

CTA
Working Paper
15/12

Linking Rural Farmers to Markets Using ICTs

Mawazo M. Magesa

Series: ICTs for agriculture



Linking Rural Farmers to Markets Using ICTs

Mawazo M. Magesa

The Nelson Mandela African Institution of Science and Technology



About CTA

The Technical Centre for Agricultural and Rural Cooperation (CTA) is a joint international institution of the African, Caribbean and Pacific (ACP) Group of States and the European Union (EU). Its mission is to advance food and nutritional security, increase prosperity and encourage sound natural resource management in ACP countries. It provides access to information and knowledge, facilitates policy dialogue and strengthens the capacity of agricultural and rural development institutions and communities.

CTA operates under the framework of the Cotonou Agreement and is funded by the EU.

For more information on CTA, visit www.cta.int

About the author

Mawazo M. Magesa is a lecturer and researcher at Sokoine University of Agriculture (SUA), Tanzania. He graduated with a BSc in Computer Engineering and Information Technology in 2004 and an MSc in Computer Science in 2010, both from the University of Dar es Salaam, Tanzania. Magesa is currently undertaking PhD studies in Information and Communication Technologies for Development at The Nelson Mandela African Institution of Science and Technology, Arusha, Tanzania. He has lectured on both computer science and ICT courses to undergraduate students at SUA. His research areas include adopting e-learning in higher institutions in Tanzania and agricultural system simulation and climate change and adaptation in Africa. He has also developed a variety of teaching materials and has published a book on e-learning.

About CTA Working Papers

CTA's Working Papers present work in progress and preliminary findings and have not been formally peer reviewed. They are published to elicit comments and stimulate discussion. Any opinions expressed are those of the author(s) and do not necessarily reflect the opinions or policies of CTA, donor agencies, or partners. All images remain the sole property of their source and may not be used for any purpose without written permission of the source.



This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License. This license applies only to the text portion of this publication.

Please address comments on this Working Paper to Benjamin K. Addom (addom@cta.int), Programme Coordinator, ICT, at CTA.

Contents

Executive summary	v
Introduction	1
Linking smallholder farmers to markets	2
Agricultural market information services	2
Provision of market information services	3
Agricultural extension	3
Market information	4
Esoko	4
Manobi	5
LINKS database – Tanzania	5
KACE	6
FARMIS and Infotrade	6
Virtual marketplaces	6
M-Farm and Lima Links	6
AMIS stakeholders and cost of information	6
Business model	8
Impacts	10
Challenges	13
Learning from experiences	13
Success factors include:	14
Constraints include:	14
ICTs with agricultural value chain	15
Conclusions and recommendations	17
Role of government	18
Role of the private sector, NGOs and CBOs	18
References	18

Executive summary

Access to markets and marketing information by smallholder farmers depending on agriculture in developing countries have always been challenging. Factors such as poor road infrastructure, illiteracy, financial constraints, poor communication means and lack of access to information, all limited their access to markets. These smallholders depend on traditional means of communication and sell their produce at the farm gate and local markets. This has not been fruitful for these poor farmers as traders, intermediaries and other stakeholders in the chain take a large share of their produce. As a result, rural farmers remain poor and agriculture contributes little to their income, economy and welfare.

The use of information and communication technologies (ICTs) is one approach to linking smallholder farmers to markets. Different scholars have proved the benefits of their use in disseminating information to users. ICTs link farmers to markets and provide them with current marketing information. Based on the information, farmers can perform informed decision-making during selling and when farming. The aim is to increase farmers' income and improve productivity.

The successes of using ICTs in linking farmers to markets depend on other factors and stakeholders. The involvement of government in setting enabling policies and improving physical infrastructure in rural areas is important. NGOs and farmers' organisations may get involved in linking farmers to markets and in helping them to use current technologies in their farming activities. The willingness and readiness of these smallholders to adopt the use of ICTs in accessing markets is also challenging.

This study has explored the use of ICTs (especially mobile phones) in linking farmers to markets in sub-Saharan African countries. The use of ICTs ensures that farmers get current marketing information thus reducing information asymmetry and bypassing intermediaries. ICTs also enhance transparency and built trust between farmers and traders. This study has cited cases where the use of ICTs have impacted on the selling decision of individuals, improved their bargaining power and income. Lastly, the study has highlighted the roles of different stakeholders in ensuring that ICTs are incorporated into the agriculture value chain by smallholder farmers.

Introduction

The agricultural sector accounts for the overwhelming majority of rural employment in many developing countries. It contributes significantly in terms of aggregate growth, exports, employment and linkages with other sectors. Smallholder farming dominates agricultural production and a large proportion is for subsistence (Eskola, 2005; Aina, 2007; Aker, 2010). The sector plays a key role in ensuring national food security and for generating demand for industrial goods and services. To increase their income and improve their livelihoods, rural farmers engage in businesses by selling their farmed produce. Some of the produces are exported for business purposes. Some studies (e.g., May *et al.*, 2007; Rao, 2007) show that agricultural growth is the principle routes to reducing poverty in developing countries, especially in rural areas.

Despite the importance of agriculture to economic development, small-scale farmers have remained poor and are not well linked to markets (Aina, 2007). Lightfoot and Scheuermeier (2007) noted that small-scale farmers are exploited and do not get a fair share of the final consumer price due to poor access to markets and marketing information. Rural farmers mainly get market information from their fellow farmers via word of mouth (Kindness and Gordon, 2001) the radio and through occasional meetings with extension agents and village leaders; they sometimes get information from magazines and newspapers (Manda, 2002). Farmers don't interact with extension workers very much as there are few of them and they are mainly concentrated in urban areas (Aina, 2007).

Poor access to markets and marketing information has left rural farmers exploited by other players in the chain. Rural farmers often don't know the prices of their produces at distant markets. And due to poor road infrastructure and financial constraints, they often cannot transport their produce to distant markets. Traders and middlemen visit the farmers at their homes and local markets and make purchases there. In most cases, farmers negotiate based on the prices proposed by the traders or middlemen. Traders and middlemen cheat farmers by taking advantage of their lack of knowledge of market prices, poverty and weak bargaining power arising from illiteracy and low social status (Lightfoot and Scheuermeier, 2007). Intermediaries often flout market norms and their pricing lacks transparency (Rao, 2007). Van Crowder (1997) noted that farmers' markets access is limited by costs (in terms of time and resources), illiteracy, lack of information and poor knowledge of marketing.

Some authors in the literature (e.g., Kindness and Gordon, 2001; Eskola, 2005; Lightfoot and Scheuermeier, 2007; Rao, 2007) have argued for improvement of market access to rural farmers that may even involve physical infrastructure (Adam *et al.*, 2012). Improved roads may encourage rural farmers to transport their produce to distant markets in towns and traders in turn, will flock to rural markets to compete in purchasing produce. Intermediaries will be bypassed; this will help farmers to decide on where to sell, when to sell, who to sell to, and how to plan their production (Kindness and Gordon, 2001; Ferris and Robbins, 2004; Kleih *et al.*, 2006). Farmers may also be aware of the types and quality of produce being sought by national, regional and international customers (Ferris and Robbins, 2004). The governments monitor price trends in order to review their policies and functioning (Shepherd and Schalke, 1995; Kleih *et al.*, 2006).

