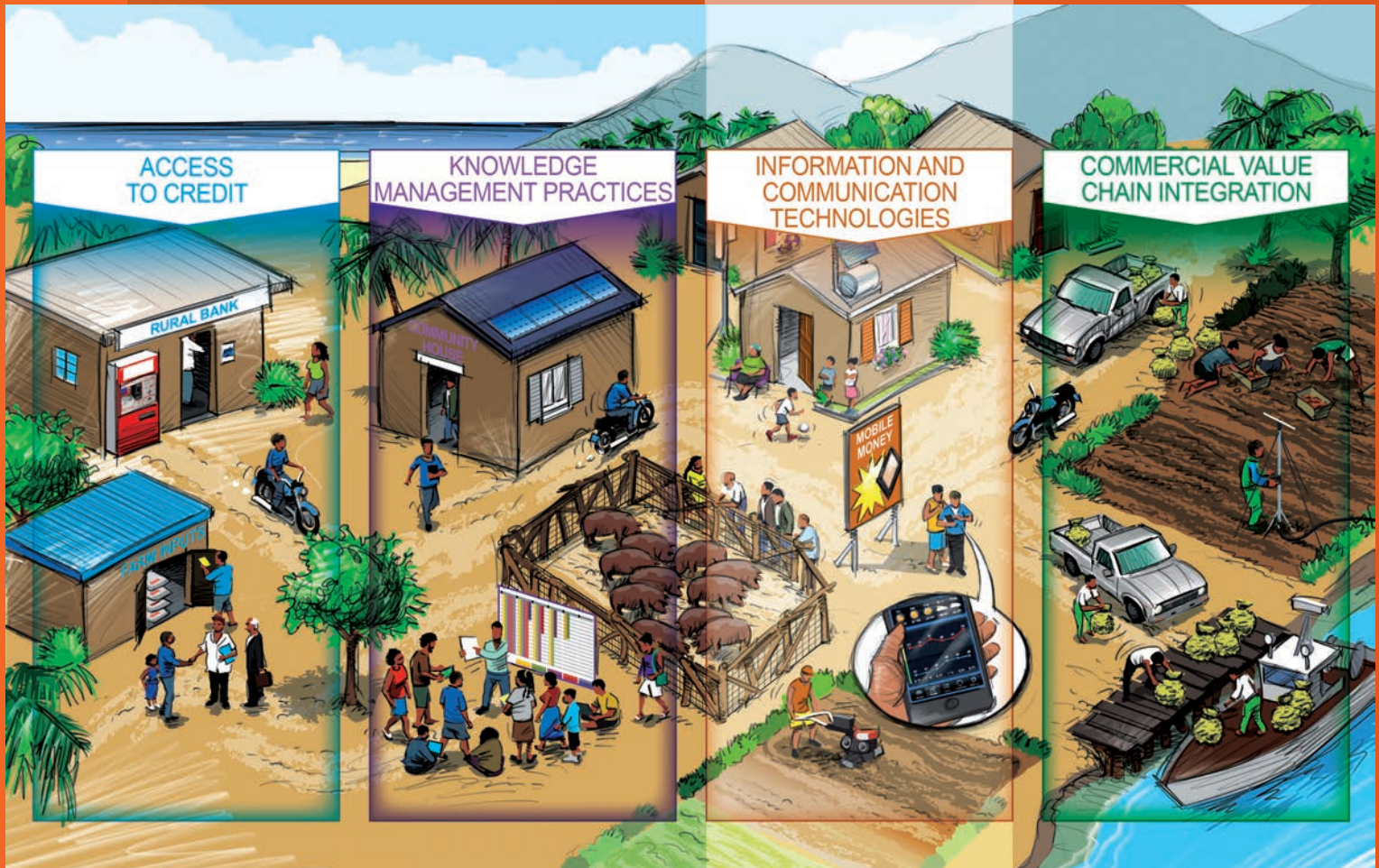


A radio campaign in Malawi shows how ICTs can improve the lives of family farmers

GPS technology is changing the way Mango growers do business in Ghana

Involving youth in farming is an upward spiral that lifts the status of the profession



Building resilience for family farming

Family farming

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ICT Update



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Guest editor

ICTs improving family farming

ICTs are transforming the lives of family farmers, giving them better access to information, markets, services and inputs, and making them more resilient to external shocks.

ICTs are helping millions of smallholder family farmers in developing countries gain better access to information, tools and technology that can transform their livelihoods. Indeed, ICTs help family farmers sell and market their produce, boost their ability to cope with dwindling access to water, land and soil nutrients, and deal with the extreme climate events, pests and diseases that affect their crops. If more of these ICT solutions are tailored to the needs of smallholder family farmers and put within their reach – especially the women farmers who form the bulk of this group – then their agriculture can rapidly move from being a subsistence activity to a successful and sustainable business.

Accessing markets

Agriculture is becoming more market oriented globally. Individual family farmers, however, are finding it increasingly difficult to participate in markets – not only in national and international markets, but even in local ones. Smallholder farmers have small amounts of farm produce to market but often do not have access to systems of communication, finance and transport. If they could somehow aggregate their produce and collectively synchronise their production and marketing systems, then they would be able to enter these markets more easily as a collective.

ICTs can help smallholder farmers improve their production systems so they can fetch better prices, avoid gluts and have the critical mass to grow market-led crops. Conventionally, this is done by cooperatives and farmer organisations, which bring together farmers. These organisations help reduce weaknesses in the value chain. In most developing countries, however, these organisations are weak and often face constraints in planning and monitoring production systems and setting up logistics for an efficient marketing system.

Some cooperatives have tried to overcome these constraints by taking control of the land of participating farmers. This approach, however, diminishes the opportunity for family farmers to participate in the decision-making processes that impact their livelihoods, and so ultimately this approach has failed.

ICTs now provide the potential to overcome these constraints. They can help family farmers coordinate their planning and monitoring of production and marketing systems by virtually aggregating data, without cooperatives having to take over the land or do the decision making for their farms. Access to credit, financial and insurance services for family farmers has been a major constraint to improving their farming and incomes. With the increasing availability of mobile phones and the internet, smallholder farmers can now access financial services much more easily.

ICTs also allow family farmers to see their farm processes from many different viewpoints, and this enables them to make more sound economic and environmental decisions. Access to ICTs and information also increases their technological literacy. A farmers' organisation that uses ICTs can now support individual farmers by suggesting what crops they should grow, and where, when and how to market them with these ICT-run systems. These systems can also help farmers organise and plan inputs. Connectivity also gives smallholders easy access to knowledge-based services that help farmers to solve farming problems.

Precision technology and land rights

Cloud-based data, application services and the wide availability of smartphones and 'phablets' have made precision technology – such as mapping systems with high resolution and three-dimensional maps – more widely

available to these farmers. Once the privilege of large farms, smallholders can now use these tools too to measure soil moisture and nutrients, for example, or environmental carbon dioxide.

The sensors used to make these measurements can be linked to GPS systems and incorporated into sensor networks that can help farmers monitor the well-being of their crops at a micro level. The use of drones and digital cameras are enabling farmers to use very low-cost remote sensing to monitor their crops. With close monitoring, farmers can use water and soil nutrients more effectively and sustainably. This, in turn, improves the resilience of their farming system.

Many smallholder farmers have difficulty securing their rights to land and other resources. Many family farms have tenancy agreements. But they keep poor records of allotment, ownership and tenancy. Cadastral surveys containing maps and records can now be managed and accessed at a lower cost using geographical information systems in the public domain. As a result, farmers can obtain records for their farms and use them to get mortgages, bank loans and compensation. When records become available in the public domain, farmers' rights to land and other resources become more secure.

A new paradigm for farming

Like society in general, ICTs are ushering in a new paradigm for farming and agriculture. The flow and use of information and knowledge in this paradigm resembles that of a network and therefore calls for new forms of collaboration and partnership.

ICTs have huge potential to provide knowledge-based services to farmers and others earning their livelihoods in activities related to agriculture, such as agri-businesses, agro-industries and financial services. In the near future, these services will be provided largely by micro, small and medium enterprises to farmers in villages and entrepreneurs who operate in local, national and even international markets. Governments and the public sector in most countries are now the major generators, managers and disseminators of organised data and information related to agriculture.

Governments are also responsible for agricultural development, research, innovation and extension. New forms of collaboration and partnerships are now needed between the public and private sectors to adapt to changing circumstances in the agricultural sector – changes in which governments and the public sector provide data and information, while the private sector provides the knowledge services.

Much of the data in the future will be generated and shared by communities. For farming this will occur through agricultural communities that contribute to commodity chains in terms of input, processing, marketing and consumption. Fields and farms, and all the related processes, will generate huge sets of data – 'big' data that will need to be processed instantaneously.

