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RESEARCH PAPER

# Impacts and Challenges of ICT Based Scale-up Campaigns: Lessons Learnt from the Use of SMS to Support Maize Farmers in the UPTAKE Project, Tanzania

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Providing smallholder farmers with support through conventional government extension approaches is challenging as the number of extension agents is decreasing. At the same time, new information and communication technologies (ICTs), such as short message services (SMS) sent via mobile phones, show considerable promise to complement existing extension services. In the UP-scaling Technology in Agriculture through Knowledge and Extension (UPTAKE) Project, ICTs were used to create awareness and increase uptake and adoption of agricultural innovations by maize farmers in Tanzania. Two SMS-based maize campaigns were implemented during the 2016/2017 and 2017/2018 cropping seasons in the Southern Highlands of Tanzania. Prior to the start of the campaigns, formative research to determine maize production knowledge, practices and challenges was conducted in Mbeya and Songwe Region. After the campaign a telephone survey, key informant interviews and focus group discussions were conducted. During the campaign, about 3.8 million SMS were disseminated to over 55,000 farmers. 73% were male, 19% owned smart phones and 86% farmed maize on up to 1.2 hectares of land. Farmers reported maize production challenges as: unreliable markets, inadequate extension services, pest outbreaks and lack of knowledge to identify counterfeit inputs particularly seeds and fertilizers. The UPTAKE mobile SMS campaign was a new approach to agricultural extension in this area. A telephone survey amongst a sample of farmers who received the SMS revealed that 53% of respondents considered that this was now their preferred as a source of information compared to traditional sources including neighbours and family members, demonstration plots, agricultural extension workers and radios. Key lessons learnt relate to management of databases of farmer contacts, importance of participatory processes in developing content and designing SMS campaigns, and the need for flexibility and promptness in responding to emerging threats such as delayed rains and outbreaks of pests. Good practices like buy in and authorizations from the government administrative structures and compliance with country's regulations on communication are integral to the success of ICT projects.

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**Keywords:** ICT; Small-scale Farmers; Agriculture; Extension; Maize

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## Introduction

In Tanzania, smallholder farmers cultivating less than 3 hectares of land dominate the agricultural landscape. They largely rely on rainfed agriculture (Global Yield Gap Atlas, 2015) and traditional farming implements (Makoi, 2012). Farmers still rely on conventional agricultural extension systems, although these have often had limited success in improving agricultural productivity, yields and profitability (Msuya & Wambura, 2016). Small holder farmers face many challenges including lack of timely information, inadequate extension services, pest outbreaks and lack of knowledge to identify counterfeit inputs particularly seeds and fertilizers. To increase productivity amongst other desired results, a wide variety of information services is needed that should be available and accessible to all farmers (Chepyator, 2016) and the agricultural content should reflect the farmer's diverse circumstances and livelihoods (FAO, 2006).

In the past, common sources of agricultural information were extension services, field days, information desks, farmer field schools, training and visit, demonstration plots, agricultural shows and exhibitions (Chepyator, 2016). These traditional agricultural extension approaches have shown limited successes in terms of numbers reached, technology transfer and adoption (Dixon, 2010). The decline in number of extension officers against increase in number of farmers, lack of capacity to address emerging threats of pest and diseases, inadequate infrastructural support and lack of motivation are amongst the challenges associated with traditional extension services. Policy makers have, however, advocated for changes from top-down to demand-driven and farmer-led, participatory approaches during planning and implementation of interventions to farmers' problems in order to be more effective (Chepyator, 2016). According to Kiptot et al. (2006), there is need for low-cost, bottom-up communication mechanisms, a need that is currently met by ICT tools such as radio and mobile phones. These tools offer advantages over traditional methods.

Advances in mobile technology has made it the platform of choice for creating, distributing and consuming innovative digital solutions. The mobile economy report of 2016 (GSMA Intelligence, 2016) showed that 46% of the population, equivalent to more than half a billion people in Africa, subscribed to mobile services at the end of 2015. In Tanzania, mobile ownership stands at 81.5% of the population, making telephony an easy and cheap way to communicate relevant information to rural communities. This creates an opportunity to enhance information access and support data-driven decisions in small-scale farming thereby promoting adoption of innovations to increase productivity and profitability. This contributes to increased food security and a reduction in poverty.

Present innovations such as use of campaigns for mass dissemination of information have been successfully used to enhance information access. Boa et al. (2016) defines an extension campaign as a coordinated effort to inform many farmers about an agricultural topic of widespread concern or interest in a relatively short period of time to achieve quick, large-scale change in farmer behaviour and practices using a variety of communication channels.