Linking smallholder farmers to markets

Due to lack of connectivity to more lucrative markets at regional, national or international levels, most smallholder farmers who practice subsistence farming largely depend on local markets or the farm gate to sell their produce. In some areas, traditional marketing channels operate and there are no clear links between farmers, processors, retailers, consumers and others. Also, farmers lack access to reliable and cost-efficient inputs such as extension advice, mechanisation services, seeds, fertilisers and credit. In reality, the agriculture value chain is too long and inefficient. This leads to weak incentives and low investments and productivity. As a result, smallholders' income remains low and poverty is endemic.

But how can these smallholders emerge from this poverty trap? Torero (2011) proposed that one way is to link "farms to markets" by improving physical infrastructure such as information technology that connects smallholders to markets and reducing transaction costs and minimising risk. In supporting the proposal, Prakash (2008) and Rapusas (2008) insisted on using technology and information to establish linkage between farmers, producers and markets. This study explored use of information technologies (specifically agriculture market information services) in linking smallholder farmers to markets.

Agricultural market information services

Agricultural market information services (AMISs) are a set of integrated and co-ordinated processes and tools to collect and deliver agricultural and/or livestock market information and services to farmers, traders, food processors, government functionaries and others that may benefit from current market data (Zoltner and Steffen, 2013). AMISs increase the transparency of markets by providing current market information to smallholder farmers. Market access encourages farmers to act directly to the marketplace, improve their produce, choose better marketing and delivery channels, promote their products and influence prices (Van Crowder, 1997). Informed farmer may choose which crops to plant or how long to store their produce until prices increase. Market access also enables traders to decide how to price goods and where to sell them. Eventually, this increases the income of farmers, improves their bargaining power and reduces information asymmetry (Svensson and Yanagisawa, 2009), shifting the share of income toward smallholder farmers (Zoltner and Steffen, 2013).

AMIS initiatives may change the way traders do their business and may also transform the farming habits of rural citizens (Payne, 2011). AMISs can carry additional information such as agricultural extension advice, weather forecasts and prices for agriculture-related inputs. These AMISs are accessible over the internet and even on mobile phones. In addition, AMISs (e.g., KACE) distribute information via radio, newspaper and television. Some AMISs (e.g., AMITSA) take advantage of social networks such as Facebook and Twitter to reach their audience. Again, this widespread diffusion increases accessibility for all market stakeholders.

AMISs have not been very successful in many developing countries. They don't provide timely, accurate and cost-effective market information (Coon, 2009) and thus are not commercially useful to farmers and traders (Shepherd, 1997). A large percentage of services are primarily data-gathering exercises, which is done inadequately (Shepherd, 1997; Ferris and Robbins, 2004); the information is scattered across different sources and not easily

accessible (Coon, 2009). Thus traders are forced to use their own private networks get up-to-date, reliable and trusted information (Coon, 2009). Ferris and Robbins (2004) encourage developing countries to improve market information provision in order to compete in globalised agricultural markets.

Provision of market information services

The provision of agricultural marketing information aims to increase the efficiency of agricultural markets and contribute towards overcoming issues of market failure. This helps farmers to monitor market conditions and make better decisions on where to sell their produce; it also helps them to negotiate for improved prices. Similarly, traders use market information in their decision-making and identification of marketing opportunities. This review has used the first three services (out of five) provided by any AMIS as proposed by Donner (2009), which are: mediated agricultural extension, market information and virtual marketplaces.

Agricultural extension

Agricultural extension – the practice of gathering, developing and sharing knowledge about farming and rural livelihoods with rural populations – is a decades-old and common activity (Donner, 2009). It has traditionally been defined as the delivery of information and technologies to farmers (Ponniah *et al.*, 2008). This is based on the idea that ‘modern’ knowledge and information is transferred through extension agents to recipient farmers. The purpose is to help farmers increase their production.

The recent training and visit (T&V) approach operating in more than 40 developing countries provides continuous feedback from farmers to extension agents (Ponniah *et al.*, 2008). Extension agents physically visit farmers and engage in knowledge and technology transfer. It emphasises the dissemination of unsophisticated, low-cost, improved practices and it teaches farmers to make best use of available resources. The T&V approach also uses the technology of radio and TVs thus allowing for rapid and low-cost dissemination of agricultural knowledge (Donner, 2009). As the number of extension workers is decreasing, Aina (2007) encouraged the integration of ICTs in delivering extension services. A number of AMISs are currently delivering this service over the internet or mobile phones. Some innovative initiatives to address the information gap between extension workers and farmers are presented in Box 1.

Box 1. ICTs and extension services.

Esoko¹ has established call centres in Ghana where farmers call and get rich and detailed advisory agricultural advice.

Using push technology, the Collecting and Exchange of Local Agricultural Content (CELAC)² project in Uganda maintains a database of farmers in 15 districts to whom it regularly distributes agricultural information via SMS, phone calls and phone conferencing.

The Kenya's National Farmers Information Service (NAFIS)³ serves farmers' needs throughout the country including the rural areas where internet access is limited. It enables farmers get critical extension information by either browsing its website or by accessing summarised voice-based service information through mobile phone calling.

The mobile application iCow Soko⁴ in Kenya, allows registered livestock farmers to get text messages about the breeding, nutrition, milk production efficiency and other best dairy practices through periodic SMS messages.

Market information

Access to recent and updated market information in developing countries is low and inadequate. A number of factors have been attributed to this failure including high illiteracy level, high cost in terms of time and resources needed, lack of regular reliable information, isolation from the required infrastructure and an enabling policy environment. ICTs have emerged as a tool to bridge the information divide between the rural farmers and the global community.

In developed countries, there is some evidence of usage of the latest ICTs to link suppliers and users of agricultural information services, including marketing information (Van Crowder, 1997). The developing world has now joined the race and there are initiatives in almost every country to ensure rural farmers are linked to markets and buyers. There are a number of initiatives to link small-scale farmers to markets and marketing information. Although there are a number of applications providing this service in sub-Saharan Africa, Esoko and Manobi are two prominent and successful ones and are discussed below.

Esoko

Esoko provides an internet platform to enable farmers to get market information and trade using mobile phones and web pages. Esoko focuses on agricultural value chains in order to improve the transparency of markets and the operational efficiency of organisations. It collects and provides content such as prices, bids and offers, weather and agricultural tips to which users can subscribe.

The company offers three tiers of services: (1) price alerts via SMS; (2) the option for users (e.g., a livestock association) to relay information on prices, transport, input availability and

1 www.esoko.com/

2 www.celac.or.ug/

3 www.nafis.go.ke/

4 <http://icow.co.ke/>

more via SMS; and (3) the option for users to develop management information systems for their operations.

Farmers subscribed to Esoko receive a package of weekly advisory services consisting of current market prices, matching bids and offers, weather forecasts, and news and tips. Through Esoko, farmers can negotiate better prices, choose different markets or time their sales better. Esoko allows business companies to profile thousands of individuals, group them, and then send important messages to them. With Esoko, government agencies can track market prices, production data, commodity quantities and field activities, all in real time. Esoko also offers trade-related website options for customers.

Compiled from (African Business, 2009; Payne, 2011).