Individual farmers are being given the ability to create and manage sophisticated information thanks to low-cost connectivity, massive computing power accessible through cloud computing with shareable tools,



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applications and intelligently linked content. This 'democratisation' of science will draw farmers into agricultural research, innovation and development processes. This could transform the entire structure of agricultural research and innovation systems, especially for family farmers, whose specific needs seem to have been ignored by current technological innovations.

There are now a large number of ICTs within reach of family farmers that would help them to improve their farming practices. Technological trends indicate that many more innovations are in the making as well. However, their availability is still too widely dispersed. Individual technologies and tools are not integrated yet in ways that would help smallholder family farmers improve their farming practices.

For example, there are applications that enable farmers to do online banking but which are not linked to farmers' needs, such as credits through mortgages and crop insurance. To make ICTs even more widely available, institutions, their policies, the governance of information flows and the way they organise their work all need to undergo major transformation.

This new paradigm calls for new policies, and new regulatory mechanisms and laws. Old institutions need to be revamped; new institutions and organisations need to be established; and government work processes need to be restructured. The main concern of governments should be to provide not only data and information but also the infrastructure and investment that promote new capacities and the integration of information systems and services. ◀



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Financial services for family farmers

Family farming

What is the role of village savings and loan associations (VSLA) to support family farming?

→ There are more than one million VSLA members in Uganda, and the majority of these are from rural areas where agriculture is the primary source of income.

VSLAs meet on a weekly basis over the course of a cycle to save and take

interest-bearing loans. This can provide access to credit to support members in buying inputs throughout the cycle and also offer a place to save and generate additional savings by loaning to other members.

At the end of a cycle there is a share-out where members get their savings back and their share of the profit made on loans taken. This capital injection can also support family farming efforts by funding the purchase of livestock, agricultural equipment and inputs without the need for credit, and perhaps on a larger scale than a mid-cycle loan would allow.

Furthermore, the group can provide a vehicle for the purchase of large

community assets, with some groups investing in machinery that can be used by members and rented out to other members of the community to generate additional income.

What technology tools are used by VSLAs to support family farming?

→ VSLAs follow a methodology that traditionally teaches record keeping in paper ledgers and storage of cash, collected and not loaned on, in a metal box secured by three padlocks, a separate member holding a key for each. Grameen Foundation is working with Barclays and CARE to find ways to introduce

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technology to VSLAs that will improve access to financial services.

This work has resulted in the development of a smartphone application called Ledger Link that allows the VSLA to record their meetings in the app and submit the data to the bank for secure storage. This valuable financial data is no longer at risk of being lost in case of theft or destruction of the metal box where the group store their paper ledger.

By sending data to the bank, the VSLA will also build a credit history that can inform future loan applications. This could allow strongly performing groups to access funds at the beginning of a cycle when member contributions are low but demand for loans still exists, often driven by planting seasons. This credit history may also support individuals who want to access credit in the future to support their farming activities.

Grameen Foundation is also working with Airtel to develop a new type of mobile wallet. This will allow groups to store money securely in a group wallet protected by 3 PINs (much like the three padlocks). VSLAs with bank accounts will be able to push and pull money to and from the account, reducing the costs, time and risk associated with carrying it to the bank physically. This product will also be offered to the groups banking with Barclays.

ICTs offer a relatively low-cost way to serve a large number of people

Which ICTs have had an impact in improving the functioning of VSLAs?

→ There are currently limited ICT successes with VSLAs in Uganda. The focus has been on providing training to set up groups on financial literacy, conflict resolution and linking groups to banks such as Barclays. The Ledger Link smartphone application developed by Grameen Foundation and Barclays, and the Airtel group wallet, are new uses of ICT for VSLAs. Development has been strongly rooted in user research, and an iterative process has ensured that the products are aligned to the need of the groups and their members.

Early pilots and prototyping have yielded positive results, and the smartphone application has been shown to reduce record-keeping errors and even detected fraud. This will support the long-term development of groups and enhance the positive VSLA dynamics by managing the

risks. The group wallet should also reduce fraud and the costs and risks associated with both holding cash in a metal box in the community and transferring it physically to the bank.

Can ICTs enable VSLAs to offer other financial services to family farmers such as crop and livestock insurance and cashless financial transactions?

→ By developing user-focused solutions for VSLAs we hope to make them more accessible and easy to use. This should overcome barriers to adoption of both these ICT developments and help to pave the way for products and services targeted at these groups in the future as they become more familiar with ICTs and trained in how to use them.

Engaging with the private sector to deliver these products should raise awareness of the potential for provision of other financial services to these groups. Furthermore, the existing products are supported by robust commercial models to ensure commercial viability; therefore these can act as a proof of concept in the ability to viably serve this new type of consumer. Opportunities for insurance products and to facilitate cashless transactions for family farmer VSLA members are just some of the services under consideration in the near future.

Are there any constraints for VSLAs to use technology tools, especially new ICT tools for providing financial services to family farmers?

→ The cost of hardware is a key limitation, both in terms of basic phones for mobile money services and smartphones for the use of more sophisticated products like the data collection application.

It is also necessary to train the users on new technologies and processes. This can be logistically complex and costly as groups are geographically dispersed. The group demographics mean that those targeted often have low levels of education, which can make the delivery of training and information more complex.

How can these constraints be overcome?

→ Providing ICT developments that require hardware to a group rather than an individual can reduce the cost barrier. Splitting the cost between many members can make an expensive asset affordable – a US\$100 smartphone split between 30 people becomes more affordable at US\$3.33 per person.

Finding ways to subsidise hardware costs or spread them over time could help to reduce this adoption barrier. Finally, if the

hardware can be used to generate other revenue streams for those purchasing it the incentive to commit is strengthened.

With regards to training, Grameen Foundation's experience has shown that when it is provided, and products have been developed through a robust research-focused approach, users can learn to use a new tool relatively quickly. Adopting a training approach tailored to the needs of the user is important, and ensuring that the value proposition is explained in a way they can relate to and comprehend is also key – for example, explaining that by using the group wallet they can reduce the time and cost of travelling to the bank to make a deposit and increase the time and money they have to invest in farming activities.

How can ICTs improve VSLA services in the future?

→ At Grameen Foundation we believe there are many opportunities to use ICTs to better serve VSLAs to improve financial inclusion. ICTs offer a relatively low-cost way to serve a large number of people, and the clustering of people into VSLAs further supports this.

Both the data collection tool and group wallet are in the final stages of testing and are due to be launched later in 2014. The success of these products with this consumer group could pave the way for many more ICT developments, targeting VSLAs, and through them, family farmers in the future. ◀

A farmer in the northern Ugandan district of Oyam puts savings into a secure box, part of the Village Savings and Loans Association.



Flickr/Trust for Africa's Orphans

Family farming

The figures are alarming: according to the Food and Agriculture Organization of the United Nations, the world's population is expected to reach nine billion people by 2050. This statistic means that by then farmers will have to increase food production by at least 70%, if not more. Meeting this demand and simultaneously preserving natural resources and preventing environmental degradation is going to be a massive challenge. If

conducted a rural rapid appraisal in order to uncover the agricultural goals and challenges of smallholder farmers within the communities and then identify climate-smart innovations that respond to these needs and priorities. The aim of the appraisal was to engage family farmers in a process of articulating climate-smart agricultural practices that they would like to learn about through radio.

Another appraisal sought to assess

Radio listener clubs

A mobile-based feedback system was installed to complement and enhance the radio broadcasts. The idea was to develop a system that was user friendly, easy to manage, web-based, self-analytical and accessible to all users in real time. This system enabled the broadcasters to engage their audience through SMS and flash calls. The broadcasters were also able to provide advisory information services

e-adaptation to climate change in Malawi

An ICT-enhanced participatory radio campaign in Malawi shows that ICTs can be easily integrated into the lives and work of smallholder family farmers.

the agricultural sector is to feed this growing global population and provide the basis for economic growth and poverty reduction, then it must undergo radical change.

Climate change is likely to make this task more difficult, however. Family farmers, who produce more than 70% of agricultural products in sub-Saharan Africa, are particularly vulnerable to climate change as they rely on rain-fed agriculture and have poor access to information, inputs and markets. Farm Radio Trust in Malawi is assisting farmers to adapt to climate change through an innovative ICT-enhanced participatory radio campaign.

Working with the family farmers and local extension workers in the Nkhotakota district, Farm Radio Trust

community members' knowledge of compost manure and how they were using it. Following this, a workshop was held to train the radio station staff to design and produce programmes on climate-smart agriculture and compost manure. The workshop brought together Nkhotakota Community Radio staff, family farmers, extension workers, local NGOs and others. They designed a four-month-long radio series on compost manure.

