM until 2015) cannot engage and directly benefit from cotton sales. For two years, certified cotton was not sold at premium prices because CMDT had other marketing priorities. In this period, farmers suffered a combination of low yields and low sales prices. In addition, CMDT decided to gin organic cotton at the end of the season, which led to late

sales of cotton and demotivated organic cotton farmers. Despite diverse efforts, the ginning schedule and cotton sales were out of the sphere of influence of the project and the producer organisation MoBioM.

In **Kyrgyzstan**, O&FT cotton sales are determined by the ability of the producer organisation BioFarmer to purchase cotton from farmers directly at the ginnery. Therefore, BioFarmer needed to access trade capital, which was not sufficiently and continuously available.

Economic impact

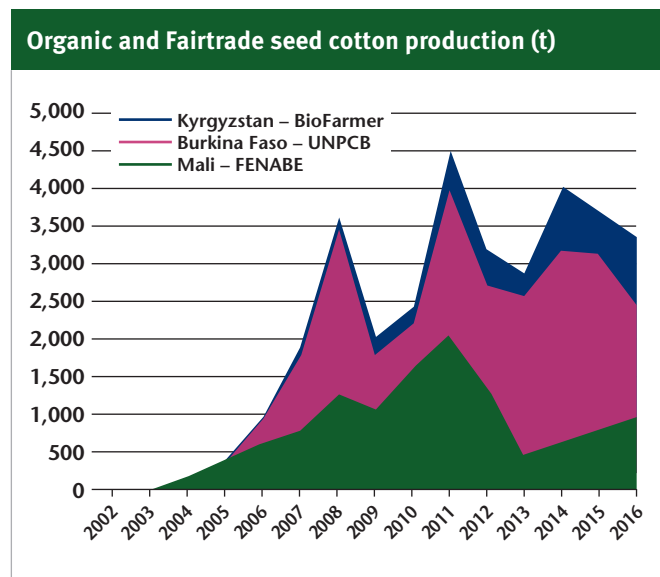
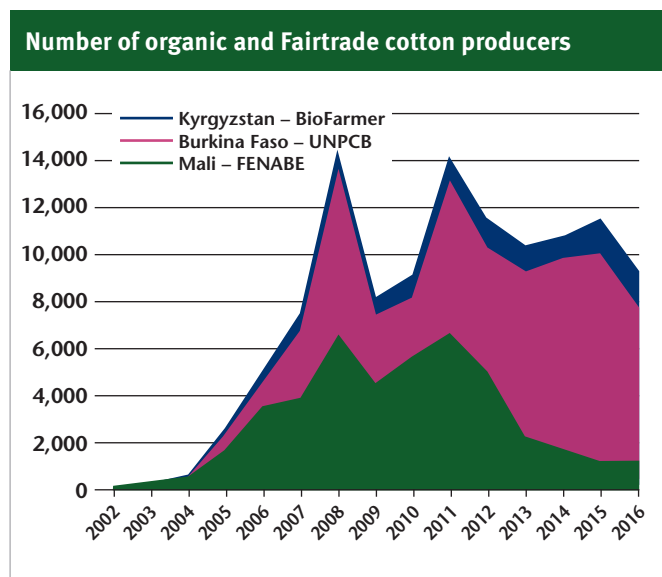
Besides having overcome debts, which is probably the main economic and social impact of the measures, all O&FT farmers together have benefited from a total additional income of 11.2 million euros, or 107 euros per farmer and year, compared to conventional farmers. The calculation bases on the following parameters, which were defined and added up for each country and year. They account for the total certified cotton area of the three countries.

Yields: In **Kyrgyzstan**, O&FT cotton farmers invested in livestock, gaining access to farmyard manure they needed to maintain soil fertility and yields. Their average yields are comparable with conventional seed cotton yields (2 t to 2.5 t/hectare). In **Burkina Faso** and **Mali**, access to and application

of organic manure or other fertilisers remained a challenge. In addition, conflicting interests prevented organic cotton from growing faster: the main business interest of CMDT and UNPCB is in the promotion of conventional cotton. Furthermore, GMO contamination in Burkina Faso led to a marginalisation of organic areas to less productive lands. As a result, yields of conventional cotton were 60 per cent higher (723 kg seed cotton/ha) than those of organic cotton (441 kg seed cotton/ha).