Manobi

Manobi,⁵ a private for-profit company based in Senegal, has developed a range of mobile and web-based applications focused on improving weaknesses in agricultural value chains. Time to Market (T2M) application enables farmers to check market prices on their mobile phones via SMS, WAP, MMS or mobile internet. The ITU (2010) mid-term review reported that Manobi provides access to price data on various crops collected from different markets across the country. Manobi personnel use mobile phones to send the price data to the Manobi database using the Wireless Application Protocol (WAP). Manobi operates in Mali, Ivory Coast, and Niger.

Compiled from (Payne, 2011)

LINKS database – Tanzania

The Livestock Information Network Knowledge System (LINKS)⁶ database operates in Ethiopia, Kenya and Tanzania. LINKS provides information on prices and sales volumes for cattle across various markets. In Tanzania, LINKS provides market information on livestock in 53 livestock markets, of which 41 are primary markets and 12 are secondary markets. In each livestock market, market monitors collect price information from buyers on concluded transactions for cattle, goats, sheep and donkeys based on breed, age, gender and grade. The market information with average prices and total volume of exchanges for the various animals is then submitted to LINKS. Weekly and monthly summary livestock market information reports are prepared and disseminated with information on average prices and total volume of exchanges from the different markets in the country. These reports are regularly sent via email, newspapers, radio and TV programmes to major data stakeholders, including private and public sector actors. Price and quantity data are publically available through the LINKS website.

Compiled from (Mapunda *et al.*, 2011)

5 <http://www.manobi.net/>

6 <http://www.lmistz.net/>

KACE

The Kenyan Agricultural Commodities Exchange Programme (KACE)⁷ offers reliable and timely marketing information to farmer, producer or consumer, seller or buyer, exporter or importer of agricultural commodities. One can sell or buy commodities or services through KACE by using any of KACE's physical or virtual trading floors. The physical trading floors are the trading boards available at KACE's market resource centres.

FARMIS and Infotrade

In Uganda, FARMIS⁸ and Infotrade,⁹ among others, link the farmers to the markets and provide current updated market information to its stakeholders.

Virtual marketplaces

AMISs also integrate the virtual marketplace for users' conveniences. Virtual marketing uses pre-existing social networks to produce raise in products awareness in order to increase sales. ICTs such as the internet and mobile phones enhance the use of virtual marketing. Donner (2009) argued that virtual marketplaces are specific venues that match buyers and sellers and are as old as markets themselves. The virtual marketplace widens the markets for agricultural produce in Africa as one can purchase the product online, make payment and have a product delivered to the destination without undertaking any travel.

M-Farm and Lima Links

The M-Farm¹⁰ company in Kenya enables farmers to sell their produce collectively by connecting them with a ready market through a mobile phone-enabled service. M-Farm aggregates farmers' orders, provide them with current market prices and facilitate access to large-scale markets such as exporters, wholesalers and retailers. With M-Farm, purchase and delivery of some products are possible.

Another mobile phone-based innovation, Lima Links in Zambia, provides nearly 'live' horticultural market price data to farmers. It allows wholesale agents to manage crop intakes from farmers along with their sales to retailers and marketeers. Through the system, traders can also send out produce volume requests to farmers within a 50 km area to fulfil certain sales quota requests (Steffen and Woodard, 2012).

AMIS stakeholders and cost of information

Different AMIS stakeholders have varying information requirements depending on the needs and applications. Access to information sources and markets, farming systems and livelihoods affects the information seeking behaviour of farmers. A number of literatures

7 <http://www.kacekenya.co.ke/>

8 <http://www.farmis.ug>

9 www.infotradeuganda.com/

10 <http://mfarm.co.ke>

have identified small-scale farmers and traders as primary use of AMISs (Ferris and Robbins, 2004; Aker, 2008; Ferris *et al.*, 2008). This has also been reflected in most of AMIS' implementation. Esoko, for example, has identified its stakeholders as farmers, traders, businesses, companies, NGOs, projects and government. KACE has identified its stakeholders as farmers, producers, consumers, buyers, exporters and importers of agricultural commodities. Chomba *et al.* (2002) grouped users as: large-scale farmers, small-scale farmers, traders, processors and public institutions and NGOs. Ferris and Robbins (2004) found that an MIS benefits farmers, traders, consumers, development agencies and government agencies. Governments and donors are also stakeholders as they team up to establish AMISs. Researchers are the stakeholders in AMISs as they use the information collected by AMISs to conduct studies.

It is critical to identify target stakeholders both in the private and public sectors, their needs and an appropriate means of communicating, disseminating and setting priorities among them. Weber *et al.* (2005) noted lack of prioritisation among the components of AMIS. Market information that is disseminated to farmers may not fulfil its objectives (Ferris and Robbins, 2004). Farmers seem to be more interested in time-specific and reliable maximum farm gate, off-lorry and retail prices of the nearest and the main neighbouring markets rather than in wholesale price information. The large-scale farmers in Zambia indicated that information needed for decision-making included gross margins for a given commodity, potential markets, volatility of the commodity market, availability and price of inputs and expected transportation costs for inputs (Chomba *et al.*, 2002). Some studies revealed that farmers who are benefitting from the price information services would be interested in other information as well, such as weather forecasts, advice on crop production and use of appropriate seeds and fertilisers (Awasthi, 2007).

Many NGOs and community-based organisations (CBOs) target the rural poor, whose livelihoods are generally focused on primary agriculture or trade. These help rural farmers to access agricultural inputs, marketing information and link them to market (Kindness and Gordon, 2001). For example, the Swedish Cooperative Centre (SCC) helps farmers in Zimbabwe solve their agricultural problems collectively and share information on agricultural marketing and market their produce together, which give them power to negotiate for better prices for their products (Moyo, 2009). Also, World Vision Malawi, managed to create an enabling environment for linking organised groups of farmers to markets (Phiri, 2009).

Governments can use marketing information over time to evaluate the effects of regulation and investment in the marketplace (Ferris and Robbins, 2004). The information enables governments to learn food securities within their countries. Usually, donor support for AMIS development is for a fixed time of the project execution. Islam and Grönlund (2010) cautioned that despite being useful to governments, development agencies and researchers, AMIS should mainly serve the needs of the ultimate target group of farmers and traders. They also cautioned that donors funding AMIS development should not value their needs and become clients.

Usually, the cost of accessing and using information from the AMIS is born by the primary stakeholders (i.e., farmers and traders). This challenges the sustainability of most AMISs as most rural farmers in developing countries are poor and illiterate and thus may not recognise the necessity of information and fail to pay the costs of access. Some technical and cultural aspects may also limit access to information by these stakeholders. Some studies have

proposed that the cost of information should be low (e.g., Islam and Grönlund, 2010; Zoltner and Steffen, 2013) in order to encourage and promote the usage of AMISs. Kubzansky *et al.* (2011) noted that three Google Apps introduced for free in Uganda gained traction but their usage dropped when fees were introduced. Different strategies such as education, advertising and local support may encourage more primary stakeholders to use AMISs.

It is essential to develop a viable business plan that will ensure the sustainability of the AMISs. The plan will clearly narrate how the AMIS will run, who will pay for it (e.g., the government, donors, users, support from NGOs and CBOs etc.). It might be better to have payment made every time someone accesses the information rather than having a long-term arrangement (e.g., a quarterly or annual) subscription. Some AMISs allow one to pay through mobile phone every time one queries the information (i.e., sends an SMS), while others maintains a database of registered users where they pay registration fees and an annual subscription fee. Box 2 highlights the payment details of some AMISs in Africa.