This paper focuses on the use of SMS to raise awareness and increase uptake and adoption of agricultural innovations by smallholder maize farmers in the Southern Highlands of Tanzania, in particular for the campaign that ran during the 2016/2018 planting season. The UP-scaling Technology in Agriculture through Knowledge and Extension (UPTAKE) project was funded by IFAD through the USAID ICT Extension Challenge Fund. The project aimed to use ICT-enabled extension services (radio and mobile short messages) to enhance reach through targeted campaigns and focused on agricultural innovations promoted under the Scaling Seeds and Technologies Partnerships (SSTP) program in Tanzania. CABI led the mobile component disseminating good agricultural practices (GAP) in the form of SMS through a Mobile Value Added Services (MVAS) platform provided by Esoko Tanzania. Farm Radio International (FRI), a Canada-based not-for-profit organisation, led the radio component.

The aim of the study was to investigate the impacts, challenges and lessons learnt in implementation of agricultural ICT based campaigns as a means of disseminating information on selected agricultural technologies to smallholder farmers. This piloted SMS without complementary radio. The lessons learnt could be used to inform planning of similar programs in future for the benefit of smallholder farmers and communities and enhance sustainability of such programs.

## The campaign

An initial campaign was conducted in the Southern Highlands Zone of Tanzania covering Iringa, Rukwa, Ruvuma, Njombe and Mbeya regions. These regions account for over 45 % of the total annual maize production in Tanzania (USAID, 2010). 32 SMS were sent out to the farmers in time for the 2016/17 planting season between November/December. A second campaign took place in the 2017/2018 season. In total, 64 SMS were sent and a database of 55,710 farmers was compiled comprising mobile phone numbers for farmers who consented and were interested in receiving SMS about maize.

A rapid assessment (RA) and a formative research were undertaken at the inception of the campaigns to understand the unmet information needs on maize production, existing knowledge and practices of the farmers, and quantities and varieties of seed available for promotion during the campaigns.

Registration and profiling of farmers was conducted by Esoko. The company's enumerators were accompanied and introduced to the farmers in the villages by agriculture extension officers from the district agriculture office. In the villages, farmers were mobilized, briefed about the SMS campaign before demographic and crop production data that was used to segment the farmers according

to the crops they produce and their location was collected from those who consented. Data collected included, mobile telephone number, name, gender and age of the farmer, all crops cultivated and location.

To prepare for the campaign, agricultural technologies were identified and compiled into a technology brief through a write-shop based participatory process with local stakeholders including farmers, research experts, extensionists, communication specialists and local government agricultural officers. A participatory content development process was then used to repackage information about the technologies into simple and accurate short messages that were easy for farmers to understand.

Information on Good Agronomic Practices (GAP), in form of SMS, was pushed to registered farmers at no cost to them. The messages were synchronised with the local crop calendar. During the two cropping seasons, a total of 64 SMS, written in Kiswahili the national language were sent to these farmers. In total, around 3.8 million SMS were sent out by Esoko by the time this study was conducted.

After initially forecasting average rainfall for the 2016/2017 planting season for the Southern Highlands Zone, in early December 2016 the Tanzania Meteorological Agency reported below normal rainfall. For the unimodal rainfall area, it was also forecasted that while rainfall was expected in late December 2016, it would not sustain long-duration crops and therefore farmers were advised to 'grow drought tolerant and early maturing crops'. The Tanzania Agricultural Research Institute (TARI) Uyole, a partner in the maize campaign, picked up the agency's warning and alerted the UPTAKE team.

The project team opted to hold back on dissemination of previously agreed messages, so as to appropriately address the abnormal weather pattern. New messages were developed encouraging farmers to plant improved Uyole Hybrid (UH) maize varieties. These are early-maturing improved hybrid varieties developed by TARI Uyole through its Maize Improvement Programme. The new messages disseminated information about the UH varieties and contact details for the seed companies that stocked them.

In March 2017, TARI Uyole issued a second alert, this time for an outbreak of stalk borer. Once again, the UPTAKE team revised the messages and asked farmers to inspect their fields and take recommended measures for pest management. Preliminary monitoring confirmed that as a result some farmers identified stalk borer and saved their crop by applying the recommended measures. An interesting observation was that some farmers forwarded the information they received via SMS to other farmers, thereby extending the reach of the campaign.