Sales prices: In **Kyrgyzstan**, the average price was 18 per cent higher for organic seed cotton (34.6 som/kg) than for conventional cotton (29.2 som/kg). In **Mali** and **Burkina Faso**, sales prices were around 60 per cent higher for organic cotton fibre (324 FCFA/t) compared to conventional cotton fibre (203 FCFA/t). These premium prices more than compensated the relatively lower yields. In addition, the farmer communities benefited from a total Fairtrade premium of 799,000 euros, or 5 euros (West Africa) and 28 euros (Kyrgyzstan) respectively per farmer and year.

Input costs are, on average, 73 euros/ha lower in organic farming compared to conventional farming, thanks to the abandonment of chemical pesticides, herbicides and synthetic fertilisers. Total savings in input costs amounted to 8.4 million



euros from 2002–15, or 74 euros per farmer and year. Labour costs are not included in this calculation. Organic production usually requires more labour input during the vegetation period, whereas, because of the higher yields, in conventional cotton production, manual labour is higher during the harvest period.

Social and environmental impact

Despite the considerable economic benefits, social benefits were the primary reasons for farmers to adopt organic practices. These include better health thanks to the abandonment of harmful production inputs, as well as access to productive lands and cash crop production for women in West Africa. Other benefits were reduced production risks thanks to enhanced soil fertility and diversification, access to rural advisory services, and markets for rotation crops. The benefits from the production of rotation crops have been so compelling that numerous organic farmers have limited cotton production in favour of more beneficial organic food crops, such as vegetables or sesame. In addition, the renunciation of an estimated 6,000 t of chemical fertilisers led to a calculated reduction of around 11 million t of CO₂ emissions in the period between 2002 and 2015.

Key learning

Producer organisations play a key role in value chains. Today, they have the capacities to offer rural advisory service for organic agriculture, ensure input supply, and manage internal control systems as well as organise external certification. BioFarmer in Kyrgyzstan reached a self-financing of 100 per cent based on sales margins, while the producer organisations in Mali and Burkina Faso cannot benefit directly from cotton sales because of the persisting sales oligopolies of the cotton companies. What key lessons can be derived from this cotton experience?

■ Access to trade finances is critical for the profitability of the producer organisations. In Mali and Burkina

Faso, trade capital is available via the national cotton unions, whereas in the privatised Kyrgyz cotton sector, access to trade capital continues to be a limiting factor. If the producer organisation lacks the capital to pay organic cotton in time, organic farmers relinquish premium prices and sell organic cotton at a conventional price. This reduces the margin the co-operative gets from sales and constrains the sustainable business. Promising approaches to access trade capital include pre-financing by the cotton trader, loans from local and international banks, as well as investments by local cotton seed processors. Donor organisations can also play a key role by offering bank guarantees.

■ The policy environment can seriously affect the development of organic value chains. In Mali and Burkina Faso, the parastatal cotton companies have a mono-/oligopoly on cotton trade, input sales and ginning services. Ginning and sales of organic cotton thus fully depend on the priorities of these institutions, and the farmer organisations cannot claim for the full margin from cotton sales. Further, the cotton companies are heavily involved in agricultural inputs business, which limits their interest in strengthening the organic sector. In particular, in non-privatised settings, policies conducive to organic sector development have proved to be key to the sustainability of the O&FT cotton value chains.

■ Investments in O&FT value chains should entail an advocacy component that addresses e.g. the introduction of organic curricula in education institutions and in public extension services, the protection against GMOs, as well as the business environment of producer organisations.

■ Farmers' adherence to the value chain is key for the sustainability of the producer organisations' business: In the first years, farmers need the most support in order to get acquainted with the O&FT system, whereas yields increase only after some years of organic farming. Furthermore, organic certification usually requires a conver-

sion period. Hence, farmers who leave the value chain at an early stage drive the costs of the producer organisation by generating less margin. Five aspects support farmer adherence to the sustainable cotton value chain:

1) Services to mitigate risk of GMO contamination.

2) Beneficial fund flows to farmers via pre-financing of inputs, timely sales of cotton and rotation products. In this regard, trade capital, diversified production and marketing systems are key.

3) Sales prices that compensate lower yields or trigger investments into organic intensification instead of organic by default.

4) Diversified production and marketing systems to increase farm income, reduce cluster risks and enhance fund flows. Since the fibre market is different from the staple market, a separate business network must be established to market rotation crops of cotton.