Box 2. Payment mode.

Esoko relies on the subscriptions from its members for its financing. Membership are of different levels. There is an annual individual membership priced at US\$35, which provides users with 10 SMS alert a week; a small business annual membership is priced at US\$250 and users can post contents onto personalised pages to market their goods. Full membership gave full access to the system at an annual subscription cost of US\$1,500. Esoko estimated that it needs 10,000 individuals and 2,000 businesses in any one country to be profitable as an enterprise (African Business, 2009).

Manobi: Offers free entry-level services (market information) for growers making less than US\$2/day. Value-added services (e.g., on-farm management and local market linkages) and third party services (e.g., market integration, certification, contracts, bulk procurement, and financial services) are provided at a fee.

Infotrade charges substantially higher rates: UGX25,000 (US\$10) per commodity per month or UGX125,000 (US\$50) for all 46 commodities. However, one can pay a fixed price of UGX62,500 (US\$25) for information on a total of up to 10 commodities (Zoltner and Steffen, 2013).

LINKS: It costs TZS58 (US\$0.04) per message for a user in Tanzania who wants to access the LINKS database using a mobile phone (Mapunda *et al.*, 2011).

iCow: Farmers pay KES5 (roughly US\$0.05) per SMS, which amounts to approximately KES1,200 annually based on average estimated usage (~US\$12.66).

Most services attempt to lower these fees by negotiating preferred rates with mobile network operators and then pass the remaining fee on to the user, but the strategy often means losing the poorest small producers who are unable or unwilling to pay the fee (Zoltner and Steffen, 2013). Some AMISs encourage companies to advertise on their websites to raise additional revenue. Unfortunately, most AMISs have not disclosed their payment details. No study has been done to examine the readiness of smallholders to pay information costs.

Business model

One of the biggest challenges facing mobile agriculture platforms to date has been the question of how to achieve financial sustainability. Services initiated with donor support don't

usually survive after the project completion period. For example, an FAO survey between 1995–96 of its 120 member countries revealed that only 53 governments operated a functioning market information system (Van Crowder, 1997; Coon, 2009). The survey further indicated that only 13 countries carried out daily transmissions of price information (Coon, 2009). Service providers should have business plans to ensure AMISs scale-up and achieve some financial independence.

Different scholars have suggested that AMISs must be supported by robust and coherent business models in order to achieve long-term financial sustainability (Loucky, 2012; Zoltner and Steffen, 2013). The business model should clearly state the specific needs of the target users, the partners involved, the technical operations and the cost and revenue structure (Loucky, 2012). Payne (2011) encouraged service provider to select a business model to allow the business to break-even or ideally make a profit so the service can sustain itself and be scaled to thousands if not hundreds of thousands of farmers. Governments, donors and development organisations may choose to subsidise the service or the basic service for certain users and other services may be offered on a fee basis.

Esoko is an example of a service provider whose service is scaling-up and is financially stable (Box 3). It began in 2005 with funding from USAID/West Africa's MISTOWA project. A for-profit private company with private investors, Esoko has substantially enhanced its technical platform, services offered and business model and is providing services based on a tiered franchise/subscriber model to several countries in sub-Saharan Africa; it works with several USAID projects including projects in Burkina Faso, Cote d'Ivoire, Ghana and Malawi.

Box 3. Esoko business model.

- Private franchise where private companies seek private equity investment and sell (mostly organisation level as opposed to farmer level) subscriptions, training/consulting services and deliver services via SMS to target customers. Franchises will handle data collection, marketing, customer service, operations and interconnect issues between Esoko systems and MNOs. They will share revenue with Esoko and must meet minimum performance standards.
- A licensee or reseller model in which private companies sell Esoko's subscriptions, training/consulting services and SMS to customers. These private companies typically exist already and intend to use Esoko's offerings as a complement to what they're already doing. This model does not require equity investment and the reseller does not have to meet performance targets while they maintain some levels of exclusivity in a country. Licensees will handle data collection, MNO negotiation, sales and client support. Licensees also share revenue with Esoko, although they provide Esoko with a higher percentage of sales than a franchisee.
- Public-private partnerships where an NGO is funded by a donor to jump-start a market information system with the long-term sustainability plan of transitioning operations to a private enterprise.
- Public projects that sell licenses to Ministries of Agriculture, NGOs or associations for the Esoko service or use of its platform.
- Private businesses that sell licenses to multinational corporations and businesses for the Esoko service or use of its platform.

Adapted from (Liu and Payne, 2011)

Thus, designing the business model that can allow for sustainability and reaching the scale is essential. In a successful private business model, service costs are usually covered by revenue (user payments, third party fees for advertisements and data). In some cases, governments may decide to run the AMIS and the services provided are considered to be public. In this case the government meets all the running costs.

Impacts

The recent developments of ICTs have completely changed the way people communicate, share information and even do their businesses. ICTs have emerged as a tool to bridge the information gap between the 'haves' and the 'have nots'. Using ICTs, poor rural farmers can get price information on their products that can help them to make important sales decision. Also, using ICTs, these poor farmers can even receive money from their relative in urban areas using mobile applications such as M-Pesa. ICTs are really transforming the lives of rural communities in developing countries.

The literature has documented how traders and farmers have benefited from the use of mobile phones. Donovan (2011) reported that mobile phones help to increase income, improve efficiency of markets, reduce transaction costs and offer a great opportunity for innovative interventions, especially in service delivery. The World Bank study in Philippines found strong evidence that purchasing a mobile phone is associated with higher growth rates of incomes (Labonne and Chase, 2009). This finding reflects the evidence that farmers equipped with information have stronger bargaining power and can access a number of markets at the same time.

Mobile phones have a greater impact on price dispersion across markets. The impact is greater where travel costs are higher, especially in remote areas connected by unpaved roads. A study by Aker (2008) in Niger on the effect of mobile phone service penetration on grain markets found reduced market price dispersion across markets by 10%. The study also found that grain traders began trading in more markets once they had mobile phones, had more market contacts and their profits increased by 29%. A similar study by Jensen (2007) in Kerala, India found that mobile phone coverage alone led to significant market efficiencies: the difference in prices across markets declined, as did waste; fisher's profits increased by 9% and consumer prices declined by 4%. Another study done by Japan International Cooperation Agency (JICA) in Uganda on the banana market found that mobile phone coverage rose information flows and encouraged farmers' market participation (especially for those living furthest from markets) (Muto and Yamano, 2009). Box 4 presents a case where access to marketing information has helped farmers to make vital selling decisions.

Box 4. Knowledge exchange and making decisions

Bahati Tweve, “a market spy and investigator”, is a farmer in the southern highlands of Tanzania who helps his fellow farmers gather information on prices, types of produce in demand, quantity and quality of produce and potential buyers. Armed with this information, farmers can make informed choices about what to supply; they can bypass the middlemen who prey on their lack of market knowledge.

Tweve is supported by the First Mile Project, which trains small farmers, traders, processors and others from poor, rural areas to build market chains and improve market access and information. Tweve uses his mobile phone to collect market information from distant markets and pass it to his fellow farmers. Matilda narrates how information has benefited them.