The radio messages started by helping the farmers understand a series of issues, such as the meaning of climate change and its effects, the importance of compost manure in building resilience to climate change, the process of making manure using locally available resources, gender mainstreaming in the process of making compost manure, and how to actually apply compost manure efficiently in the fields. These radio messages were developed in the local language so the target audience could understand them easily.

on climate-smart agriculture and remind the audience of the topics and broadcast times through SMS.

In order to increase listenership and learning among family farmers, the radio station mobilised 20 radio listening groups and supplied them with wind-up radios. These wind-up radios had mp3 recorders and 4GB memory cards that enabled members to record radio programmes so that they could listen at a later time.

When the feedback system was installed, only about 40% of the population had mobile phones. However, the research team discovered that thanks to the radio listening clubs, the presence of just a single mobile phone in the community made a huge difference. The radio listening clubs were given a training session that showed members how to use the radio sets and which explained the importance of participation and feedback in development communication. They were also taught how to record their views and

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discussions after they listen to the programme so that they too could be aired on subsequent radio programmes. And finally members were shown how to check their SMS inboxes, enter text and send SMS messages.

By the end of the radio series, 789 contacts were recorded in the system database – an impressive number if you consider that mobile phone ownership in the area is considerably low. These contacts consisted of farmers in listener clubs and other farmers who listened to the radio broadcasts on their own. Extension workers were also included in the database so they could receive SMS reminders to help them keep track of the radio programme and provide support by visiting the clubs and mounting method demonstrations on compost manure making.

Each farmer contact received bi-weekly SMS alerts: a broadcast reminder and an AgTip on compost manure. Other farmer listeners were added to the database when they beeped, sent an SMS or made calls to the mobile numbers in the system. To keep listeners in the loop, debates, opinion polls and quiz questions were

included in the programme. Broadcasters made sure that they announced the mobile numbers during each episode.

The campaign's impact

Various studies in Malawi have shown that compost manure is made and used under the supervision of extension programmes of sustainable land management initiatives. And yet the rate of adoption by family farmers has remained low. This low adoption is mainly because farmers are not fully aware of the benefits of compost manure yet, and often lack the resources to use it anyway.

The compost manure radio campaign that was implemented in the Nkhosakota district, however, managed to register remarkable success in a short time due to its participatory approach. By the end of the campaign, about 1,000 farmers were able to make approximately 3,200 heaps ready for application.

Feedback steadily increased throughout the participatory radio campaign. Participation increased after each episode, and there was a weekly increase in the number of SMS

exchanges after each episode. The statistics (see 'feedback' box) show that the participatory radio campaign helped farmers to learn about climate change and compost manure in an effective and efficient manner. At the beginning of the radio programme, broadcasters encouraged farmers to keep the mobile number as a sign that the programme is on air and that people are listening.

Farm Radio Trust is helping to break through the digital divide

In the course of the campaign, other previously established farmer clubs asked for assistance in making compost manure. Family farmers also made calls to the radio station to ask if an extension worker could visit and teach them how to make compost manure. The radio station personnel would then make the necessary arrangements with the agricultural extension officers to visit the area to support the farmers. One particular farmer group that was

not part of the 20 radio listening clubs registered for the project. They actually organised themselves into a group and made almost 20 heaps of compost manure with technical support from the extension workers.

Another case of particular interest was a request from a community for the radio station personnel to link them up with extension workers who – by means of text messages – could teach them how to make compost manure. The radio station personnel managed to follow up with this group and link them to the extension worker responsible for that area. This led to the birth of the 21st registered listener club under the umbrella of the ‘Compost Manure Making Participatory Radio Campaign’.

Lessons learned

A number of important lessons were learned while carrying out this project. Indeed, they stand to offer anyone involved in agricultural development initiatives key advice in the use of ICTs.

- **The reality and centrality of family farming:** Compost manure is an endeavour that the whole family takes part in. While women and children normally take on the role of gathering crop residues, drawing water and animal dung, the men are normally responsible for constructing the heaps and pits for the compost. Carrying compost manure is normally done by anyone in the family, especially women and children. Therefore, it is extremely important that agricultural extension targets families.
- **Demand-driven extension:** The content of extension services must anticipate the needs of smallholder farmers. Letting farmers’ needs drive the objectives of development initiatives increases their ownership and makes them more receptive to these kinds of projects.
- **The power of ICTs:** ICTs are powerful tools in agricultural extension. Radio and mobile phones were the only platform that encouraged interaction between farmers and climate-change experts. Even if there was only a single mobile phone available in the community, it made a
- **Understanding the farmers, their context and their needs:** Far too often, the cart is put before the horse when it comes to finding solutions for family farming. ICTs and other extension methods are selected without first doing the crucial work of identifying existing challenges, information needs and viable channels of communication. A comprehensive analysis of needs and context should therefore take place before farmers are provided with solutions.
- **Joint problem solving and decision making:** Too often, development practitioners fall into the trap of ‘rural tourism’, where they collect baseline data for a project and synthesise it separately from the project beneficiaries. The use of participatory methods that involve farmers from A to Z have been found to generate the most effective results.
- **Partnership and collaboration:** In line with new development in agricultural extension, an innovation systems perspective is critical to agricultural development. Farm Radio Trust experienced remarkable results in this project by involving all stakeholders in the learning process.
- **Innovating the traditional extension systems:** One major lesson learned during the project was that ICTs cannot replace radio – nor can radio replace the extension worker. They can complement each other in a systematic way, however. ICTs

Feedback messages from farmers

	Total	Direction		Type	
		Incoming	Outgoing	SMS	Call
29-31 July 2013	902	426	476	828	74
22-28 July 2013	284	117	167	220	64
15-21 July 2013	195	88	107	138	57
8-14 July 2013	171	80	91	116	55
1-7 July 2013	160	72	88	112	48
24-30 June 2013	109	57	52	71	38
17-23 June 2013	61	42	19	26	35
10-16 June 2013	50	36	14	20	30
3-9 June 2013	32	26	6	9	23

tremendous difference because it could record and replay radio programmes.

present family farmers with an opportunity to reach a wide audience, but that will only happen if ICTs are innovatively combined with traditional extension models as was done in this project. It has to be understood that using ICTs in agriculture is a means to an end and not an end in itself.

- **Gender mainstreaming:** The position of women was analysed throughout the participatory radio campaign process. This helped to package the radio series in formats and styles attractive to women. The times at which the radio programmes were aired also took women’s household schedules into account. As the radio messages were developed, gender-focused episodes were also included. Ensuring higher percentages of women in the radio listening clubs also helped to increase women’s access to mobile phones, which is relatively lower as compared to men.

The campaign is putting to rest the myth that mobile technology is the exclusive domain of elite classes

The ICT-enhanced participatory radio campaign showed that ICTs can be easily integrated into the lives of smallholder family farmers. Indeed, it is putting to rest the myth that mobile technology is the exclusive domain of elite classes or people living in urban areas. Farm Radio Trust has managed to help break through the digital divide that prevents technology and knowledge to be transferred to rural communities through mobile phones and other ICTs. ◀

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Resilience in family farming

Family farming

How would you describe 'resilience' in the context of family farming?

→ Resilience in the context of family farming is the capacity of a farming household to maintain or ensure the recovery of its own self-specified vital and structural features while facing various external changes or hazards. These 'features' include any common desire expressed by members of a family as to what they want to keep on being and doing. Although resilience builds on basic human needs and rights, it emphasises three sensitive issues.

First, the criteria for resilience are normative, family specific and socially defined. Resilience is not a predefined feature or a universal capacity. When supported, each family can formulate a different set of expectations and boundaries. Some families may prefer the risk of emigrating as a unit, and keep its group

integrity, instead of sending someone abroad for remittances. Others may value family or faith more than increasing their income. So resilience can never be a generic model imposed from outside. It strongly reflects the autonomy of families.

Second, resilience is conservative and therefore potentially oppressive. Improving resilience at one level can decrease it at another. A family is a complex group of individuals whose life conditions, internal power relations and history vary. Age, gender and ethnic differences affect people's individual positions and capabilities with regard to resilience. The definition of resilience according to the family patriarch typically diverges from that of women and youth. The effort and pain involved in coping with hard times is usually not equally distributed either. In some situations 'shocks' affecting family resilience (in the usual sense) may actually transform the whole family system and improve equity – and so ultimately generate a more systemic, fair and sustainable kind of resilience.

Third, resilience is an adaptive process and a process about adaptation. Resilience builds on the procedural, cognitive, cultural, relational, socially normalised capacities of family groups to reflect and transform themselves: they need to learn how to establish clear boundaries (equity and aims) and decide which options to pursue. This is

true for individuals in families, for families in communities, and for villages in regions.

What role do ICTs play in enabling greater resilience in family farming?