5) The Fairtrade premium as well as public funding are important to bridge the in-conversion phase of organic farming.

Outlook

SECO and Helvetas support to the O&FT cotton value chains in Mali and Kyrgyzstan ended in 2016, while the Burkina Faso project runs until mid-2017. Owing to the growing market demand for O&FT cotton, the improved competences of the producer organisations, the alluring benefits for farmers, as well as the international community's increasing interest in supporting organic agriculture, there is a high probability that the business of these three O&FT cotton value chains will be long-lasting and outlast the completion of SECO and Helvetas' engagement.

For a list of references and a link to the full study, see online version of this article at: > www.rural21.com



*A Ladakhi farmer outside her home in Rumbak Valley. India's cold desert is a large area devoid of vegetation.
Photo: Sharada Balasubramanian*

Winter farming technologies for India's cold desert farmers

Ladakh, tucked between Kashmir and Tibet in the northern Trans-Himalayan region, holds 90 per cent of India's cold arid region. Bitter winter, cold winds and extreme weather pose numerous challenges for farmers in this sparsely populated area. Scientists and agricultural department officials have worked hard to bring less labour-intensive technologies, enabling farmers to grow crops in the winter and earn more income.

Tall, brown, barren mountains crowned in snow dot the entire landscape of Ladakh, more popularly known as India's cold desert. Situated in the western end of the Tibetan Plateau, this region faces blasting winds from Central Asia, making winters bitterly cold and harsh. About 70 per cent of the people living here practise agriculture in such extreme conditions. In one of the highest and coldest farmlands of the world, temperatures dip to below minus 20 degrees Celsius in the winter, making farming impossible. Here, farmlands are scattered, and villages are disconnected from each other. The road to Leh town, the centre point of this region,

is shut between October and June, posing marketing challenges for farm produce.

"The agriculture season lasts from April to October, and in the other months, nothing grows," says Tashi Tsetan, Chief Agricultural Officer at the district agricultural office. This has an impact on access for locals to green vegetables during the winter. Further, farmers lack technology to stock vegetables for consumption in the winter. Non-availability of green vegetables adds to the nutritional problems of rural communities here. According to a scientist from the Defence Institute of High Altitude Research (DIHAR), a research and development organisation working on agriculture, animal husbandry and the flora of Ladakh, almost 72 per cent of the population face a deficit of cereals in their consumption, and 67 per cent lack access to green vegetables.

■ Unused opportunities

Despite the short farming season, farmers grow a large range of crops – capsicum, brinjal or aubergine, green peas, tomato, potato, chillies, cabbage, cauliflower and other leafy vegetables. The produce from here could be supplied to other parts of the country. "But the farmers here do not know how to earn money," says Tsetan. This is primarily because they are disconnected from the outside world. They are unaware of selling opportunities, what to produce, how to produce and how to sell their produce to earn income. There is a potential to sell vegetables grown here to the Indian Army troops deployed along frontiers in the Ladakh sector of Jammu & Kashmir and along the China/Tibet frontier. Then there is the local population. Including the army, vegetables are needed for 300,000 people in this region. More than 37,000 tonnes of vegetables

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would have to be produced to meet the demand. However, production has not yet reached 18,000 tonnes.

A few years ago, the district agricultural department initiated measures to increase farmers' income. "We chose a few far-off villages that did not have any readymade market. The farmers were asked to just grow one crop – green peas," Tsetan says. "We convinced them that we would find a market for the produce." Kashmiri traders purchase these vegetables, helping farmers earn income. Each farmer earned a profit of Rs 50,000–60,000 in the Kharu and Khaltse region of Leh district this year. The seeds for this were provided by the local agricultural authority.

■ Bridging the winter shortage gap

In the winter, vegetables are usually airlifted and sold for Rs 120–140 per kilogram – which is around three times the summer price (when for example a kilogram of potatoes costs Rs 40–50). "Even this supply depends on the cargo space, which is why local people only consume meat, pulses and dairy products in the winter," Anup Raj, a scientist at Sher-E-Kashmir University of Agricultural Sciences and Technology in Stakna, explains. The researchers give training to farmers on pickling vegetables for winter consumption.