Farmer Matilda Arnoldi Mushi discovered that being better informed is empowering: “We are no longer ignorant. When middlemen come and say TZS10,000 (US\$6.4), while in Dar the maize sells for TZS30,000 (US\$19.2), we say ‘no’. We are now in a position to bargain fairly.”

From January to mid-February 2006, five farmers’ associations sold 70 tonnes (t) of maize for US\$143 per tonne using mobile phones, market “spies” and price updates broadcast on local radio stations. In the same period, farmers without market information sold their maize for just US\$65 per tonne. The use of “spies”, and enabling farmers to negotiate with bigger traders, has helped eliminate the cheating and mistrust that previously hindered trade.

Compiled from (*New Agriculturist*, 2008)

Accessing market information allows farmer to make important selling decisions, including when and where to sell and to whom to sell to. Box 5 presents cases where marketing information has helped farmers to opt for different markets due to big price differences. The total result is to increase revenue and improve productivity.

Box 5. Cases where market information benefited farmers.

Among the success stories of Esoko is Sara Maunda, a Malawian village farmer, who lived in Dowa, 38 km from the capital Lilongwe, whose life was completely transformed when she started using a mobile phone in June 2011 to get prices for commodities. Sara refused an offer of MWK30 per kg for her shelled groundnuts from the grain trader who arrived at her gate because the previous day she had learned from Esoko that 1 kg of groundnuts costs MWK120 in Lilongwe. When she sold her groundnuts in Lilongwe, she made MW K24,000 (US\$130) in profit but if she had sold to the vendor, she would only have made MWK4,500 (US\$27).

Compiled from (USAID, 2012; Asare-Kyei, 2013; Gondwe, 2013)

Box 5 (continued)

Mr. Samuel Mpondo owns a 25-acre farm in Salima, Malawi where he grows maize and soybeans. He travels to local markets to find buyers and he mainly relies on information from friends about markets. He used to use a truck to transport his produce to some markets. This did not always work out well as if the prices weren't good he would have to sell at a low price or return with a full truck – either way he would have huge losses. Instead of going to the market, the market now comes to Mr. Mponda in the form of SMS offer alerts from the Agricultural Commodity Exchange for Africa (ACE) on the Esoko web-to-SMS platform. With this system, ACE sends procurement offers directly to the phones of small traders and farmers like Mr. Mponda. Mr. Mponda admitted there is a lot of transparency in the way trade is done with ACE and the prices are higher than the prices he got for his produce before. With access to a transparent market that he has trust in, Mr. Mponda says would like to increase his production and he might even start buying from other farmers to boost his volumes.

Compiled from (USAID, YEAR?)

Farmers in the Kinangop region of Kenya using MFarm for collective selling have received more than double the price for certain types of produce (such as snow peas and sugar snap peas) than what they got for them when they were selling them individually. The feedback from farmers using the service has revealed that access to current market information has given them a transparent bargaining platform to use when selling individually to brokers or middlemen (Woodard, 2012).

AMIS can increase knowledge and create awareness of farmers and producers of markets.

Producers and farmers in Senegal had no access to local, national and export markets. Their selling decision heavily depended on the information they got from middlemen. As a rule, middlemen benefited from these farmers who sold their produce to them at the farm gate. Farmers like Modou Seck waited for the middlemen at their homes, negotiated their product prices (based on prices proposed by the middlemen) and finally made selling decisions. The introduction of Manobi completely changed the scenario. Farmers can now access price information at different markets and based on the information they have, they can make selling decisions with middlemen or traders. Using the Time to Market (T2M) application of Manobi, farmers check the market prices at different markets on their mobile phone. Based on the marketing information they have, farmers can negotiate a fair price as business peers with middlemen and traders. Farmers like Modou Seck have increased the annual revenue by US\$750 per acre, effectively doubling their income. The middlemen benefit too because they use T2M to choose the best end markets to get the highest price for themselves.

Narrated by Annerose (2012).

In January 2007, USAID teamed up with Manobi to find an ICT solution to Karaya gum growers in Tambacounda, a town in the interior of rural Senegal, 9 hours by road from the commercial marketplace. Karaya gum is consumed in West African cuisine and is also exported to USA and the EU for manufacturing cosmetics and pharmacology. Karaya producers were the weakest link in the chain of supply and demand. A total of 10,000 farmers did not have any access to information on their produce. These producers did not communicate with purchasers and foreign manufacturers; they also did not communicate with each other to establish commercial norms. This lack of communications made them vulnerable to being cheated by intermediaries. These gum producers had a contract to supply local exporters. Exporters argued that since they didn't know what inventory was available, they can't carry enough cash to pay farmers at the point of sale and manufacturers couldn't project the future price and supply of Karaya gum. So the producers were obliged to sell to local middlemen instead at a lower price.

Box 5 (continued)

Manobi developed an innovative application (2GIS + T2M) for these Karaya gum growers. Using their PDA/GPRS/GSM, they recorded inventories which are then displayed on exporters' screens via mobile GIS maps. Exporters can optimise their collection logistics, more accurately estimate cash requirements, and save money on transport. Gum growers sell at higher prices directly to exporters and are paid cash on delivery. Manobi claims that as a result, gum producers have increased their sales income by 40–50%

Compiled from (Manobi Development Foundation, 2007; Annerose, 2012)

Challenges

In order to ensure long-term sustainability at a sufficient scale, it is critical that any donor-supported AMIS is based on a business model that enables the services to be sustained and extended to millions of farmers (Zoltner and Steffen, 2013). Payne (2011) proposed that a service provider should select a business model to allow it to break-even or ideally make a profit so the service can sustain itself and be scaled-up to thousands if not hundreds of thousands of farmers. A company that depends on individual subscriptions or transaction fees may lose money because individual users can easily share the information. Given that governments consider market price information to be an important public good, governments may also play a key role in any successful business model, either via public-private solutions, content producers, key customers or funders.

The for-profit private AMISs (e.g., Esoko, Manobi) have shown positive trends in scaling-up. AMISs run by governments face serious challenges in sustainability and scaling-up. Possibly governments should consider public-private partnership in running the AMISs. Financial constraints of rural people and lack of awareness may also bring challenges to adoption of the services. This may lead to failure to meet communication costs. Service providers need to ensure that the marketing information provided is trusted by ensuring enumerators don't compromise the information.

Learning from experiences

It is evident that access to marketing information empowers farmers and helps to improve their decision-making. Farmers can decide when and where to sell their produce. Farmers learn the price in advance without incurring any transportation costs or other overheads. Due to transparency in trading and market competition, farmers get benefits from more accurate

weighing, faster processing time and prompt payment. Overall, farmers earn higher incomes through increased prices and lower transaction costs. Equally, the services benefit the traders by reducing the inefficiencies in the agricultural value chain.

Clearly, identifying key target users for marketing information and their information needs greatly enhances the adoption of the AMISs. The marketing information needs have expanded from regular price and demand information to new markets and product development opportunities. To improve marketing of agriculture products, the systems are incorporating other services such as post-harvest and processing technologies, new markets and buyers, requirements of the buyers and quality control, best practices in production and policy issues. The following section lists the success factors and constraining factors for adoption of AMISs.