→ The most important thing to note is that ICTs do not simply refer to computers and digital networks. The European HarmoniCOP project on tools for public participation, which took place from 2002 to 2005, strongly argued that 'technologies' are not limited to digital technologies. Other technological artefacts (such as maps, 3D mock-ups, games, analogical sensors, paper boards and post-its, the abacus, to name a few) are commonly used or extended for the needs of information and communication. Some of them have their own transformative capacity and features like computation, rendering and interactivity. This is of course especially relevant for contexts where computer-based ICTs are less common or less easily available because of a lack of finance or access to power.

The potential role of ICTs is directly linked to what information means to people in terms of their social, natural and cultural environments. And the use of ICTs shapes individuals' thinking, preferences and actions. ICTs are mainly a kind of 'partner' and not a 'source' of information.

So when thinking of resilience, you have to consider people and their families in

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their environment, what motivates their decision making and actions, and how the use of ICTs by other 'information partners' will affect them. It's also an ethical question, because the people who design and distribute ICTs tend to simplify or minimise their impact and restrict them to providing information.

ICTs can have an impact in so many ways. They can directly shape a biophysical environment. They bring information to places where it was not available before. ICTs can be used for data collection and archiving. They can process information and create conditions for interaction and communication. Virtual tests can be conducted through ICTs to see what the impact of choices would be. ICTs are support tools for establishing agreements and conventions, as well as for monitoring and evaluation purposes. And they are important for successfully setting up and running small businesses, including family farms.

Of course, we mustn't forget the fun and pleasure element of ICTs, either, which is one of their most common uses. Through ICTs, people frequently use digital social media to attract aid or attention, and to support the coordination of collective action.

In what areas could ICTs enable greater resilience in family farming?

→ I can think of at least five areas.

First, there's time economy. This impact is an obvious one. By transferring information, ICTs can replace the need to move and travel (and also change social ties). The time saved can be huge. I have experienced it in Africa when invitations were brought to their recipients by drivers. A second one is access to resources, including material and immaterial resources (such as skills, power and systemic intelligence). ICTs can help people to cope with complexity and provide them with access to more decision options, though this also brings with it the risk of information overflow and loss of focus. ICTs can also play an important role in alerting families to potential hazards.

Third, ICTs can promote social interaction. Most social structures (social networks in the traditional pre-Facebook sense) are pre-existing ones that are mainly facilitated by electronic networks. But in the world of ICTs, there are alternative ways of exploring and coordinating social commitment. It opens minds and paves the way for new coalitions. It should be noted that the ICT model of socialisation will impose itself on the 'normal' social content and protocols.

A fourth area is the potential for ICTs to envision different scenarios (and boundaries) for the future and what their

consequences would be, especially in terms of participation, which promotes acceptance and commitment. With a dynamic vision of resilience, ICTs should play a key role in the adaptive capacity of families, as well as their ability to enforce change and empower themselves in terms of evolution.

Fifth, ICTs can have an impact on social justice and the limiting conditions of resilience. ICTs are not always equally available. If ICTs are fairly designed, however, they can have much more local relevance and improve the 'capabilities' of family farms (in the sense of Amartya Sen's capability approach). And since their cost is gradually decreasing, ICTs are opening up new areas of activity in an increasing number of countries. ICTs can reshape the way people think, allowing them to break out of the norm, whether political or religious. And they can shift the balance of power in family circles and communities regarding information.

It should be added that ICTs cannot directly change the physical and political conditions of families in the face of international market prices, wars or local oppression. They do generate social change, however, which in the long term certainly can impact on resilience. Knowing also that, following the discussion above, it can also reduce the resilience of some for the benefits of others.

How can ICTs help family farmers, especially resource-poor family farmers, to adapt to and mitigate the effects of climate change?

→ First of all, I'll leave aside the obvious statements about early alert systems and coordination.

Adapting to climate change involves the combined capacity of farmers and their environment, including the policy context. Since we don't really know much about real future events, social restructuring is a key issue because it can potentially lead to an adaptive society. A real adaptive society is a radical transformative concept and often goes against the power establishment.

Farmers, their communities, their regional authorities, should assess and formulate conditions together for mutually beneficial actions, and they should especially address the most crucial uncertainty about climate change (not whether temperatures will rise by 2°C or 4°C), which is the global social response. And the response is in the response, so to speak. It is precisely the process of addressing adaptation and organising dialogues on strategies, conditions and policies that will generate a social response.

Climate change is not some pre-existing given somewhere. It's a social construct. This

observation is not relativist. Floods will kill, and dikes will be too low – by 10 cm, not 5cm. A combination of knowledge is required, and the arbitration of truth is an absolute requirement for potential ICT solutions, as long as institutions support them.

What constraints are there in using ICTs to promote resilience in family farming, and how can they be overcome?

→ There are several constraints, such as literacy, access to energy, the high cost of acquiring ICTs or ICT-related services and linguistic and cultural barriers. There is too much of a focus on non-crucial issues, such as ICT programs, though there are solutions to some of these problems. ICTs can be designed so they can be used by illiterate people. People with poor access to energy can be given autonomous devices for electricity. The costs of tools and services can certainly be brought down. People working in agriculture should be encouraged to design ICTs themselves so that they suit local needs.

How can ICTs bring more resilience to family farming in the future?

→ ICTs can pragmatically support all forms of participation related to resilience. There are several steps that could be taken to promote participation. Local ICT academies can be built to support the design of ICT tools that suit local needs. It's also important to create a culture in which different sectors work together and develop a model that is compatible across these sectors. We also need to change our data-driven way of thinking about solutions. We need to work on processes, workflows and procedures. It's also important that we take into account different perspectives and points of view so that we can integrate them technically. ◀

Farmers, their communities and their regional authorities need to assess challenges such as climate change together.





CTA WEB 2.0

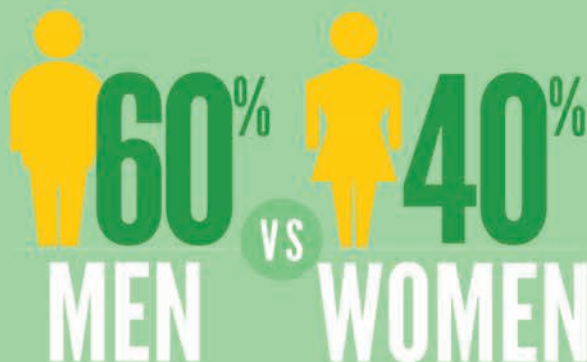
695

TOTAL NUMBER PARTICIPATED IN
CTA-HOSTED TRAINING IN 2012

2379



PARTICIPANTS
SINCE 2009



REGIONS

SUMMARY OF EVENT BY COUNTRY



& SOCIAL MEDIA TRAINING



HIGHEST PERCENTAGE OF PARTICIPANTS HOLDING BACHELOR'S DEGREES



PARTICIPANTS WERE FROM ACADEMIC INSTITUTIONS

13% FROM CARIBBEAN & PACIFIC



87% FROM AFRICA

3 BIGGEST SECTORS - TRAINING, RESEARCH AND SCIENCE, AND DEVELOPMENT



AGES

18-24 YEARS

12%

25-35 YEARS

45%

36-49 YEARS

33%

50-65 YEARS

9%

65+

1%

"I AM PRIVILEGED TO BE ONE OF THE BENEFICIARIES OF WEB 2.0 TRAINING THAT WAS ORGANISED BY CTA AT THE INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE (ILRI). THE TRAINING HAS GREATLY ENHANCED MY KNOWLEDGE OF SOCIAL MEDIA TOOLS AND PLATFORMS AND HAS GREATLY HELPED MY WORK AS WELL AS ENRICHED MY SOCIAL NETWORKS. I WOULD LIKE TO TAKE THIS OPPORTUNITY TO EXPRESS MY HEARTFELT THANKS TO CTA AND THE KMIS UNIT OF ILRI WHO FACILITATED THE TRAINING ON BEHALF OF ILRI."

TIGIST ENDASHAW, TRAINING ASSISTANT AT ILRI

THESE STATISTICS WERE CORRECT FOR 2013.

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AgriFuture Days 2014 Conference

Ajit Maru, co-organiser of the AgriFuture Days 2014 Conference held in Villach, Austria from 16 to 18 June and guest editor of this issue of *ICT Update*, summarises the key points that were raised and discussed during the conference.

Family farming

Family farming may seem to differ from one region or country to another, but a closer look reveals that its various forms across the world actually have much in common with each other. For one, family farming is generally under severe threat. Incomes from family farming are declining. Young people growing up in farming families are reluctant to take up farming as a vocation. Moreover, family farmers face multiple challenges, including the limited ability to participate in markets, climate change and severe weather aberrations, the loss, degradation and difficult access to land, water and other inputs for farming, and the loss of the agrobiodiversity that affects their livelihoods.