## **Materials and methods**

Following the campaign, monitoring and evaluation was carried out using three methods; a telephone survey, Focus group discussions (FGD) and key informant interviews (KII). These were conducted in Mbeya and Iringa regions of the Southern Highlands Zone and sought to determine the effect of the campaign and the benefits male and female farmers may have received alongside information needs of farmers in regard to maize production; their trusted sources of information; and to determine the types of information farmers wished to receive through SMS. The study also sought to learn about the effectiveness of implementation and how it could be improved. The study was carried out with the approval of TARI Uyole and consent obtained from the district agriculture office and farmers prior to the interviews. All information given was voluntarily provided and interviewees had a choice of opting out at any point during the course of the interviews.

### ***Telephone survey***

A survey was conducted in 2018 amongst a sample of farmers who had been sent SMS by the UPTAKE project. Three attempts were made to reach the randomly selected respondents over a period of three weeks: any respondents who could not be reached after three attempts was dropped from the sample. Respondents were randomly selected and the intention was to have an equal number of men and women respondents who had received SMS over two seasons, 2016–2017 and 2017–2018. A total of 352 telephone interviews were conducted. This was made up of 195 men and 157 women who had received SMS over the two cropping seasons.

### ***Focus group discussions and key informant interviews***

In addition, 40 FGDs comprising women, men and youth were conducted in the two regions and eight KIIs were held with TARI Uyole personnel, private seed companies, extension officers, NGO representatives, local officials and a farmer.

## Results and discussion

### *Demographic data*

Of the 352 people interviewed through the telephone, 39.5% were male adults (above the 35 years) and female adults were 31.5%, while the youths (below 35 years) were 15.6% male and 12.8% female respectively. In terms of level of education achieved, majority (77%) had attended primary school, followed by 13.9% with secondary education while 2% had post-secondary education and 7.1% had received no education. Field sizes varied but most of the respondents (86.6%) owned up to 1.2 hectares.

### *Key informant interviews*

Following the campaign in 2016–2017, KIIs provided some interesting insights:

- TARI Uyole reported increased demand from seed companies for early generation seed of the improved, early-maturing UH varieties (recommended in the SMS sent to farmers) which the seed companies use to bulk up so as to provide certified seed to farmers in subsequent seasons.
- The seed companies in the campaign area reported that they handled far more enquiries than usual and increased sales of the improved varieties. One leading company sold close to twice as much seed as in previous seasons. Four of the five companies that sold the UH varieties reported that, for the first time, they had no stocks to carry over to the next planting season.
- TARI Uyole also reported a 30-40% reduction in visits to the institute by farmers to enquire about the UH varieties, planting dates and suitable varieties for different agroecological zones.

### *Telephone survey*

Preliminary findings from the telephone survey are presented below.

The survey revealed that overall 71% of respondents reported they had received SMS from the project. Of these, 95% said they received messages weekly, 89% reported that they understood the messages, 91% reported they learnt something new from them and 62% reported that they had implemented changes in their agricultural practices as a result. The most common changes cited by respondents, which they attributed to receiving SMS, was scouting and monitoring for pests in the crop (40% of respondents) and improved land preparation (21%).

The percentage of respondents who reported they implemented changes as a result of receiving SMS was similar for both men and women, except scouting for pests, which was more commonly reported by women (43% compared to 35% for men), and chemical weeding, which was more commonly reported by men (20% compared to 13% for women). This may reflect a lower capacity to pay for inputs and lower opportunity labour costs for women meaning they are more prepared to take time to scout for pests.

SMS was reported to be by far the most preferred source of information (58%) followed by extension officers and own experience each being cited by 12% of respondents. It should, however, be pointed out that this result was obtained during a telephone survey.

When asked what additional information farmers wanted to receive, the most common requests were for information on general maize production, information on other crops, markets, land preparation and crop production with additional farm inputs and weather information in that order. The desire for market information was likely prompted by the bumper harvest in the 2017/2018 cropping season which, unlike the preceding season, benefited from adequate rainfall.

## Lessons learned

From the focus group discussions, key informant interviews, telephone survey and experiences of the implementation team, a set of lessons were drawn about use of SMS as an approach to provide information to smallholder farmers. Lessons are presented under five headings: database related lessons, message content; delivery of messages; impact; and sustainability.

### *Database related lessons*

#### **Recruitment and profiling of farmers**

A prerequisite to sending information to farmers via SMS is a database that includes mobile phone numbers of farmers who have given their consent to receive such messages. For the UPTAKE project this activity was outsourced to a commercial entity, Esoko, which has the relevant expertise, experience and

infrastructure, and human capacity. In addition to collecting contact details for farmers in the areas targeted by the project, other information was collected about the farmers and their farming activities. The company managed the database in line with Tanzania Communications Regulatory Authority (TCRA) guidelines for data protection which aim to protect consumers against violation of their privacy. To ensure data security, Esoko maintains stringent data protection guidelines. Farmer information is protected and only accessible to authorised personnel. The system has user-level security and data download restrictions. The system also automatically masks sensitive farmer information both in viewing and sharing.