Success factors include:

- Political commitments at the country level that ensure the AMISs are supported by donors or are subsidised by government budgets. The LINKS database is donor funded but the government is committed to taking it up after donor withdrawal (Mapunda *et al.*, 2011).
- Service providers focusing on the needs of target users by assessing user feedbacks, measuring it regularly and improving the services. In 2011, Esoko conducted interviews and training courses and organised workshops at 11 grain bulking centres in Malawi, where it assessed user feedback (Byres *et al.*, 2011).
- Combining several business model might help to build the sustainability of AMISs. Esoko and Manobi have a combination of different business models that are contributing to their sustainability and scaling-up potential.
- Increasing cellular network coverage in rural areas that encourages more ownership of mobile phones.
- The steady drop in communication costs encourages rural citizens to purchase mobile phones for communication purposes. This has worked with fish workers in Kerala (Jensen, 2007) and with grain traders in Niger (Aker, 2008).
- Establishing solid linkages with farmers, farmer communities and trade associations and NGOs that work with farmers, both as users and suppliers of information.
- Provision of a wide range of services to support more stakeholders e.g., extension services, weather information and detailed reports.
- Encouraging users to use the AMIS through promotion and advertising.

Constraints include:

- Farmers failing to purchase mobile phones and meet communication costs due to financial constraints.
- Lack of awareness of marketing information and low literacy levels among rural farmers. Users fail to operate the mobile phone and read text messages. For voice services, users may prefer to hear their local native languages.
- Poor network coverage in some parts of rural areas. Byres *et al.* (2011) reported that in some rural areas in Malawi, the farmers could not access the system due to poor signal or total unavailability of the system.

- Poor road infrastructure in rural areas, thus farmers found it difficult to reach markets and depend heavily on intermediaries.
- Sharing market information among farmers. The more users access the system, the more revenue the system generates. If users share the information, then this lowers the use of the system and revenue decreases. In their report, Byres *et al.* (2011) established that in many cases, farmers in Malawi shared the information.
- Lack of political commitment due to their few visible benefits as observed by politicians.
- Withdrawal of donors and supporting agencies and governments failing to run the AMISs due to budgetary constraints.
- Failing to provide detailed information to farmers.

ICTs with agricultural value chain

As the demand for food production increases, ICTs are playing an increasingly important role in supporting agricultural value chains in developing countries. They appear to offer opportunities for improving supply and trade efficiencies. Different types of ICT have different strengths and weaknesses when applied to particular interventions in the value chain. Their roles are increasing in connecting farmers with information on everything from production and marketing to weather. The impacts of ICTs may influence market competitiveness in different ways. Farmers may change their farming systems to more demanding and competitive produce; they may produce quality produce as demanded by consumers; they may opt for different markets according to the information they have to hand, and even decide to process their produce to capture the best paying markets. In all these, ICTs are just an adjunct to the process; they are not meant to overshadow the people and institutions involved.

Stakeholders use different ICT applications and tools at different stages of agricultural value chains, from pre-production to advisory services and marketing and consumption. Different scholars (e.g., Dixie and Jayaraman, 2011; Furuholt and Matotay, 2011) have highlighted the importance of services provided by mobile phones in enhancing the agricultural supply chain. Furuholt and Matotay (2011) and Halewood and Surya (2012) identified five areas in which mobile phones can be useful to farmers in enhancing agricultural supply chain. Their findings are as follows:

- **Access to timely information:** Mobile devices improve access to timely information about prices, market and farming practice.
- **More efficient and transparent markets:** Make the process efficient and transparent, reduce waste and empower smallholders in negotiation with traders, and link smallholders to distant markets and higher end agricultural value chains.
- **Advance warning:** Improve advance warning of weather risks, pests and other environmental risks and provide timely, locally relevant information on how to respond to these.
- **Access to complimentary services:** Facilitate access to vital complementary services, particularly financial services.
- **General communication and co-ordination:** Help the rural poor to connect with one another for more effective collective action as producers, traders and citizens.

Furuholt and Matotay (2011) summarised the ways in which mobile phones can support the activities of the farmer in the agriculture value chain (Table 1).

Table 1. Agricultural value chain activities.

Activity performed by farmer	Activities that can be facilitated/enhanced by mobile phones
Preparations for farming	Coordinating labour pool (voluntary-based, family members and neighbours) Collecting weather information Investigating seeds prices Preparation <i>kraal</i> manure for planting (mainly used by the farmers in the area during planting)
Farming	Pooling of labour for cultivation and weeding Organising manure for use during planting Collecting and exchanging rain information Hiring/borrowing farming implements (e.g., hand hoes, ox ploughs, harrows etc.) Investigating prices of tractors for cultivation Ordering and hiring of oxen for cultivation Collecting information about new types of seeds Ordering seeds Investigating labour cost for cultivation and weeding in neighbouring villages Organising fertiliser Collecting information about availability of extension officers and subsidised farm implements from the local authorities Coordinating information and deliveries of pesticides
Harvesting	Organising and pooling of labour for harvesting Arranging for storage equipment and warehouses/stores Arranging for and ordering of preservative chemicals against mice and other pests
Post-harvesting (Marketing and transport)	Organising transport from the farms to warehouses (tractors or ox trailers) Calling market centres, traders, dealers and check prices and stocks of crops before settings deals with middlemen/agents or deciding to travel to obtain better opportunities. Calling for and ordering transportation to markets Selling crops via mobile phone Contacting distant families/relatives (for decisions and money transfers) Money transfers and payments

Mobile phones applications introduces the following to agricultural value chain:

- Efficiency delivery of services
- Communications facilitated by mobile phones reduce distance and time farmers have to travel to access the services. Services are delivered within a relatively short period of time and at a reduced cost.
- Empowerment of farmers
- It is often argued that “information is power”. Mobile phones enable farmers to access distant information within a very short time. With a mobile phone, a farmer in a remote area can learn the price of his/her produce at a distant market in town. This enables the farmer to negotiate better for the price of his/her produce.
- Enhancing transparency and trust
- Mobile phones enhance and strengthen communication linkage between smallholders and traders, thus allowing them to form a partnership network. This network is usually built on trust that depends on the transparency of the parties involved.
- Knowledge of farmers increases
- Although ICTs are not meant to replace experts, the dependence of farmers on knowledge from experts will decrease. ICTs, including mobile phones, may facilitate the delivery of services that can enable farmers to manage his/her farm activities. This may be very beneficial in developing countries where experts are few and are concentrated in towns.
- Innovative partnership among groups
- Individuals with a common interest may form a partnership where they can share their knowledge and expertise with others. For example, traders can form their network where they can share issues that are common among them. Farmers also may form a partnership where they can share their farming experiences.

Conclusions and recommendations

This study has demonstrated the advantages of ICTs, especially mobile phones, in enhancing the agricultural value chain. They are effective in enhancing communication between parties in the chain, linking farmers to markets and networks and providing them with real-time market information. This calls for different stakeholders to invest in supporting interventions that increase the outreach of ICT in rural and agricultural markets. In the near future, a number of developments are anticipated in remote rural areas.