Family farmers' access to the new information, knowledge, skills and technology that could benefit their farming is being continuously eroded

and reduced, thereby increasing their isolation from economic, social, political and technological change. Across the world, family farmers are abandoning their traditional livelihoods, and as a result their numbers are diminishing rapidly. Still, for the majority of rural people family farming will remain the main source of livelihood for the foreseeable future – at least until 2030 and beyond.

Emerging trends

A number of trends – sometimes conflicting – have emerged in family farming:

- Aggregation of farmers/further disaggregation (breakdown of traditional communities and families)
- Increased market participation, but also isolation from markets
- More complex food chains, but also the re-emergence of simple food chains
- Access to massive data and information with the capacity to process and use it, but this access can also cause new forms of inequity and information conflict, as well as a lack of capacity to learn and use

information effectively and adopt and adapt to change

- Increased, more equal availability and access to affordable, safe, high-quality, nutritious and healthy food, but also reduced availability and access to sufficient, wholesome, nutritious food for individuals, households and communities
- Agriculture as a polluter, major extractor of natural resources and cause for environmental degradation, but also greater recognition of farmer and farming services that protect the environment, heritage and quality of life

Given these trends, there are several potential scenarios for family farming in the future. Family farming could end up in the following situations:

- As rural poles of farms and farming linked to complex agri-food chains
- As a continuum of rural–urban multi-functional systems of activity linked to local markets of diversified products
- As agro-industrial systems of activity linked to global markets of standardised products
- As marginalised farms in abandoned rural areas

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One or several of these scenarios may exist or co-exist in a given country or region, depending on the policies implemented by governments.

The applications of ICTs could influence the emergence and function of underlying systems that support the above scenarios. Conversely, these scenarios could influence the application and use of ICTs. For example, rural poles with complex agri-food chains for agricultural commodities used as industrial and manufacturing feedstock and food would benefit from ICT automation, robotics, integrated farm management systems and traceability systems. And this scenario may drive the emergence and rapid development of these ICTs.

Rural-urban systems could benefit significantly from information systems that educate producers and consumers on the linkages between production and consumption in terms of resources used, wastage, ecosystem conservation and community participation. Similarly, large agro-industrial systems would greatly benefit from ICTs that can monitor and support decision making at various levels and also automate many human labour-intensive farming functions.

An important question is whether ICTs can help to reduce the marginalisation of family farming and the abandonment of rural areas by these farmers. These farmers also play a vital role in preserving cultural heritage and ecosystems that enhance the quality of life of urban areas, a role that is not yet fully recognised by society. Indeed, the marginalisation and abandonment of family farming could have disastrous consequences for society. Following are a number of ICTs that are impacting agriculture:

- Automation, robotics, autonomous, linked tools, equipment and process monitoring
- Wearable computing
- Controller area networking/sensor networks/grid computing
- Big data at different scales from the field and the farm to the global
- Farm management information system
- Global Positioning System – multi-satellite
- Drones and low-cost satellites/micro-satellites
- More precise geo-spatial data and 3D maps with elevation
- Humidity, environment and soil

nutrient sensors

- Visualisation and integrated display
- Social media, massive online open courses, online learning
- Access to financial services
- Traceability systems
- Telematics
- Variable rate irrigation/fertigation and prescriptive planting
- Weed, biodiversity and pest management through integrated systems

The uses of these ICTs individually and with other ICTs in systems are resulting in complex applications to improve productivity and resource use, and reduce time and drudgery in farm management, forecasting, marketing, logistics and quality assurance, for example. ICTs are increasingly improving access to information, knowledge, skills and technology for farmers and their communities. ICTs are also improving farm productivity and farmers' ability to participate in markets, and ICTs are helping to increase the sustainability and resilience of farming systems while transforming them to meet new challenges.

These trends do not only concern digital ICTs but ICTs in general, such as print media, ICTs for educational purposes and ICTs used in mixed media and multiple channels of communication, such as audio and video streaming through 3G and 4G-enabled smartphones. Other trends include the democratisation of science and education, which is increasing the flow of new information and learning to family farmers. These could be harnessed to generate an exponential increase in innovation and capacity to adopt and adapt new ideas, skills and technologies to improve family farming.

There are possible disruptions to these trends in farming and the use of ICTs in the following areas:

- Health scares (food, environment)
- Trade disruptions and exclusions (non-tariff, tariff, political, market failures)
- Political upheavals
- Information conflicts
- Other resource conflicts (water, land)
- Developments in other technologies such as nanotechnology, materials, biotechnology, space technology
- Emergence of alternative socio-economic values to short-term profit and productivity

- Counter-movements, for privacy and against intellectual property rights, for example

Improving farming systems through ICTs

Equitable participation in fair and just markets, and the need to learn and effectively use knowledge, skills and technology to adapt family farming to emerging challenges – these are the trends (and possible disruptions) in family farming and ICTs, and they indicate that family farmers require the development of a variety of measures to improve their farming systems through ICTs:

- Policies that promote and enable the aggregation of family farmers and farming systems, through cooperatives, producer organisations, and farmer organisations, for example. ICTs can contribute to the 'virtual' aggregation of farms, and synchronise farm inputs, processes, outputs and logistics to enhance participation in markets
- New forms of advisory and support services for knowledge, skills and technology and participation in markets
- Trust centres with data and information agreements, treaties with regulatory and enforcement mechanisms to share data at various levels and among multiple categories of users from plot, farm, farming system, region, national to global agricultural and related systems
- Inclusive governance of the flow of data, information, knowledge, skills and technology
- Inclusive development of standards
- Open technologies: open data, information, knowledge and learning
- Increased democratisation of science, learning and support for exponential innovation
- Lower cost of hardware, infrastructure and connectivity

There are several dimensions to fulfilling these needs, but two in particular are crucial, and will go a long way to improving family farming. First, we need investment through a variety of sources, such as public, private, crowd and community sourcing. And we need infrastructure to be put into place for data, applications, analytics, hardware, software and connectivity, content, integration of data, information, information systems, and applications and governance. ◀



FLICKR/TERRIEM

ICTs in rural Ghana

A mango growers association in Ghana is using ICTs to address the challenges affecting their livelihoods.

Family farming

The Volta Mango Growers Association (VOMAGA) is a legally registered dynamic cooperative of smallholder mango producers in Fodzoku, a rural community in the Volta region of Ghana. Fodzoku is a farming and fishing resettlement community along the banks of Lake Volta with a population of about 6,000. The community has a vast plot of arable land suitable for cultivating mangoes and vegetables. Land ownership in the community and plot allocation among family farmers has always been a challenge. Climate change has affected the soil and groundwater retention, and what's more, these family farmers have to meet certification requirements for the export of their mango produce to international markets.

Members of the VOMAGA cooperative have started to use ICT tools to address some of these

constraints and enhance their living conditions. These tools include GPS and GIS technology and soil-testing kits, and there are plans to use agrometeorological services in the future and smart ICT-based technologies to package this weather, water and crop-related data to better inform the cooperative's decision making.

Use of ICTs by mango farmers

Volta is the most easterly region of Ghana and shares a border with Togo on its eastern side and with the Volta River and Lake Volta on the western side. It has lush vegetation and is relatively mountainous. Agriculture plays a vital role in the region's socio-economic development. The region's economy is mainly rural and agricultural, employing about 74% of the economically active population.

The horticultural sector in Ghana has emerged as a vital sector for the economy following the diversification of the country's export base. Mango, pineapple, papaya, fresh chillies and bananas are some of the products that are mainly exported to European markets. The VOMAGA cooperative is

trying to actively participate in this rewarding industry, but it faces the challenge of meeting mango export certification requirements. In addition, farmers in the cooperative are struggling against poor production planning and are having difficulty establishing the spatial locations and concentration of their respective farms required for traceability and documentation.

It is crucial that members of VOMAGA become organic or GlobalG.A.P. certified in order to enhance their competitiveness on the local and international markets. Certification, however, requires that their fields and orchards are clearly identifiable. In Africa this is usually done via GPS references. So they have to have their farms mapped to obtain the required geo-references.

Even though farmers in the VOMAGA cooperative have been rather slow to adopt ICTs, they have now been widely accepted and their use is spreading. Indigenous technologies and local innovations do continue to play a vital role in the operation of their farms, however. One could say that modern technology is acting as a propeller for

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productivity as it addresses some of the specific constraints mentioned earlier. The use of GPS and GIS technology are useful tools that enable farmers in the cooperative to meet export certification requirements more easily. With support from the Market-Oriented Agriculture Programme, which is funded by the German development cooperation agency GIZ, these farmers have been trained to use specific devices, such as the Trimble Juno 3B Handheld GPS device and the TerraSync mobile application (see box) for farm GPS mapping (collection of geo-reference farm data). Syecomp Business Services Ltd, a market leader in the use of GPS applications in Ghana, was contracted to provide on-field technical training and assessment.