The district agricultural department is supporting farmers with various technologies to lengthen the growing period, which, at altitudes of around 3,500 to 4,000 metres, is shortened to about two months. Greenhouses are well suited for this purpose. With them, the growing season can be extended by 45 days. Even fruits like watermelon and muskmelon can be cultivated. Greenhouses are not new to Ladakh; Europeans brought this technology to India long ago. They were initially set up for farmers' personal consumption. However, in the context of government support activities, commercial greenhouses were developed by the agricultural department. Tsetan says: "Our experts from the agricultural department went to China, looked at the model there and brought it here as climate conditions in Lhasa, Tibet, are similar to those here. They harvest tomatoes in the months of January and February, so we thought, why can't we do this in Ladakh?" The scientists modified the technology to suit the local conditions. The design is such that the temperature inside the greenhouse is 20 degrees higher than the outside temperature. Given that Ladakh has about 300 sunny days a year, greenhouses are a very appropriate technology. They are a passive solar heating system in which sunlight gets trapped, keeping the temperature and humidity high. Besides, both the farmers and the cattle can keep warm in them in the winter – without artificial heating.

The district government gives a 50 per cent subsidy on greenhouses for farmers. Tsering Angchok, a 55-year old farmer from Saboo village grows vegetables in his six acres of land. He set up a greenhouse six or seven years ago at a cost of Rs 150,000, with a government subsidy of Rs 80,000. "Before we had the greenhouse, we placed a plastic sheet on our crops, covering them before sunset and pulling the sheet away after sunrise," Angchok says. "Sometimes, we even covered the land with blankets and logs to keep the crop safe. Now, the quantity of vegetables produced has increased, and I can sell more."

The government is looking at an innovative way to cluster greenhouses in these villages. "Instead of giving greenhouses to individual farmers who are isolated from each other, if we have greenhouses in a group of 8–10, 400–500 kilograms of produce can be taken from one place," explains Tsetan. As the farmers using greenhouses are dispersed in different villages, there is no visibility of project implementation. But if a whole group of farmers in a village were to use greenhouses, the entire produce could be sold from village clusters. "This model, if implemented, could be replicated in other areas as well."

The farmers use local resources – mud, bricks, stones and timber – to build the greenhouses. The agricultural department gives them polythene sheets, in addition to the subsidy it provides. But after a few years, these sheets tear. The farmers then stop using the greenhouse. Long-lasting polycarbonate sheets that are also suitable in windy and high altitude areas could be an alternative. But they are more expensive and not subsidised right now. However, this year, the agricultural department has proposed that central government take this project ahead.

"The walls of the greenhouse should not be wasted, either," says Angchok Mahay, District Agricultural Officer. He adds: "Vertical trays can be fixed to these walls, and farmers can grow coriander, mint and other plants



Low tunnel, a low-cost technology, is used by farmers in Ladakh for growing vegetables.
Photo: Sharada Balasubramanian

on them. A bunch of coriander, for instance, sells at Rs 20 in the market. This can be a good source of income for farmers.”

The greenhouse has its own benefits, but it is costly and not movable. As an alternative, low tunnel technology was taken to farmers. It involves digging the soil at a depth of one and a half metres. The farmers can build the low tunnel anywhere on their land to grow leafy vegetables. Only a polythene sheet is needed to place over the tunnel. According to a recent publication in the Asian Journal of Horticulture, this technology has increased seed germination for cabbage cultivation from 75.3 per cent to 91 per cent in Kargil region. Time required for the production of marketable seedlings was reduced from 53 to 45 days and from 85 to 75 days for saleable cabbage. The total cabbage yield and net profit per unit area were above normal when grown under low tunnels as the produce reached the market earlier.

Digging underground trenches is also supported by the government. Farmers in the region are already familiar with the trench system, which is better known as the “poor man’s greenhouse” or the “vegetable cellar”, since vegetables are stored underground with this method. The open field trenches are 10 x 12 x 2.5 feet in size. Here, potatoes are stored in gunny bags, placed underground and covered by two feet of mud that is removed in March, when the vegetables are still fresh. The vegetables can also be taken out in the winter, only that the mud gets layered by ice that has to be dug out. In addition to potatoes, radish and carrots can be stored in these trenches, and farmers mostly use them for self-consumption.