- Increasing cellular network coverage in rural areas may lead to integration of ICT in the agricultural value chain
- Improving rural infrastructure including roads may lead to flow of services into rural areas
- The introduction of more specialised and ‘interactive’ applications that help farmers to enhance their activities will reduce number of visits to the expert.

For example, after specifying the symptoms of the animal, a disease diagnostic tool may propose the treatment options for the diagnosed disease. Then, the livestock owner purchases the drugs from the veterinary officer.

- Farmers may turn to commercial farming rather than subsistence farming, leading to increased agricultural productivity.

- There is a possibility of bypassing intermediaries due to increased access to markets and marketing information. This will enhance transparency and trust in the business and farmers will be in a powerful bargaining position.

Governments, international organisations, NGOs and private organisations all play a role in promoting the use of ICTs within rural communities. This study concludes by recommending the roles that governments, private sector and NGOs should play to ensure ICTs are used to the maximum.

Role of government

- Building infrastructure that will ensure services are delivered in rural areas. This may involve constructing rural roads, providing electricity in villages, and deploying experts in rural areas.
- Setting and implementing ICT policies that promote usage of ICTs in delivering services.
- Subsidising or lowering tariffs in some sophisticated devices that assist in accessing. This may promote usage of ICT devices in rural areas.
- Empowering extension officers to visit farmers regularly. In turn farmers may start seeking advices and information.
- Helping rural communities develop their own relevant local content.

Many international organisations, NGOs and private organisations target the rural poor whose ability to access remunerative markets is a critical determinant of their income and well-being. These organisations identify intended beneficiaries and provide them with training; they link beneficiaries to markets, help them access inputs, agro-processing technologies and marketing information. Some provide simple credit programmes.

Role of the private sector, NGOs and CBOs

- Providing assistance to individuals, groups and communities to improve access to market and market information for their produces
- Providing training in strengthening individuals, groups and communities capacity
- Developing linkages to traders and other stakeholders in the marketing chain (e.g., input suppliers, credit sources and transport agents)
- Working with farmers to identify production and marketing opportunities
- Encouraging small-scale farmers to operate community groups

References

- Adam, C., Bevan, D., Gollin, D. and Mkenda, B. 2012. *Transportation Costs, Food Markets and Structural Transformation in Tanzania*. Oxford Department of International Development. University of Oxford. Accessed 20 September 2012. www.qeh.ox.ac.uk/research/projectDetails?res_id=346
- African Business. 2009. 'Esoko – The new market info system for African farmers'. *Special Report*, Telecoms. Accessed 20 September 2013. <http://www.thefreelibrary.com/Esoko+-+the+new+market+info+system+for+African+farmers.-a0200510820>

- Aina, L.O. 2007. 'Globalisation and small-scale farming in Africa: What roles for information centres?' *In World Library and Information Congress: Seventy-third IFLA General Conference and Council*. Durban, South Africa. 19–23.
- Aker, J.C. 2008. 'Does digital divide or provide? The impact of cell phones on grain markets in Niger'. Working Paper No 154. Center for Global Development. Accessed 15 October 2011. www.cgdev.org/content/publications/detail/894410
- Aker, J.C. 2010. 'Information from markets near and far: Mobile phones and agricultural markets in Niger'. *American Economic Journal: Applied Economics* 2 (3): 46–59.
- Annerose, D. 2012. Manobi: Business services to improve the agri-value chain e-efficiency. New initiatives to promote Africa's SMEs and inclusive agribusiness development, Manobi. Accessed 12 November 2013. www.emrc.be/documents/document/20121204173912-agri12-workshop_b-daniel_annerose-manobi.pdf
- Asare-Kyei, D. 2013. Mobile Agriculture: Providing Tools and Support for Market Information Services and Commodity Price Exchange. Global Commodities Forum, 19 March 2013. UNCTAD, Geneva, Switzerland
- Awasthi, B.D. 2007. 'Relevance of market information system to environment protection'. *Journal of Agriculture and Environment* 8: 46–54.
- Byres, A., Kaonga, T., Mkumba, F., *et al.* 2011. Esoko – A review of its operation with grain bulk centres (GBCs) in Malawi. *Study for Market Linkage Initiative*, USAID Malawi. Accessed 13 November 2013. <http://communities.usaidallnet.gov/ictforag/node/374>
- Chomba, G., Mbozi, G., Mundia, D., Simpamba, M., Mwiinga, B., Donovan, C. and Mushingwani, S. 2002. 'Improving the transfer and use of agricultural market information in Zambia: A user needs assessment'. Working Paper No. 6, Food Security Research Project, Lusaka, Zambia. Accessed 20 August 2013. <http://ageconsearch.umn.edu/bitstream/54462/2/wp6zambia.pdf>
- Coon, J. 2009. *Developing Export Market Information System: Status, Challenges and Priorities for Tanzania*. Poverty Reduction and Economic Management, The World Bank, Washington, DC.
- Dixie, G. and Jayaraman, N. 2011. Strengthening Agricultural Marketing with ICT. In: *ICT in Agriculture: Connecting Smallholders to Knowledge, Networks, and Institutions*. 205–37.
- Donner, J. 2009. 'Mobile-based livelihood services in Africa: Pilots and early deployments'. *In Communication Technologies in Latin America and Africa: A Multidisciplinary Perspective*. 37–58.
- Donovan, K. 2011. 'Anytime, anywhere: Mobile devices and services and their impact on agriculture and rural development'. *In ICT in Agriculture: Connecting Smallholders to Knowledge, Networks, and Institutions*. 49–70.
- Eskola, E. 2005. 'Agricultural marketing and supply chain management in Tanzania: A case study'. Working Paper Series No. 16. ESRF Study on Globalisation and East Africa Economies. Accessed 12 May 2012. <http://tanzaniagateway.org/docs/agriculturalmarketingandsupplychainmanagementintanzania.pdf>
- Ferris, S., Engoru, P. and Kaganzi, E. 2008. 'Making market information services work better for the poor in Uganda'. *In Research Workshop on Collective Action and Market Access for Smallholders*. Cali, Colombia.
- Ferris, S. and Robbins, P. 2004. 'Developing marketing information services in Eastern Africa: The FOODNET experience. Local, national and regional market information services'. ASARECA Regional Marketing Network.