### **Database compilation and management**

The data collection process at profiling stage should be meticulous with embedded verification processes to ensure completeness and accuracy. Using a database of mobile phone contacts in an African context can be challenging. Management of the database should therefore be an ongoing practice to address challenges such as the widespread practice of maintaining multiple identification module (*SIM*) cards amongst subscribers that target access to cheaper call costs within a network. This practice may result in failure to reach subscribers as these lines are often used within a single phone. Inactive lines are often deactivated by the mobile service providers to comply with the law. As a result subscribers' numbers can often not be reached which makes use of the database to send out messages or subsequent telephone surveys difficult. Strategies to cope with this challenge include: continuous feedback and analysis, enhancing self-registration into databases to allow farmers to register multiple phone numbers and a reverse look-up algorithm to increase chances of timely information delivery.

### **Gender breakdown of database**

The project was undertaken in an area with a traditionally patriarchal society. However, FGDs revealed that previously rigid attitudes to distinct and different farming roles for men and women were breaking down: the only role that is still solely a male responsibility was spraying pesticides. Given the important roles women play in farming, the project aimed to include 50% women in the database. However, this proved to be challenging: of the 55,710 farmers recruited to receive SMS, 73% were men and 27% women. Phone numbers that were provided in public settings belonged to men irrespective of whether men or women were recruited, and in spite of both men and women owning phones. The trend changed when women were purposively recruited in women-only settings, such as women's groups. This suggests that targeted recruitment may be a pre-requisite for improving access to information for women. Additional studies are needed to tease out how men and women share information they receive via SMS with their spouses and whether it really matters which partner actually received the SMS.

Youth who participated in FGDs indicated that although a minority were given small parcels of land by their parents over which they had decision-making powers, most helped on the family farm and were not involved in making decisions.

### **Compliance with regulations**

To enable effective targeting and avoid the risk of being penalized by the regulator, Tanzania Communications Regulatory Authority (TCRA), for sending spam, it is necessary to develop a database of farmer contacts who wish to opt in to a service, ideally with additional demographic information including gender, age and location. The project also complied with other TCRA regulations relating to information security. Esoko the private VAS provider ensures that only authorized users have access to the farmer database. It has user-level security and data download restrictions. The Esoko system also automatically masks sensitive farmer information both in viewing and sharing. The data is stored in accordance with the Tanzania regulatory framework and aligned to international data protection guidelines.

It is obligatory to get authorizations as well as buy in from the government administrative structures. The success of the recruitment activity is also largely dependent on the support of the local extension for mobilization and collection and collation of clean data. Extension departments should therefore be integral partners in the recruitment process. Where the campaign runs longer than a season, farmers must be able to opt out because they may already have garnered information from the first season and do not necessarily require it again in the second season. Farmers are more likely to prefer receiving information if this is dynamic, responding to changing circumstances that demand changes in behaviour, such as abnormal weather or pest and disease outbreaks.

### **Cost of profiling farmers**

Developing a database of farmers including contact and other useful information is relatively expensive: Esoko, who provided this service as part of their SMS aggregation offering to UPTAKE, charged USD 1 per farmer. For the 2016–2017 SMS campaign described here, farmer profiling represented about 40% of the total costs of an SMS campaign targeting 42,000 farmers each with 25 SMS. However, the profiling can pay off in terms of effective targeting, particularly where a crop is not grown by a majority of farmers.

### ***Message content lessons***

#### **Importance of participatory approaches**

The UPTAKE case study demonstrated the importance of involving a wide range of stakeholders, including local officials, experts, farmers and input suppliers, in the design and execution of the SMS campaign. The participatory approach is vital for promoting consensus-building amongst stakeholders with diverse views, interests, technical know-how and experience. The approach meant that the messages were ratified by the zonal authority and that farmers and others would be informed of varieties that were actually being made available by the seed companies. The project showed that scientists responded well to participatory write-shop approaches co-facilitated by scientists and moderated by a communication expert, that allowed intermediaries and farmers to ensure that messages were understandable by the target audience and actionable in the local contexts.

