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.

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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 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.

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 monitoring 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 providers, 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*