■ Other earning opportunities

Despite the difficult environmental conditions, the region offers a big potential to provide the farmers with an income. Ladakh is a land of organic farming, where chemicals have not yet touched the soil. As Buddhists, the farmers do not use any pesticide

Government support

The district agricultural department has given support to build 1,670 vegetable cellars or underground trenches since 2000. They give each farmer Rs 8,000 to build them. The open field trenches have been supported by the local department since 2000 as well. So far, the department has helped build 4,780 trenches with a subsidy of Rs 2,000. Support for low tunnels started in 2014, and 689 have been supplied to farmers so far. In all, 73 greenhouses have been given to the farmers since 2007, with a subsidy of Rs 80,000 per farmer.

or insecticide on religious grounds. The soil is fertile, making the land suitable for generating high quality seeds. Here, cauliflower seeds are ready in a year, as compared to two years in other regions. Seed production for carrot, onion and potato would also be possible. However, a certified seed company is required along with packaging, grading and marketing support.

Floriculture could also be a great business opportunity for the local people. “Gladiolus flowers from here were sent for grading to the Department of Horticulture, Jammu & Kashmir. In one stick, there were a minimum of 10–11 florets and a maximum of 17–20 florets. Apart from Ladakh, people will find such quality only in France or the Netherlands”, says Tsetan. The congenial climate adds to the colour, fragrance and quality of the flowers. “About six or seven years back, we wanted to send these flowers by air to New Delhi, India’s capital. We asked for a concession, but there were other issues with the central government, and the scheme did not work. We have initiated talks to start this year, but we would still need marketing support,” he adds.

■ The human factor

However, the region also faces some very different challenges. Zaskar is one of the remotest places in the world, surrounded by 21 glaciers. One has to walk on a frozen river for 45 kilometres to reach this village. Here, snow falls to a depth of four to five feet, isolating the farmers. “They do not want to work with outsiders or trust people they don’t know,” says Raj, who has been working here for two decades. “There are huge socio-logical barriers to the implementation

of technologies. Once the trials are done, the technology is transferred, and the agricultural scientists have left, the farmers do not continue it. Scaling up is very tough.”

In such a difficult environment, government measures alone are not enough to secure livelihoods. Tata Trust, one of India’s oldest philanthropic organisations supporting community development, adopted two villages in the region as ‘potato villages’. With the Indian Army’s support, they airlifted potato seeds and distributed them among the farmers in the region. In May 2016, four truckloads of more than 20 tonnes of potatoes seeds were given to Ladakhi farmers for producing high quality potatoes. The Trust is also providing apricot farmers with harvest nets costing Rs 1,500 each. Farmers growing apricots, one of the main cash crops here, face 30–40 per cent losses as the fruit falls to the ground and gets dirty. Using the nets will reduce losses. “In the next two years, the trust will be looking at projects worth about Rs 30.6 million for Ladakh region,” says Raj.

Disconnected from the rest of the country, in an isolated highland, this place shows an immense potential to grow organic, healthy food that can reach other parts of India. But this requires strong marketing, packaging and technological and financial support. The research institutes, local agricultural officers and NGOs are working towards the development of this region. But more support from the central government is needed, above all in terms of concessional air freight rates to transport flowers, high quality organic potatoes and other vegetables. Once it is in place, development and better livelihoods could become a reality for the farmers.

GlobalFood Symposium looks at changes in agri-food systems

Is international agricultural trade good or bad for combating hunger and poverty in the developing countries? Which strategies are best suited in the agricultural sector to promote sustainable development? What is changing for farmers in the Global South through the spread of sustainability standards and the use of information and communication technologies? These and other questions were discussed at the 3rd GlobalFood Symposium in Göttingen, Germany, in late April 2017. The Global Food Symposium is held every three years by the University of Göttingen's GlobalFood Graduate College (GRK).

With around 70 lectures and 30 poster sessions, senior and junior researchers from 35 countries presented new research findings and discussed policy challenges related to global agri-food system transformation. The topics ranged from development policies, food governance and household welfare through issues concerning agricultural production and technologies, market participation of smallholders and the role of sustainability standards to aspects such as consumer preferences, dietary diversity and the role of women in modern agri-food systems. A brief selection is given in the following.

■ Food security, price volatility and the power of standards

It is undisputed that food price volatility poses a threat to food security, especially for people living near or below the poverty line; their food secure status can quickly turn into food insecure. The effects of financialisation and speculation on volatility have been examined in numerous studies. But how do export restrictions impact on food price volatility? To find this out, Bernhard Dalheimer, Bernhard Brümmer and Tinoush Jamali Jagh-



Promoting dietary diversity is one important aspect of nutrition interventions.