Member farmers of VOMAGA were given an intensive one-day training course in the use of the Trimble Juno 3B device and its software. The training involved a presentation on the theory of GPS mapping of farms, an explanation of the general features of the Trimble Juno 3B device, an overview of the TerraSync software interface and a demonstration of what the device can do for farmers. The training was immediately followed by on-field practice. Farmers were taken to mango farms where they were shown how to conduct field boundary mapping. Relevant farm features, such as farmhouses, farm equipment and streams were captured with the integrated digital camera. Farm information, such as farm size, GPS coordinates, shapes, elevation and other features were presented via the TerraSync application in real-time on the field.

All this data needed further processing, however, so it was submitted to Syecomp Business Services Ltd for that purpose. Syecomp produced maps, indicative geo-references of farms and other relevant outputs for farm documentation for each farmer in the VOMAGA cooperative.

These farmers felt empowered using such technologies themselves to solve some of their challenges.

Impact of these ICTs

Ghana's main destination market for fresh produce exports is the European market. There is exciting interest from other growing markets in the Middle East and the Eastern Asia. Most buyers from these markets require

GlobalG.A.P. certification from producers. The use of GPS and GIS technology is a step towards helping VOMAGA meet these export requirements for their produce. Unique codes are assigned to each farm during GPS mapping, and farmers also collect additional information, such as crop-specific production data, agronomic practices, and plot and farm history.

GPS mapping of farms provides exact farm measurements, which prevents farmers from over- or underestimating the size of their farm plots used to cultivate mango in the community. As a result, farmers can now plan their farm production needs much more effectively and generate yield forecasts for their farms and avoid paying too much for farm labour and agri-input services. This has had a positive impact on the productivity and revenue of farmers in VOMAGA.

The adoption of GPS mapping technology has also helped the cooperative determine the gross margin of their farm produce so it can conduct comparative assessments. It has also resulted in a host of other benefits, such as transparency regarding crop volumes under production and easier logistic planning between mango farmers and buyers.

The future

Climate change, water scarcity and food security are beginning to have negative impact on the mango farms belonging to the VOMAGA cooperative. Even in seasons of abundant rainfall, the farmers still lack the appropriate scientific knowledge on weather, soil, water and crop-related conditions to successfully deal with climate variation. The cooperative has been making plans to use satellite and remote sensing data to assist member farmers in their decision making. Specifically, it concerns an agrometeorological information service powered by the web and through text messaging in close partnership with Syecomp Business Services Ltd.

The implementation of this plan will be based on farm GPS data collected from each individual farm and plot. The idea is to use the tool to monitor plot-specific information from satellite measurements. So rather than provide very general data on plant growth, water availability in soil and the nature of the soil, for example, the tool will provide plant, water, and weather-specific information.

Trimble Juno 3B is an economical rugged IP54 handheld computer that includes GPS and a digital camera. It uses the Windows professional operating system and has a 3.5" screen. It can store up to 2GB of data and has a memory card slot as well. The GPS has an accuracy of two to five metres. Trimble Juno is especially useful for taking field records and conducting field boundary mapping activities. The TerraSync software is designed for collecting and updating geographical data on a field computer. Once installed on the Trimble Juno 3B handheld device, it can help boost farm productivity. The TerraSync software is arranged in five sections:

- a Map section;
- a Data section;
- a Navigation section;
- a Status section; and
- a Setup section.

→ See www.trimble.com/mappingGIS/juno3.asp

In the future, several steps need to be taken to further improve the situation of family farmers such as those in the VOMAGA cooperative. First, national policies need to be geared towards supporting family farmers and smallholder farmers in their attempt to adopt productive ICT-based technologies. Second, there should be an overall assessment of ICT deployment in the agricultural sectors of specific countries so comparative assessments can be conducted. And finally, we need targeted investment support from private companies for the development of innovative tools to address specific constraints in rural agricultural sectors, such as the Fodzoku community in Ghana. ◀

The Volta Mango Growers Association in Fodzoku, a rural community in the Volta region of Ghana, has started to use ICT tools to improve the livelihoods of its members.





Decision support systems for family farmers

How would you describe the role of 'decision support systems' in the context of their use for family farming?

→ Decision support systems include all tools and techniques that help farmers decide on their course of action for farming. Family farming faces many risks and has limited opportunities. Farming is becoming more complex and is affected by a number of factors, some within farmers' control, but many beyond.

Indeed, this type of farming faces many constraints: participating effectively in markets, gaining access to vital inputs, such as land, water and finance, and the tools and knowledge to cope with climate change. It is important that family farmers have access to these

tools, and advisory services, which they can use to forecast, plan, monitor and measure the outcomes of their decisions and actions. As far as the use of ICT-based decision support systems is concerned, these now take on many forms. Some offer forecasts, optimised plans and continuous monitoring, while others are map-based, indicating the availability and flow of resources.

My own organisation PROGIS has developed DokuPlant®, an expert database based on our own technologies and that of local experts. It contains information about farm machinery, inorganic and organic fertilizer, pesticides and chemical substances, seeds and varieties, as well as cropping-methods. These technologies optimise farmers' returns and help reduce the risks to their farming. Expert data can be used together with other farm planning and management tools.

How can decision support systems improve family farming?

→ Ultimately they should help family farmers to increase their returns, reduce costs, improve the quality of their products, get better access to markets, and maintain and further improve the resilience and sustainability of the farming system and the ecology it is situated in.

What are the decision support systems available for plant protection and irrigation management for smallholder family farmers?

→ There are many now available. Some are commercial. Some were developed as experiments and have been offered to the public.

For plant protection we have systems that forecast, optimise interventions and help diagnose the problem. Forecasting systems obtain data from a variety of sources including automated weather systems, past

Family farming

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data and epidemiological models. Plant protection is very complex as we cannot measure with one sensor all the conditions in which pests thrive. We have to use multiple sensors that are grouped and networked with other groups elsewhere. By using these sensors and a network of weather stations and models that predict specific situations (for example, a pest will start in five days), a farmer can start spraying in advance in an attempt to control the disease. This information can be shared with farmers in the afflicted areas by means of an SMS reminding them to 'please spray tomorrow', for example.

For monitoring and diagnosing pests and diseases, we use images of fields and affected crops and potential pests. In the future, it may be possible to use photometry with multiple filters, such as those used for infrared and ultraviolet wavelengths of light, and support this with pattern recognition. We will also be developing decision support systems and knowledge-based systems in conjunction with these technologies. We also need to develop the human expertise that can conduct investigations and provide recommendations with all these tools.

For irrigation, we now have map and sensor-based systems at various scales, from watersheds and farms to fields and plots. Soil moisture sensors located at different depths measure the moisture. The irrigation process can be started and managed in a precise way with groups of sensors so that a field is not flooded and water is used in an efficient way – where and when it is needed. The latest generation of sprinklers has nozzles that can be triggered individually. We are now able to use three-dimensional, accurate maps that also render elevation. With sensors linked through sensor networks, we can monitor soil humidity and local weather conditions and manage irrigation.

Precision agriculture is gradually becoming possible for smallholder family farmers. This availability is the result of more affordable technologies, including maps, sensors, the 'Internet of Things' and cloud computing, all of which are used to monitor and control irrigation equipment and entire systems. Video technology, drones and other intelligent farm management tools are enabling farmers to do quick and accurate modelling or simulation at very small scales, for example to calculate within a few seconds various potential outcomes for different situations and compare these outcomes for optimisation.

These services for smallholder family farmers will increase their returns and

boost the resilience and sustainability of their farms in an affordable way, because the costs will be shared with others in the local community. This will bring new forms of entrepreneurship and cooperation. For example, it may lead to new information and knowledge-sharing cooperatives.

Have decision support systems that use ICTs improved the agricultural activities of family farmers?

→ We have reports from many farming systems all over the world. In Germany, for example, family farmers and cooperatives are benefitting from their ability to plan better. Think, for example, of farming inputs, crop monitoring and logistics, and the harvesting and processing of crops such as sugar beets. In Kenya, forecasting systems with automated weather stations have been used for pest and disease control.

What constraints are there in using decision support systems to assist family farmers?

→ The scale of farming influences the accessibility, affordability and ability to effectively use these systems, especially for smallholder farmers. Public extension systems in most developing countries are not set up to use these systems. Many of the systems available on public platforms are elementary and provide little ground support. There is also the question of expertise. For example, at which soil moisture levels should one switch irrigation on or off for locally grown crops on different types of soil? We need local experts who can support this technology and develop local models that will help farmers.

Another major issue is collaboration and cooperation. Take weather stations. Different organisations need similar data from weather stations for agriculture, water, tourism, rivers and risk management. But they rarely cooperate when it comes to setting up stations and sharing data. This only adds to the overall costs instead of reducing them.