#### **Need for flexibility and rapid response**

The Southern Highlands maize SMS campaign clearly demonstrated the need for teams behind agricultural SMS campaigns to be able to react quickly to changing circumstances and emerging situations. In this case, it would clearly have been pointless to send out the messages on maize production timed for when the rains should have occurred. This has budgetary implications: teams of stakeholders and experts may need to be brought together at short notice to review the changing circumstances, agree on the most appropriate response and develop the appropriate SMS' to convey these messages. The revised messages also need to go through the necessary validation and approval processes quickly. Input providers need to be alerted to potential increased demand for key inputs. Messages appropriate to the situation in the farmers' fields must be disseminated in time for these to be acted upon. This is all challenging but the UPTAKE example shows it is possible and can generate meaningful impact.

#### **Language**

To accommodate different dialects in the Southern Highlands, a common language, Kiswahili, was used. Segmentation on the basis of language was not considered practical. Efforts were however made to ensure terminologies used were understood and for maize varieties, the different names by which these are known in different localities were used.

#### **Refining messages**

Useful approaches here include ensuring farmers are represented and listened to when SMS campaigns are being developed, pre-testing messages with focus groups before scaling up and systematically collecting farmers' feedback after a campaign has been delivered.

### ***Delivery of messages***

#### **Dealing with multiple SIM cards**

Some mobile phone users have multiple SIM cards to take advantage of beneficial rates for calls within a network. This means that a farmer may not receive an SMS when it is sent out as the relevant SIM card is not inserted, which can mean that messages may be received when it is too late to act. Also, when the relevant SIM card is reinserted, farmers may be inundated with SMS, including those from the maize campaign. Issues related to multiple SIM cards may be part of the explanation why only up to 71% of respondents in the telephone survey reported they had received SMS from the project.

#### **Information sharing**

A total of 30% respondents reported that they shared the information received via SMS with neighbours. During the FGDs, it emerged that farmers who shared information were more likely to be more progressive in their attitude to farming and were also better educated. Those who did not share information attributed it to the assumption that everyone received the same SMS. The finding that farmers who tend to be better

educated and more progressive share the information they receive via SMS with their neighbours suggests that a more targeted approach could be used in which these 'influencers' are sent the SMS and they are then relied on to spread the information within their communities. Although identifying the influencers raises its own challenges, this approach could be highly cost-effective and therefore more sustainable: large numbers of farmers could be reached with fewer SMS being sent, which would also represent major cost savings.

19% of respondents also reported they owned smart phones. This demonstrates the emerging potential to communicate with farmers using more sophisticated apps and digital services.

### ***Lessons on impact***

#### **Response to an urgent threat**

The most commonly adopted change in farming practice reported by respondents in the mobile phone survey was scouting/monitoring of pests. This is in response to messages added to the campaign to address the stalk borer outbreak in season one and fall armyworm outbreak in season two. In season one, SMS messages advised farmers to scout for stalk borer and, if they found it, apply appropriate pesticides.

While the majority of the SMS dealt with routine good agricultural practices, the messages about stalk borer alerted farmers to a problem in real time and recommended a clear course of action that they could implement. This observation may provide evidence that SMS are especially relevant, and farmers are especially receptive to, messages that convey urgent information about pending threats and what they can do to save their current crop.

#### **Lead-time for inputs**

Because it takes time to bulk up and produce certified seed, within a season the companies can only sell the seed stocks that are available, so there are limits on how fast they can respond to increased demand. So, when the campaign encouraged farmers to sow early maturing varieties, some companies reported that they ran out of stock of the promoted varieties.

### **Sustainability**

#### ***Beyond project lifetimes***

This work was done within the context of a time-limited donor project. Important considerations going forward include: who owns the database of farmer contacts and other information; for what purposes can this legally be used and; what business models could the database support? An important consideration is, what did the farmers actually sign up to? The cost of capturing the contact and other details for a farmer is around USD 1 so clearly the costs can be high when large numbers of farmers are targeted. A lesson learnt from the UPTAKE project is that it is important to have very clear contracts detailing what information will be collected and who owns the database during the project lifetime and afterwards.

#### ***Alternative business models***

Messages targeting use of products, such as pesticides (as discussed under *Response to an urgent threat*, above), may also be attractive to input suppliers, which offers the potential for sustainable business models that can continue beyond the project lifespan. Encouragingly, the seed companies involved in the 2016/17 SMS campaign requested a second campaign and indicated that they were willing to make financial contributions towards the cost. Caution should however be employed to ensure data protection laws are adhered to, to pre-empt practices such as unsolicited telemarketing by the private sector. 52% of respondents also reported that they were willing to pay for agricultural advisory services. Notably though, most information services offered in Tanzania were found in a previous study to be unsustainable and therefore short lived.

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## Competing Interests

The authors have no competing interests to declare.

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