Photo: Eva-Marie Meemken

danie of the University of Göttingen took a look at developments on the international wheat markets from 2002 to 2015. They found not only that Argentina was the country with the largest number of export restrictions but also that export restrictive policies significantly increased price volatility. Quotas had the most pronounced effects. The young scientists therefore suggest more binding regulations to be adopted in the next round of negotiations on the General Agreement on Tariffs and Trade; from a volatility perspective, they do not see an apparent need to ban tariffs.

The role of private standards for manufactured food exports from developing countries was examined by Malte Ehrich and Axel Mangelsdorf. They wanted to see whether the proposition that standards can help developing countries to integrate in global value chains could pass a practical test. To find this out, they

evaluated more than 50,000 IFS (International Featured Standards) audits from around 12,000 companies in 87 countries from 2008 to 2013. The result was that while IFS certification increases exports on average, the effects remain robust for high-income countries only, whereas the potential of IFS to integrate low-income countries in value chains is limited.

■ Does agricultural diversity guarantee better nutrition?

In Ghana, the economic growth of the past years has been accompanied by a structural transformation of the economy and progressing urbanisation. Since 2010, less than 50 per cent of the population have been living in rural areas. Olivier Ecker of the International Food Policy Research Institute (IFPRI) looked at changes in diets in rural Ghana over the years and the role played by agricultural diversity in

this context. Ecker assumes that dietary diversity is positively correlated with dietary quality and, hence, nutrition. His surveys have confirmed that farm production diversity matters for dietary quality; however, the effects are smaller in the South than in the North of the country (where market penetration and access are less developed). The conclusion he draws is that in regions that undergo economic transformation, policies and programmes that support rural income growth may be more effective in dietary quality than those to promote farm production diversification. The latter may be ineffective among smallholder farmers if the farm households face staple food shortages and the interventions do not increase household incomes.

■ Women empowerment, ICT use and dietary diversity

Do the nutrition and livelihoods of women automatically improve when they have access to knowledge and to markets? This issue was raised by a team headed by Paul E. McNamara of the University of Illinois in the USA. The scientists studied an impact evaluation in production-oriented extension services in Bangladesh. The women were given special advice e.g. on the production and use of vermicompost or on aquaculture. In order to improve access to markets for women farmers, agreements were signed with traders. Once a week, they offered a selling point in the villages where the women could collectively sell their goods. Thanks to these two measures, the women's income rose by 25 to 44 US dollars per month. The assumption that women tend to spend more on nutrition and health than men was also confirmed: With the rise in household income, food security and dietary diversity of the households increased too.

Gender aspects were also the focus of research by Haruna Sekabira of the University of Göttingen. The young scientist wanted to know whether the use of mobile phones can contribute to gender equity and improved nutrition

in smallholder households in Uganda. He set out from the assumption that nutrition effects of mobile phone use can occur through various pathways, for example, as also referred to above, via better market access and related income gains among women or because women empowerment – in this case through easier access to news services and information thanks to mobile phones – may raise their nutrition knowledge and awareness, which could also contribute to improved dietary practices. His analyses revealed that female mobile phone use has stronger positive welfare effects than if males alone use mobile phones. He concludes that equal access to mobile phones cannot only foster economic development, but can also contribute to gender equality, food security, and broader social development.

So is digitisation the silver bullet for smallholder empowerment? It is a fact that in many African countries, public service provision is lacking e.g. in infrastructure, social protection and education, with the poor being disproportionately excluded from these services. It is a further fact that the use of voicemail and SMS can reduce the cost of communication by up to 50 per cent as compared with in-person visits. At the same time, mobile phone coverage has risen strongly on the continent. Jenny Aker of Tufts University in the USA has been doing research on the promises (and pitfalls) of ICT for agriculture initiatives for many years – and she warns against too much euphoria. Her surveys have shown that the quality and timing of information is crucial to how it is actually used by the farmers. Also, standardised information for such a sector as heterogeneous as agriculture is only useful to a certain degree. In addition, the question arises which technology – simple mobile phones, smartphones, ... – is available to the farmers and how they use it. Lack of experience with a given technology can result in their not fully engaging with ICT-based agricultural interfaces. And as wonderful as it might be, digitisation cannot solve all existing information asymmetries.

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