We do not have a network of automatic weather stations yet, nor a service that offers data to those who want it for a small fee. In developing countries, these stations could be implemented by a governmental organisation as part of the infrastructure. The different users – public or private – can pay for the data service and build value added services for different sectors.

There is another problem as well. There is a powerful sales process at work at the moment that tells farmers what the system is capable of doing but does not reveal what the real costs are or what kind of an infrastructure is needed to support the system. So if we want to use new ICTs to support smallholder family farming, we

also need new organisational models for the new services. Technology alone will not improve smallholder family farming.

How can these constraints be overcome?

→ Again, we have to innovate and develop new organisational models for these new services that match the rapid development of technology and meet these farmers' needs. We also need to build the capacities of these farmers and their communities to use these technologies.

I strongly believe in more capable advisory systems. To take Austria as an example: one well-informed, experienced and practical advisor, who also understands farmers' needs, can support 200 family farmers. We can lower costs, increase benefits and promote more ecological sustainability even in smallholder systems (and we do have them here in Austria too). The advisor is ideally part of the farming community and is paid by it. All farmers benefit! This really is achievable.

What is the future of using decision support systems to improve family farming?

→ Technologically, many ICT-related developments – from sensors, open data, cloud computing, the 'Internet of Things' and the use of drones – will contribute to more affordable, accurate, precise and available decision support systems. Decision support systems in the future need to become even more heuristic. The systems can be improved if we analyse big data and provide greater precision. They also need to improve the way they present the logic of their decision support through better visualisation for greater, more general comprehension. ◀

It is important that family farmers have access to ICT tools so they can forecast, plan, monitor and measure the outcomes of their decisions and actions.





Flickr/AfaelBenevidetz

Flying donkeys

The Flying Donkey Challenge, a project of La Fondation Bundi, defines a flying donkey as 'an unmanned cargo aircraft with a maximum takeoff weight of 60 kilos'. The objective of the Flying Donkey Challenge is to lay the foundation for the development of innovations that will make large-scale unmanned civilian air cargo delivery services possible in Africa and beyond. These flying donkeys can be used to transport goods to the market, for example, and circumvent the problem of poor infrastructure.

The main challenge will take place before 2020 and will be a race between flying donkeys around Mount Kenya in less than 24 hours, delivering and collecting 20-kilo payloads along the way. The final location of the ground stations and flight corridors are yet to be confirmed, but the organisers have the following details in mind for the route: total distance of 200 km; six ground stations along the route; three delivery and collection missions; and a maximum distance between ground stations of 50 km.

In the meantime, four 'enabling technology and design sub-challenges' are slotted for 2015, including 'precision takeoff and landing', 'GPS denied navigation', 'sense and avoid' and 'cargo and delivery'. And there will be three 'non-technical competitions' as well, namely 'business model competition', 'legal paper' and 'logistics paper'.

Organisers of the Flying Donkey Challenge are looking to the sky as a solution because 'Africa is growing too fast to build out its road network'. The organisation hopes that flying donkeys will be established 'within a generation, lifting Africa by creating jobs and enabling e-commerce and community to community exchanges in a shared economy'.

→ <http://www.flyingdonkey.org>



Flickr/COIAR CLIMA

e-extension in Kenya

According to BizTech Africa, the Kenyan ministry of agriculture is introducing e-extension services in order to relieve pressure on the 5,000 extension officers in a country where 80% of the population is involved in agriculture. It is hoped that the ministry's ICT approach will reach over seven million farmers annually, 'as opposed to the conventional one-on-one service that impacted less than two million farmers'.

The System of Things

According to an article on ITWeb Africa, 'Systems of Things: The building blocks for the next internet revolution', now that we are more connected globally than ever before, it is time to benefit from our connectedness by putting in place the right systems to 'gather, analyse and gain insights from the massive volumes of data generated by these connected devices'. The author suggests that the building blocks for 'systems of things' have already been laid in Geoffrey Moore's 'Systems of Engagement' and 'Systems of Records', as well as the 'The Internet of Things': big data, fast data, predictive analytics, cloud, and mobile. Indeed, the author suggests that if 'African companies get these building blocks right, and are able to embed their Internet of Things applications directly into their existing business processes, they will be able to chart their own destiny'.

→ Original article: <http://goo.gl/BwxQD4>



Flickr/McCausland

The e-extension programme 'hinges on' high mobile phone and internet penetration in Kenya, 77.2% and 63% respectively. Indeed, estimates put the number of Kenyans with internet access at 20 million and mobile phone users at 30 million, many of whom are farmers. Over 600 e-extension agents have been trained for the project. They have been given smartphones and laptops to help reach out to farmers.

→ Original article: <http://goo.gl/uQIEHH>

BRCK II



In June 2013, *ICT Update* reported on an innovation-in-the-making called BRCK, a modem designed specifically for the continent of Africa and referred to as 'your backup generator for the internet' by Ushahidi, the Kenyan technology

innovation firm that developed the device. The modem caters to the need in Africa for a modem that addresses the problem of getting – and staying – online. BRCK connects to the internet in different ways – by hopping from one network to another, creating a hotspot for multiple devices, while plugged in or running on battery power.

In July 2014 the BRCK blog finally announced the first shipment of BRCKs for later that month. It came after several setbacks, including a shipment of cases from China that 'looked nothing like the first articles... or the amazing cases that were molded from 3D prints'. But with patience and perseverance BRCK has finally arrived. The launch is planned for 9 July 2014 in Nairobi, where BRCK developers will show how the innovation can be used for business and personal uses.

→ <http://www.brck.com>

Orange African Social Venture Prize



Young entrepreneurs in Africa can get ready to try out their innovative ICT skills. According to IT News Africa, French telecom giant Orange has launched its fourth Orange African Social Venture Prize. Participants in this year's contest

are being asked to integrate an Orange application into their project. One of the conditions of the contest is that the entries are designed for use in at least one of the 18 African countries in which Orange operates, and that their ICT innovation is used to help improve living conditions in these countries.

The 2014 Social Venture Prize is offering a special 'partner' prize that will award four projects with grants varying from €10,000 to €25,000, but winners will also receive a six-month support package from entrepreneurs and ICT experts and. The first prize will be offered a patent submission in the project's country.

→ Original article: <http://goo.gl/pACXgQ>

Farm to table

Founded in 1991, Women in Business Development Inc. (WIBDI) supports a network of 600 family organic farmers. It is developing a project called 'farm to table' with the aim of providing hotels and restaurants in Samoa with 80% of their food needs through local production.

The project will create a lasting business relationship between individual producers and the growing tourism market. The idea is simple: every Monday, producers send a list of products available in the restaurant and place an order late Tuesday afternoon. Producers who accept the order then deliver their products in the local WIBDI, who pays the following Friday. The 'm-Link system', which is aimed at extension workers, producers and restaurateurs, is built to support this process.

'm-Link' is made up of three applications: m-Link Extension, m-Link Producer and m-Link Kitchen. m-Link Extension provides extension on crops, pests and diseases, and organic certification. m-Link Producer is designed to help producers in the agricultural field (planting, harvesting and processing) and the commercial field (bookkeeping, budget, etc.) A support system (wiki) allows producers to share information as well. M-Link Kitchen offers restaurateurs a database of available products and prices each week, enabling them to order, and it also offers nutritional information on products and recipes.

In its pilot phase, the project involves 20 producers and seven restaurants. It is expected to grow rapidly and will be presented on the occasion of the UNSIDS conference in Samoa in September 2014.

→ Original article: <http://womeninbusiness.ws>



500 million of the world's 570 million farms are family owned.

1.5 billion people are estimated to be involved in family farming.

56% of agricultural production is provided by family farms.



Building sustainable and resilient family farms

Family farming

How would you describe 'resilience' in the context of family farming?

→ Simply put, in this context resilience is the ability of a family farmer or a community of family farmers to sustain themselves successfully through shocks that affect their well-being and quality of life. Shocks to family farming can be due to external causes, such as droughts, floods, earthquakes, disease and pest epidemics or internal to a family or community, for example illness, death, debt or the fragmentation of land.

These shocks can have long- or short-term effects and can occur as a one-off, together or in sequence, as a series of disasters. The external causes usually affect large numbers of family farmers, though in some cases internal causes such as market failures or resulting debts can also affect family farmers. To bring greater resilience to family farmers we need to forecast, prevent, mitigate, overcome and adapt to the factors that affect the well-being of family farmers so they can cope with these challenges.

What role can ICTs play in enabling greater resilience in family farming?

→ ICTs can contribute to greater resilience in family farming by enabling many of the actions I just mentioned: forecasting, preventing, mitigating and adapting to

those causes that affect the well-being of family farmers. Many emerging ICTs can contribute to these enabling actions. Of course we are familiar with the use of radio and television to broadcast information related to disasters, but today cell phones are also used for the same purpose. In fact, cell phones can target specific individuals and communities by informing those who farm in low-lying areas of impending floods, for example.