- Furuholt, B. and Matotay, E. 2011. 'The developmental contribution from mobile phones across the agricultural value chain in rural Africa'. *Electronic Journal on Information Systems in Developing Countries*. 48 (7): 1–16.
- Gondwe, G. 2013. Mobile phones transform Malawi farmers. BiztechAfrica. Accessed 20 September 2013. www.biztechfrica.com/article/mobile-phones-transform-malawi-farmers/6663/#.UmZdePmnoIQ
- Halewood, N.J. and Surya, P. 2012. 'Mobilizing the agricultural value chain'. In *Information and Communications for Development 2012: Maximizing Mobile*.
- Islam, M.S. and Grönlund, A. 2010. 'An agricultural market information service (AMIS) in Bangladesh: Evaluating a mobile phone based e-service in a rural context'. *Information Development* 26 (4): 289–302.
- [ITU] International Telecommunication Union. 2010. 'World Telecommunication/ICT development report 2010. Monitoring the WSIS targets. A mid-term review'. International Telecommunication Union, Geneva, Switzerland. Accessed 4 November 2013. www.uis.unesco.org/Communication/Documents/WTDR2010_e.pdf
- Jensen, R. 2007. The digital divide: information (technology), market performance, and welfare in the south Indian fisheries sector. *Quarterly Journal of Economics* 122 (3): 879–924.
- Kindness, H. and Gordon, A. 2001. *Agricultural Marketing in Developing Countries: The Role of NGOs and CBOs*. Natural Resources Institute, University of Greenwich.
- Kleih, U., Onumah, G., Temu, F., et al. 2006. *Training Manual on Market Information System for Coffee and Cotton Sub-Sectors in Tanzania*. United Nations Offices for Project Services.
- Kubzansky, M., Cooper, A. and Barbary, V. 2011. *Promise and progress: Market-based solutions to poverty in Africa*. Monitor Group. Accessed 6 November 2015. <http://web.mit.edu/idi/idi/Africa-%20PromiseAndProgress-MIM.pdf>
- Labonne, J. and Chase, R.S. 2009. 'The power of information: The impact of mobile phones on farmers' welfare in the Philippines'. Policy Research Working Paper No. 4996, World Bank, Washington, DC.
- Lightfoot, C. and Scheuermeier, U. 2007. 'Organizing the learning for rural marketing through linking local learners: How to improve smallholder farmers' links to markets'. *Rural Development News* 2: 30–4.
- Liu, A.T. and Payne, J. 2011. 'Software platforms for mobile applications for agriculture development'. Briefing Paper, USAID. Accessed 6 November 2015. <http://bit.ly/1NTtIV5>.
- Loucky, J. 2012. Mobile Agriculture: 'Understanding the challenges and opportunities for sustainable mobile agriculture solutions'. *Section II: Examining Mobile Agriculture Business Models*. USAID.
- Manda, P.A. 2002. 'Information and agricultural development in Tanzania: A critique'. *Information Development* 18 (3): 181–9.
- Manobi Development Foundation. 2007. 'Manobi puts vulnerable gum producers online via cellphone'. Accessed 12 November 2013. www.manobi.sn/sites/foundation/website/index.php?M=5&SM=1&IDComm=2
- Mapunda, A., Chassama, J. and Pica-Ciamarra, U. 2011. 'Livestock market data: Collection, dissemination and use in Tanzania'. Livestock Data Innovation in Africa. Brief 7. FAO, Rome. Accessed 15 October 2013. <http://hdl.handle.net/10568/16608>,
- May, J., Karugia, J. and Ndokweni, M. 2007. *Information and Communication Technologies and Agricultural Development in Sub-Saharan Africa: Transformation and Employment*. Generation African Economic Research Consortium, Southern Africa.

- Moyo, N. 2009. 'Experiences of NGOs with activities to link farmers to markets – study circle methodology'. In *FAO – NAMC Expert Consultation on 'The Role of NGOs in Linking Farmers to Markets'*. 5–8 October 2009, Somerset West, South Africa, 10–18.
- Muto, M. and Yamano, T. 2009. 'The impact of mobile phone coverage expansion on market participation: Panel data evidence from Uganda'. *World Development* 37 (12): 1887–96.
- New Agriculturist*. 2008. 'Bahati Tweve: The honest "middleman" brokering deals'. Accessed 11 November 2013. www.new-ag.info/en/focus/focusItem.php?a=477
- Payne, J. 2011. *Using ICT to provide agriculture market price information in Africa*. Briefing Paper. USAID. Accessed 20 August 2013. <http://bit.ly/1RB6Zso>.
- Phiri, E.M. 2009. 'Learning from the private sector – linking farmers to markets in Malawi'. In *FAO – NAMC Expert Consultation on "The Role of NGOs in Linking Farmers to Markets"*. 5–8 October 2009, Somerset West, South Africa.
- Ponniah, A., Puskur, R., Workneh, S. and Hoekstra, D. 2008. *Concepts and Practices in Agricultural Extension in Developing Countries: A Source Book*. International Livestock Research Institute, Nairobi. Accessed 6 November 2015. https://cgspace.cgiar.org/bitstream/handle/10568/99/Source_book.pdf?sequence=2
- Prakash, V. 2008. 'Some successful case studies from India'. In *Linking Farmers to Market: Some Success Stories from Asia-Pacific Region*. APAARI – FAO RAP. 85–112.
- Rao, N.H. 2007. 'A framework for implementing information and communication technologies in agricultural development in India'. *Technological Forecasting & Social Change* 74 : 491–518.
- Rapusas, R.S. 2008. 'Some success stories in the Philippines'. In *Linking Farmers to Market: Some Success Stories from Asia-Pacific Region*. APAARI – FAO RAP. 1–38.
- Shepherd, A.W. 1997. *Market Information Services: Theory and Practice*. FAO, Rome.
- Shepherd, A.W. and Schalke, A.J.F. 1995. 'An assessment of the Indonesian horticultural market information service'. Marketing and Rural Finance Service, Agricultural Support Systems Division, FAO, Rome.
- Steffen, M. and Woodard, J. 2012. *Lima Links*. ICT and AG Profile. USAID. Accessed 6 November 2015. <http://bit.ly/1keMEPI>
- Svensson, J. and Yanagizawa, D. 2009. 'Getting prices right: The impact of the market information service in Uganda'. *Journal of the European Economic Association* 7 (2–3): 435–45.
- Torero, M. 2011. 'A framework for linking small farmers to markets'. In *Conference on New Directions for Smallholder Agriculture*. 24–25 January 2011. IFAD HQ, Rome.
- USAID. 2012. *Frontlines*. Economic Growth Edition, USAID 50th Anniversary.
- Van Crowder, L. 1997. 'Marketing information systems for small-scale farmers'. *Information Development* 13 (4): 179–183.
- Weber, M.T., Donovan, C., Staatz, J.M. and Dembélé, N.N. 2005. 'Guidelines for building sustainable market information systems in Africa with strong public-private partnerships'. *Policy Synthesis*, USAID. Accessed 6 November 2015. <http://ageconsearch.umn.edu/bitstream/11433/1/ps050078.pdf>.
- Woodard, J. 2012. MFARM: ICT and AG profile. USAID. Accessed 11 November 2013. http://agrilinks.org/sites/default/files/resource/files/MFarm_profile_0.pdf
- Zoltner, J. and Steffen, M. 2013. 'An assessment of market information systems in East Africa'. Briefing Paper, USAID. Accessed 6 November 2015. https://agrilinks.org/sites/default/files/resource/files/An_Assessment_of_Market_Information_Systems_in_East_Africa.pdf.

The Technical Centre for Agricultural and Rural Cooperation (CTA) is a joint international institution of the African, Caribbean and Pacific (ACP) Group of States and the European Union (EU). Its mission is to advance food and nutritional security, increase prosperity and encourage sound natural resource management in ACP countries. It provides access to information and knowledge, facilitates policy dialogue and strengthens the capacity of agricultural and rural development institutions and communities.

CTA operates under the framework of the Cotonou Agreement and is funded by the EU.

For more information on CTA visit, www.cta.int

Contact us

CTA
PO Box 380
6700AJ Wageningen
The Netherlands

Tel: +31 317 467100

Fax: +31 317 460067

Email: cta@cta.int

 www.facebook.com/CTApage

 [@CTAflash](https://twitter.com/CTAflash)