Another emerging area is the ability to model family farms and simulate the most suitable farming system for improving their management. These solutions reduce risk and increase the resilience of farms. Of course, the role of automatic weather stations in forecasting local weather, which in turn helps in many other areas such as disease and pest management, is now becoming widespread.

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How can ICTs enable family farmers, especially resource-poor family farmers, to adapt to climate change and mitigate its effects?

→ Climate change will affect farmers in many ways. Climate variability will cause extreme weather patterns with more frequent droughts, and sudden downpours of rain will cause floods and waterlogging, hailstorms, and hurricanes, for example. As mentioned, ICTs can play a crucial role not only in forecasting the weather but also providing information to prevent damage and destruction, and help people cope with the short- and long-term after-effects.

Resilience and sustainability of farming are also interlinked. ICTs can play a significant role in bringing sustainability to farming, for example, by preventing wastage of irrigation water and energy. Soil humidity sensors linked to sprinklers and drip irrigation can help manage water use in the most effective manner. When these sensors are linked in a network, as is now possible, then entire fields and farms can be monitored on their use of resources, such as water and soil nutrients.

Very soon, digital cameras with special filters, such as for temperature and certain optical wavelengths, will come into use to monitor crop health. These can be mounted on small drones to periodically monitor fields from an appropriate altitude. There are ICTs that enable more widespread financial services in rural areas where banks would not find it economical to operate. ICTs can even provide health services for family farmers in remote areas.

Which ICTs have helped to improve the resilience of family farmers in their farming, food security and livelihoods?

→ We have already seen the impact cellular telephony is having on the economic and social well-being of family farmers in many parts of the world. As mentioned earlier, cell phones in Africa are enabling this category of farmers to use services they did not have access to previously, and this is helping them to participate better in markets. Cell phones also help family farmers search for secondary occupations that augment their earnings. Many people are also unaware of the role that ICTs play in agricultural research and innovation, for example in the design and development of new seeds that resist droughts or waterlogging.

What constraints or limitations are there in using ICTs to bring more resilience in family farming?

→ The availability of and access to ICTs is the foremost limitation. First of all, the ICTs

that are available are usually appropriated by resource-rich farmers. In today's world, these are non-family farmers, such as corporate farmers who practice family farming. A classic example is today's dairy industry, as well as the use of precision farming. Many of the sensor-based technologies have been appropriated by these two types of farming. Though some of the technologies can be used by smallholder family farmers as well, since they were first appropriated by large farmers, their further development has been directed by this category of farmers.

Access can be and often is limited by policies, regulations and organisational structures. For example, many national agricultural research organisations, who are the main managers of agricultural information in the developing world, are not investing in ways of opening up or sharing information that would be useful to small family farmers. These organisations' reluctance to share is limiting the capacities of these farmers to build sustainable and resilient farms.

How can these constraints be overcome?

→ First, society and governments must acknowledge the role that ICTs can play in rapidly innovating agriculture and contributing to the sustainability and resilience of family farming. There is very little awareness of the role this technology can play, unlike in biotechnology, for example. And this requires advocacy and championing from the experts who are aware of the potential of this technology.

The second is the need for investment. This initially has to be done by the public sector in developing countries. The investment has to be in infrastructure, such as connectivity, or capacity building and in some cases even in the form of subsidising appropriate ICTs. Governments in many parts of the world have subsidised new irrigation technologies such as drip irrigation. So why not also subsidise sensors and sensor networks along with the drip irrigation systems as a package?

Public-private partnerships can play a significant role in this area. Many of the knowledge services that could contribute to resilient family farming will be provided by micro, small and middle entrepreneurs. The government and public sector institutions need to support the entrepreneurs financially and technically, not only so they can provide these services but also so they can innovate. This support could also generate new employment opportunities, especially for youth in rural areas, many of whom may belong to families of these farmers.

Another important limitation to overcome is the capacity to use these technologies effectively. There must be capacity development for all those working in agricultural value chains – from scientists, extension workers and farmers to transporters, processors and market intermediaries – so they can effectively use ICTs in their own activities.

How can ICTs bring more resilience to family farming in the future?

→ The future lies in many of the new technologies that are on the horizon, as well as in a greater awareness in family farmer communities of the potential benefits of using these technologies. Some of these emerging ICTs include the ability to manage and effectively use 'big data' generated on farms to improve farming. Another example is low-cost sensor technology that can monitor humidity, temperature, environmental gases and soil nutrients. This technology can be coupled with high-resolution 3D maps of farmlands, which can in turn be linked through the 'Internet of Things' to generate data that can be shared through cloud computing. Applications for smartphones or phablets, which allow farmers to use the data and technologies just mentioned, are another example.

In the future, a large part of the data and information used by family farmers will be self-generated by the farmers themselves. There will be a need for new forms of collaboration and cooperation for sharing and exchanging this data, information and knowledge. Social networks will become important, and most likely social media will have a new and different role to play. All this will contribute to bringing more resilience to family farming in the future. ◀

Technology can play a crucial role not only in forecasting the weather but also providing information to prevent damage and destruction, and help people cope with the short- and long-term after-effects.



Creating an upward spiral

The use of ICTs to access big data for farming purposes may well lift the status of the profession of farming as a whole – for both family farmers and young people.

Family farming

I was recently nominated co-chair of one of the working groups tasked with the responsibility of drafting the orientation papers for discussions at the International Encounters on Family Farming and Research conference scheduled to be held in Montpellier, France in early June 2014. My group's theme is 'Family farming facing the challenges of urbanisation and employment' – a theme that is steeped in today's innovative and emerging trends.

The group consists of experts and researchers with many years' experience in the development field – in fact, I am the youngest member of the group. And as the youngest member, the onus has been on me to push for more youth perspectives to be accommodated in the working paper – which I managed to do. Indeed, the stimulating exchanges in this group revealed the many challenges and opportunities that face family farming in an increasingly populated, urbanised and youthful world.

Although family farmers produce most of the food consumed in the world, they face enormous challenges in accessing resources for production. Moreover, they struggle with a

changing climate and other disruptions – against which they have little or no resilience – and they are stifled by competition from industrial farms and cheap imports, both of which restrict their market access. And most importantly, they are being starved of the manpower they need to thrive as a result of the unfavourable perception of agriculture among the youth. Indeed, young people are increasingly moving away from the countryside.

Despite all these challenges, family farming has survived through the years. An expanding global (and urbanised) population, with rising incomes and changing consumption patterns that favour more nutritious food – especially in developing countries – presents new opportunities for family farming to thrive in the coming years. But these changes will require some adjustment on the part of family farmers themselves and some institutional support from policy makers and development organisations.

Harnessing big data

One way for family farmers to survive in this highly competitive environment is to begin to harness and allow the power of big data to guide their decision making from the production to the marketing stage. Big data, which in the agricultural context is the collection and analysis of data generated from the farm to the final consumer, can help family farmers in their quest to compete with cheap products and imports from industrial farms.

Through the adoption of big data, particularly meteorological and consumer data, and by allowing it to guide their decisions, family farmers can better plan their farming activities to minimise the impact of a changing climate and build resilience to shocks. Big data can also help them to know where to direct their energy and enable them to leverage the rising demand for food sovereignty among progressively informed and sustainability-minded consumers in many (developed and even developing) countries.

Through these analyses, family farmers can gain more access to targeted markets, such as individual consumers – who are increasingly sensitive to the long chain their food passes through, not to mention the sanitary and contamination crises associated with industrial farms in the past – instead of concentrating on general markets, where pricing is usually not to their advantage. 'Big data' enables family farmers to discover where these consumers are, what they want, why they want it and how to satisfy their needs.

But most importantly, the use of 'big data' in planning, production, marketing and all other activities along the chain may help to retain young people on family farms. Why? Because young people are tech-savvy and tend to follow and pick up on trends. Young people are also more inclined to use ICT tools to access data, and they certainly have the skills to do so.

The use of ICT tools to access big data for farming purposes is also something that may well lift the status of the profession of farming as a whole. The more ICTs are used in smallholder and family farming, the more progressive the image of the profession will become. It's an upward spiral: the more young people become involved in ICTs and smallholder farming, the higher the chance that even more young people will become attracted to a career that is in touch with emerging trends.

Finding a way to convince and support family farmers to adopt the use of ICTs and big data is therefore not just a question of survival in the face of low capacity and intense competition, but it may have other indirect benefits as well. It may keep, as mentioned, more young people in farming, but it may also enhance the sustainability of rural communities. Policy makers and development organisations interested in the survival and viability of family farms should be pushing for the adoption of ICTs and providing institutional and infrastructural backing for the increased use of big data in family farming. ◀

The use of ICT tools to access big data for farming purposes may well lift the status of the profession of farming a whole.



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